

# Oracle® Cloud

## Using Oracle Spatial Studio on Autonomous AI Database



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# Preface

This document describes how to use Spatial Studio on your Autonomous AI Database Serverless instance.

## Audience

This document is intended for data analysts, application developers, and other Oracle Cloud users who want to administer and use Spatial Studio to visualize and analyze geospatial data.

## Related Documents

- [Getting Started With Oracle Cloud](#)
- [Oracle Spatial Developer's Guide](#)
- [Using Oracle Spatial AI on Autonomous AI Database Serverless](#)
- [Oracle Machine Learning Notebooks](#)
- [Oracle Machine Learning for Python User's Guide](#)

## Conventions

The following text conventions are used in this document:

Convention	Meaning
<b>boldface</b>	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

# 1

## Get Started Using Spatial Studio

### Topics:

- [About Oracle Spatial Studio](#)
- [Key Terms and Concepts in Spatial Studio](#)
- [Explore the Spatial Studio User Interface](#)
- [Set Up Spatial Studio Users and Privileges](#)
- [Access Spatial Studio](#)
- [About the Compute Environment in Spatial Studio](#)
- [Typical Workflow for Visualizing Spatial Data](#)

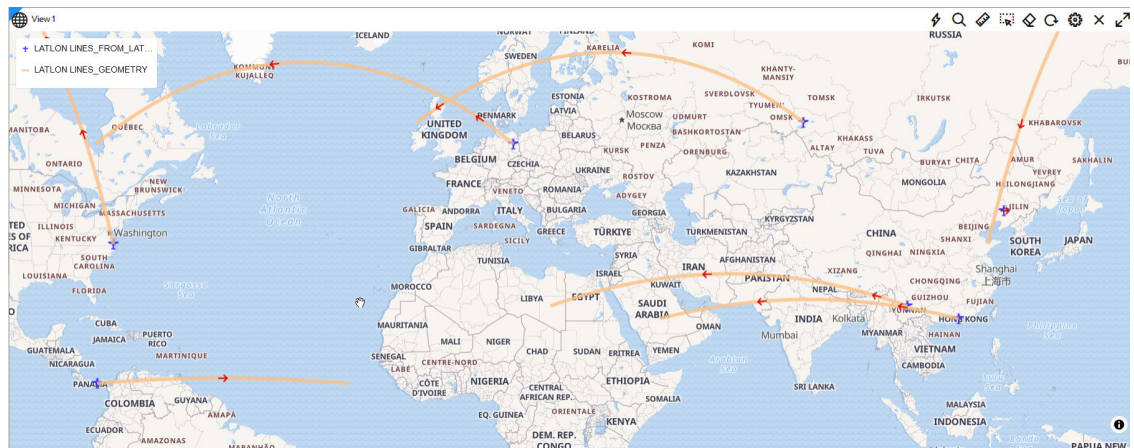
## About Oracle Spatial Studio

Oracle Spatial Studio is a web-based interface that enables you to explore, visualize, and analyze geospatial data on your Autonomous AI Database Serverless instance.

Key features of Spatial Studio include:

- Accessing geospatial data available on Autonomous AI Database and creating different types of spatial datasets.
- Provisioning a compute environment to meet your requirements for running specific tasks in Spatial Studio.
- Creating projects to visualize the geospatial data on maps or in tables.
- Publishing a project or embedding the project in an external web application.
- Running spatial analyses on the geospatial data and storing the visualization results.

The following figure shows a sample visualization of a spatial analysis dataset that connects the starting and ending points on a map layer.



# Key Terms and Concepts in Spatial Studio

Learn the key concepts and terminologies when working with Spatial Studio.

## Projects

A project contains datasets, that are logically related to some intended usage. For example, a project might be named New England Sales Territories, or Sales Territories and Customers, or Ohio Airports and Counties. When creating a project, you should know the purposes for which you want to visualize and analyze spatial data in a geographic area. It represents a *workspace* that can be saved and reopened.

## Datasets

A dataset is a collection of spatial features of a specific usage type and geometry type. For example, datasets might include Airports represented by polygon geometries, or Roadways represented by LRS line string geometries, or Accidents represented by point geometries.

## Public Dataset

A public dataset is one with a GeoJSON endpoint that can be accessed without having to log onto the Spatial Studio first. A public dataset is always visible to all the Spatial Studio users and can be used in their projects.

## Published Projects

A published project is a snapshot of the visualizations and analyses that a user has created in a project. It provides an easy way of sharing what users have created within their organization.

## Public Published Project (PPP)

A public published project is a published project where all the datasets involved are public datasets, and the published project itself is also made public. You can embed the visualizations of a public published project in other web applications, or can be viewed standalone in a web browser, without having to log onto Spatial Studio server first.

## Analysis

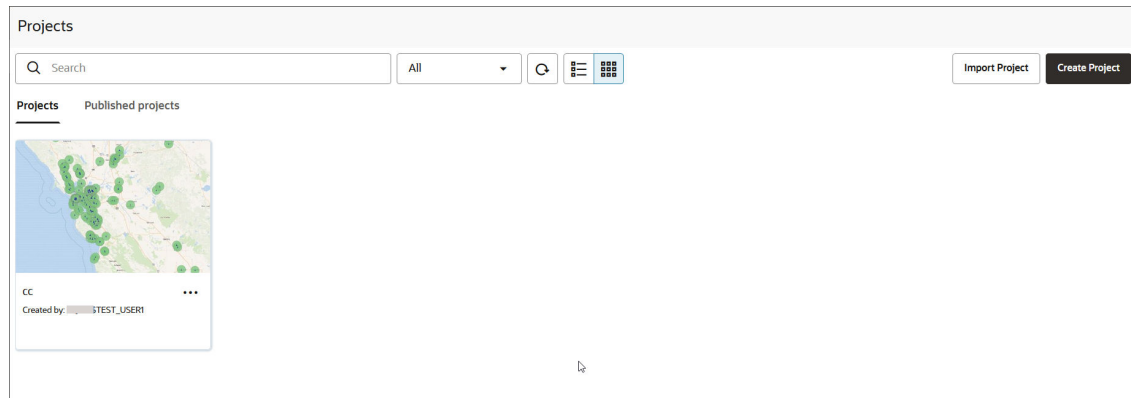
An analysis is typically one or more (spatial) operations performed on one or more datasets. The operation types and their parameters for an analysis are all stored as part of a project. The result of any analysis can be visualized, just like any other dataset.

# Explore the Spatial Studio User Interface





Explore and learn about the interactive Spatial Studio user interface.

Using the main Spatial Studio user interface, you can create one or more projects, each of which can define one or more spatial datasets on which you can perform various spatial operations.

The main landing page for Spatial Studio is as shown:



The overall layout of the Spatial Studio user interface comprises the following:

- **Header:** The header at the top of the page contains the following buttons:
  - : To display or hide the side navigation menu.
  - : Displays the status of the compute environment.
  - : To help you get started on Spatial Studio by providing an overview of the tool and links to other tutorial resources.
  - : Displays the user profile details.
- **Side Navigation Menu:** A navigation panel on the left displays the menu items. You can expand or collapse the navigation drawer. The navigation menu consists of the following options:
  - **Active Project:** Directs you to the Active Project page where your recent working project is displayed. See [Overview of Active Project Page](#) for more information.
  - **Projects:** Directs you to the Projects page where you can view your existing projects (and published projects) or create a new project. See [Overview of Projects Page](#) for more information.
  - **AI Labeling:** Directs you the AI Labeling page where you can define and add labels to AI labeling projects. See [Overview of AI Labeling Page](#) for more information.
  - **Datasets:** Directs you to the Datasets page where you can view the existing datasets or create a new dataset. See [Overview of Datasets Page](#) for more information.
  - **Connections:** Directs you to the Connections page where you can view the existing connections (data sources) or create a new connection. See [Overview of Connections Page](#) for more information.
  - **Jobs:** Directs you to the Jobs page where the various background jobs started by Spatial Studio to process various requests are listed. See [Overview Jobs Page](#) for more information.
  - **Console:** Directs you to the Console page where the Spatial Studio administrator can monitor the status and activity of Spatial Studio. It contains tabs for Settings, Maintenance, and Monitoring. See [Overview of Console Page](#) for more information.
- **User Workspace:** The page specific details for the selected menu option is displayed on the right.

# Set Up Spatial Studio Users and Privileges

Learn about creating and assigning privileges for Spatial Studio users.

Perform the following steps to set up a Spatial Studio user with the correct set of roles and privileges using Oracle Database Actions:

1. Sign in to Oracle Cloud and navigate to your Oracle Autonomous AI Database instance.
2. Access Database Actions from the Oracle Cloud Infrastructure Console as an ADMIN user.  
See [Access Database Actions as ADMIN](#) for more information.

3. Click **Database Users** in the **Launchpad** page under the **Administration** group.

4. Click **Create User** on the Database Users page, in the All Users area.

The **Create User** slider opens and displays the **Users** tab by default.

5. Enter **User Name** and **Password**, then re-enter the password to confirm.

6. Select a quota from the **Quota on tablespace DATA** drop-down.

7. Click the **Granted Roles** tab and grant the required Spatial Studio role to the database user.

Search for the required role that you wish to grant. Supported Spatial Studio roles are: SPATIAL\_ADMIN, SPATIAL\_AUTHOR, and SPATIAL\_CONSUMER.

See [About Spatial Studio User Roles](#) for more information on the different roles supported in Spatial Studio.

Note that if the database user is not assigned any Spatial Studio user role, then the user is considered a read-only (SPATIAL\_CONSUMER) user and can perform only limited actions in Spatial Studio. See [Read-Only User: SPATIAL\\_CONSUMER](#) for more information.

8. Click **Create User** to set up the new user in the database.

9. Navigate to the SQL page in Database Actions.

See [The SQL Page](#) for more information.

10. Grant the appropriate privileges based on the Spatial Studio role assigned to the database user in step 7.

- **SPATIAL\_ADMIN OR SPATIAL\_AUTHOR**

```
GRANT CREATE SESSION, CREATE TABLE, CREATE VIEW, CREATE SEQUENCE,  
CREATE PROCEDURE, CREATE TYPE, CREATE SYNONYM, CREATE TRIGGER TO  
<db_user>;
```

- **SPATIAL\_CONSUMER**

```
GRANT CREATE SESSION, CREATE TABLE, CREATE VIEW TO <db_user>;
```

11. Grant the database user connect to Spatial Studio through a proxy user as shown.

```
ALTER USER <db_user> GRANT CONNECT THROUGH "SPATIAL$PROXY_USER";
```

The database user is set with all the required privileges and can now log into Spatial Studio.

## About Spatial Studio User Roles

Learn about the different user roles supported in Spatial Studio.

The following application roles are supported in Spatial Studio:

- SPATIAL\_ADMIN
- SPATIAL\_AUTHOR
- SPATIAL\_CONSUMER

It is important to note that all the role names are case sensitive. When granted to a user, these roles allow the user to access the various features and services of Spatial Studio, governed by the rules described in the following sections.

### Administrator: SPATIAL\_ADMIN

A user with the SPATIAL\_ADMIN role is considered the system-level administrator of the accessed Spatial Studio instance, irrespective of all other roles they may hold.

A user with a system-level administrator role is not recommended for performing regular development or analysis work while inside Spatial Studio. An admin user's responsibilities are the following:

- Change global or instance-wide settings such as banner customization, custom base maps or safe domains.
- Monitor and view system logs if your Spatial Studio instance is connected to a compute environment.

### Regular User: SPATIAL\_AUTHOR

A user with role SPATIAL\_AUTHOR (but not SPATIAL\_ADMIN) is considered a *regular* user.

A *regular* user role allows the user to:

- Create various Spatial Studio objects such as connections, datasets, and projects.
- Create spatial analyses.
- Publish projects and add custom map icons.

### Read-Only User: SPATIAL\_CONSUMER

A user with the SPATIAL\_CONSUMER role is considered a read-only user and is prohibited from creating, modifying or removing any permanent objects (such as datasets, connections, spatial analyses, write-access tokens, and so on) within Spatial Studio.

A user with the SPATIAL\_CONSUMER role is allowed to:

- Create a new project from existing datasets.  
However, the new project cannot be saved or published.
- Perform data visualization activities within the currently logged in session.

**Note**

A user is a read-only user if `SPATIAL_CONSUMER` is the only role granted to them. If a user has both `SPATIAL_CONSUMER` and any other role (such as `SPATIAL_AUTHOR`), then those other roles with greater privileges will take precedence.

The following describes a few use cases that apply for the `SPATIAL_CONSUMER` role:

- As seen in [Regular User: SPATIAL\\_AUTHOR](#), a user with `SPATIAL_AUTHOR` role can create projects and datasets within Spatial Studio. Once the project(s) are finalized, the Spatial Studio administrator may change the user's role to contain only `SPATIAL_CONSUMER`, effectively freezing the projects from being modified (accidentally).
- Another use case of such a role is for read-only users to be able to visualize publicly available datasets for information purposes without creating permanent projects that can potentially consume a lot of resources in Spatial Studio.

## Access Spatial Studio

You can access Spatial Studio on your Autonomous AI Database Serverless instance either from the Oracle Cloud Infrastructure console or with Database Actions.

**Topics:**

- [Access Spatial Studio Using Oracle Cloud Infrastructure Console](#)
- [Access Spatial Studio Using Database Actions](#)

## Access Spatial Studio Using Oracle Cloud Infrastructure Console

Perform the following steps to access Spatial Studio from Oracle Cloud Infrastructure console:

1. Sign in to **Oracle Cloud**.
2. Select an Autonomous AI Database Serverless instance.  
This opens the Autonomous AI Database details page.
3. Select the **Tool configuration** tab on the Autonomous AI Database details page.
4. Copy the **Public access URL** for Spatial Studio.  
Spatial Studio access URL gets copied to the clipboard.
5. Paste the URL in your browser to launch the application.

**Note**

If you are already logged in to a built-in tool with single sign-on on your Autonomous AI Database instance, you can access Spatial Studio directly without entering your login credentials.

The login screen opens.

6. Enter your **Username** and **Password** and then click **Sign In**.

See [Set Up Spatial Studio Users and Privileges](#) for information on how to set up a Spatial Studio user with the required privileges.

You are now connected to Oracle Autonomous AI Database using Spatial Studio.

## Access Spatial Studio Using Database Actions

1. Sign in to **Oracle Cloud** and select an Autonomous AI Database instance.  
This opens the Autonomous AI Database details page.
2. Click **View all database actions** in the **Database actions** drop-down list.
3. Click **Spatial Studio** in the **Development** tab.

A few built-in tools on your Autonomous AI Database instance (such as Database Actions, Oracle APEX, Graph Studio, Spatial Studio, and so on) can be accessed from Database Actions through single sign-on. See [Access Built-in Tools from Database Actions with Single Sign-on](#) for more information.

Therefore, if you are already logged in to a built-in tool with single sign-on, you can access Spatial Studio directly without entering your login credentials.

Otherwise, the Spatial Studio login screen opens in a new tab.

4. Enter **Username** and **Password** and then click **Sign In**.

See [Set Up Spatial Studio Users and Privileges](#) for more information on how to set up a Spatial Studio user with the required privileges.

You are now connected to Oracle Autonomous AI Database using Spatial Studio.

## About the Compute Environment in Spatial Studio

You can provision a dedicated compute environment to run Spatial Studio.

By default, Spatial Studio runs using resources that are automatically allocated through the Oracle Cloud Infrastructure (OCI) Control Plane on your Autonomous AI Database instance. You can perform most of the typical activities such as uploading a shapefile (less than 50 MB), geocoding a small dataset, or creating map visualizations, using these shared resources. However, they may not be sufficient in certain scenarios, such as the following:

- Uploading images for GeoRaster datasets
- Uploading large files exceeding 50MB
- Geocoding tables with more than 500 records
- Using the Spatial AI labeling function

In such cases, Spatial Studio can be attached to a newly created compute environment with greater compute power and memory. The compute environment is shared by all users of your Autonomous Database Serverless instance. Any user can create the compute environment; however, only the Spatial Studio administrator can detach it. Detaching the compute environment terminates all active user sessions connected to that environment.

### Note

You are billed by the hour when running Spatial Studio on a newly created compute environment. For instance, if you use the compute environment for only 15 minutes and then terminate it, you will still be charged for a full hour.

The status in the application header (top right) indicates whether Spatial Studio is attached to a compute environment. The compute environment can be available in one of the following states:

- **Detached** (default): Spatial Studio is not attached to a compute environment.
- **Attached**: Spatial Studio is attached to a compute environment.
- **Attaching**: Spatial Studio is in the process of attaching to a compute environment.

#### Related Topics

- [Create a Compute Environment](#)  
You can configure a new compute environment in Spatial Studio.

## Typical Workflow for Visualizing Spatial Data

Learn the workflow to visualize and analyze spatial data using Spatial Studio on Autonomous AI Database Serverless instance.

Task	More Information
Create an Autonomous AI Database Serverless instance from Oracle Cloud Infrastructure console.	<a href="#">Provision Autonomous Database</a>
Create Spatial Studio users and grant the necessary roles and privileges.	<a href="#">Set Up Spatial Studio Users and Privileges</a>
Access the Spatial Studio Application	<a href="#">Access Spatial Studio</a>
Review if your task requires setting up a dedicated compute environment.	<ul style="list-style-type: none"> <li>• <a href="#">About the Compute Environment in Spatial Studio</a></li> <li>• <a href="#">Create a Compute Environment</a> (if required)</li> </ul>
Create a dataset using your geospatial data in Spatial Studio.	<a href="#">Work with Datasets</a>
Create a project and add the dataset.	<a href="#">Work with Projects</a>
Visualize the spatial dataset on a map. Optionally, style the map layer as desired.	<a href="#">Work with Visualization</a> <a href="#">Style a Map Layer</a>
Run spatial analysis and visualize the results.	<a href="#">Run Spatial Analyses</a>

# 2

## Work with Projects

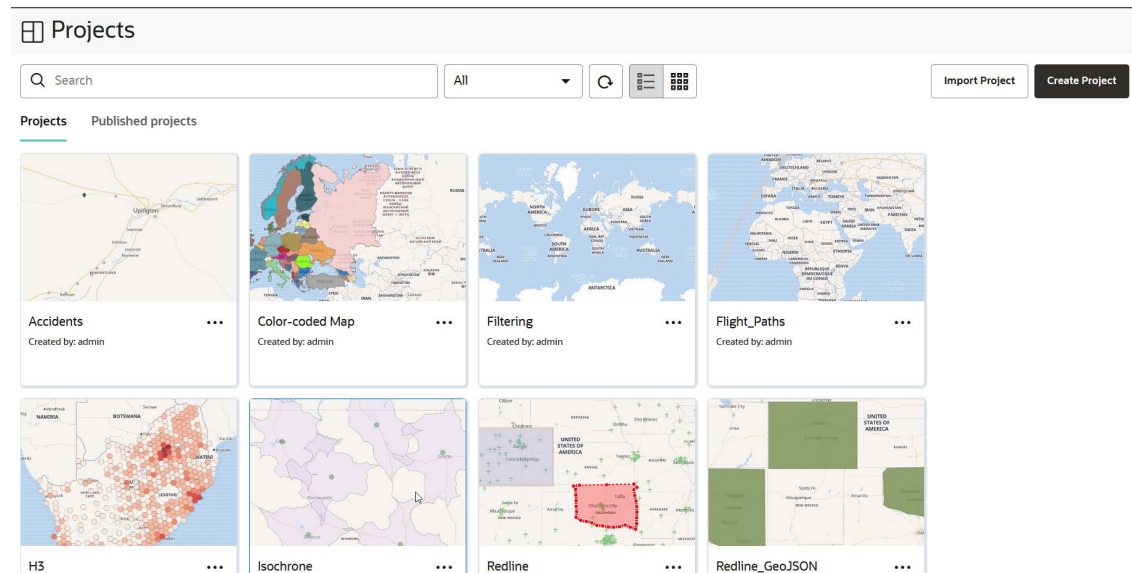
You can view all the projects ( both published and unpublished) that were created in Spatial Studio on the **Project** page. The **Active Project** page displays your current working project.

**Topics:**

- [Overview of Projects Page](#)
- [Overview of Active Project Page](#)

## Overview of Projects Page

The layout of the project page is as shown:



The Projects page comprises two tabs:

- **Projects:** Displays the list of projects created in Spatial Studio.
- **Published projects:** Displays the list of published projects.

You can perform the following actions on the Projects page:

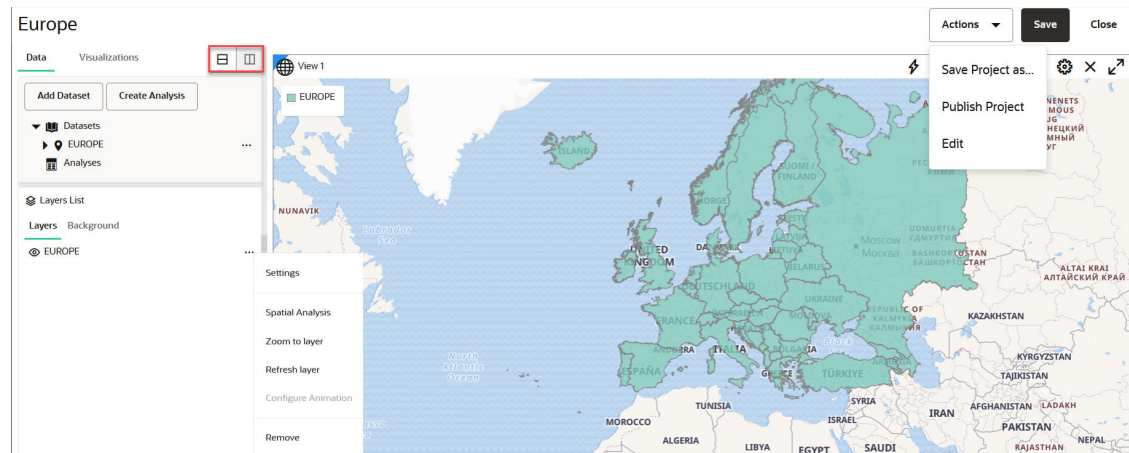
- You can select and view a project or published project in the respective tabs.
- You can create a new project by clicking **Create Project**.
- You can import a project by clicking **Import** and selecting a project zip file in the **Import Project** dialog.
- You can alter the display settings to have the projects listed as cards or in a tabular format in the respective tabs.
- You can search for both unpublished and published projects and view the search results in the respective tabs.

- You can filter to view projects that are either created by you, or shared with you, or both in the respective tabs.
- You can open, export or delete a project in the **Projects** tab by clicking the **\*\*\*** icon for any of the listed projects. For the first two actions, the project will be opened in the **Active Project** page.
- See [About Published Projects](#) for the actions supported on published projects.

## Overview of Active Project Page









The Active Project page displays your current working project. However, you can switch to your working project at any time from the other pages when working in Spatial Studio.

The following figure shows a layout of the Active Project page:



You can perform the following actions on the Active Project page:

- Creating a table or map visualization.
- Adding or removing datasets from your project.
- Adding or removing data from a visualization layer.
- Organizing the **Layers List** panel to be arranged vertically below or to the right of the project **Data** and **Visualizations** panel using the icons shown highlighted in the preceding figure.
- Adjusting the style setting or the zoom resolution for your visualization layer. You can click the menu selector next to the map layer in the **Layers** tab to display the following available options:
  - **Settings:** Shows display options for Style, Filter, Interaction, and Legend.
  - **Spatial Analysis:** Allows you to perform many spatial operations (All, or filtered by type: Filter, Combine, Transform, Measure), such as Add a buffer of a specified distance, Return shapes having spatial relationship to another, and Calculate area.
  - **Zoom to Layer:** Zooms the display (out or in) to fit the entire layer.
  - **Refresh Layer:** Refreshes the layer to reflect all user actions.
  - **Configure Animation:** Allows you to configure animation settings to visualize a moving object.
  - **Remove:** Removes the layer from the project.

- Using the project management options displayed on the top-right area of the Active Project page:
  - **Actions:** The drop-down menu allows you to:
    - \* **Save Project as:** Creates a new copy of the project.
    - \* **Publish Project:** Publishes the project.
    - \* **Edit:** Allows you to edit the project details (such as, Name, Created By and Description).
  - **Save:** Saves your updates to the project.
  - **Close:** Closes the project.
- Using the map tool bar options on the top right of the map visualization pane:
  - : The **Actions** drop-down menu allows you to:
    - \* **Create Custom Region:** Creates custom region for the selected polygons.
    - \* **Save Selections:** Saves selected features on the map layer to a dataset.
    - \* **Save Pins:** Saves the pins dropped on a map layer to a dataset.
  - : **Search** based on address, latitude or longitude.
  - : The **Measure Menu** allows you to measure liner or radial distances.
  - : The **Select By Shape** drop-down menu allows you to make a rectangular, circular, or a polygonal selection.
  - : The **Clear Menu** allows you to clear selections, pins, tool drawings, or all.
  - : **Refresh Layers** allows you to refresh the map layers.
  - : **Settings** allows you to configure your visualization settings.
  - : **Delete** icon allows you to remove the map visualization from the project.

## About Published Projects

You can share your Spatial Studio project with other users by publishing it.

Once your project is completed on the **Active Project** page, then you can save and publish the project. The published project gets displayed on the Projects page in the **Published projects** tab.

You can perform the following actions on a published project:

- **Open:** Opens the project.
- **URL:** Provides the URL for the published project. You can use the URL to embed the project in an external web application through iFrames. However, note that this is typically only used for published projects that contain only public datasets. A public published project can be accessed through its URL by any user on the internet without logging into the Spatial Studio application.
- **Sync with source project:** Keeps the project synchronized with the source.

- **Permissions:** Allows you to make a published project public (or private if it is already public).  
Note that this option will be enabled only if all the datasets that are in the published project themselves are already public. In such cases, you may choose to use the **Permissions** option to make the published project itself also be public.
- **Edit:** Allows you to edit the project name and description.
- **Delete:** Deletes the published project.

# 3

## Work with AI Labeling

You can use Oracle Spatial Studio to label data for AI tasks and to leverage Spatial AI geospatial raster analysis and modeling capabilities.

### Note

Spatial Studio needs to be attached to a compute environment for AI Labeling. See [Create a Compute Environment](#) for more information.

#### Topics:

- [About AI Labeling](#)
- [Overview of AI Labeling Page](#)
- [Get Started with AI Labeling](#)

## About AI Labeling

Learn about AI Labeling in Oracle Spatial Studio on Autonomous AI Database.

#### Topics:

- [What is AI Labeling](#)
- [Key Concepts in AI Labeling](#)

## What is AI Labeling

AI Labeling in Oracle Spatial Studio prepares training data for deep learning by creating and managing labels directly on geospatial raster data, including airborne photos, satellite imagery, and any other gridded data.

Geospatial rasters are sourced from GeoRaster objects in Oracle Spatial Database or from geospatial imagery stored in Oracle Cloud Infrastructure (OCI) Object Storage. They are presented to the user as geospatial raster chips for labeling. Chips are raster tiles appropriate for training deep learning models, usually small in size. AI Labeling supports both georeferenced and non-georeferenced geospatial rasters.

AI Labeling supports the complete data preparation workflow for Spatial AI. It also includes:

- **Manual labeling** of geospatial raster chips to mark features such as buildings, roads, or vegetation.
- **Loading labels** from supported formats (for example, GeoJSON, YOLO, or mask images).
- **Storing labels** and their corresponding raster chips in Autonomous AI Database, OCI Object Storage, or locally, to continue the workflow directly in Spatial AI.
- **Auto-labeling** using geometry features either from Oracle Spatial databases or from Oracle-managed geometry data, which maps physical features on the ground.

These capabilities make Spatial Studio the primary tool for preparing labeled geospatial raster datasets for use in Spatial AI to train new models or apply transfer learning on existing models with additional data.

AI Labeling in Spatial Studio is typically used in the following scenarios:

- To automatically generate initial labels through auto-labeling, followed by manual review and edit.
- To manually prepare training datasets by labeling geospatial raster chips or refining auto-labeled results.
- To leverage existing label data by loading labels from supported formats.
- To continue the AI workflow by storing labels in the database, OCI Object Storage, or local files for use in Spatial AI.

## Key Concepts in AI Labeling

Oracle Spatial Studio provides a labeling environment that integrates tightly with Spatial AI for preparing geospatial raster data for deep learning.

This section introduces key concepts used in AI Labeling.

### Geospatial Raster

A geospatial raster is an image composed of a grid of pixels, each tied to a specific location on the Earth's surface. In AI Labeling, geospatial rasters are the raw input for deep learning workflows. They may be georeferenced (tied to real-world coordinates) or non-georeferenced (treated as plain images).

Also, note that:

- Geospatial rasters stored in OCI Object Storage are accessed as collections of raster chips, each chip being a separate image used for labeling.
- Large geospatial rasters stored as **GeoRaster** objects in Oracle Spatial can be split into chips when creating a project in Spatial Studio, where the user defines the chip size for labeling and deep learning processing.

### Chip

A chip is a smaller portion of a geospatial raster image and the basic unit of work in AI Labeling. Chips make it possible to apply machine learning and deep learning techniques to very large geospatial rasters by dividing them into manageable pieces.

In Spatial Studio, users label chips directly. These labeled chips provide the training data for deep learning models.

### Label

A label assigns semantic meaning to geospatial raster data. In AI Labeling, labels can be:

- **Feature-based:** Attached to specific regions in a chip, such as buildings, roads, or vegetation.
- **Chip-based:** Applied to the entire chip, used for image classification (for example, labeling a chip as urban, forest, or water).

Labels are the ground truth used to train machine learning and deep learning models. They can be created manually in Spatial Studio, imported in supported formats, or generated automatically.

### Auto-labeling

Auto-labeling is the process of automatically generating labels without manual drawing. It uses known features from maps to label geospatial raster chips. In Spatial Studio, auto-labeling can be performed in two ways:

- **Auto-labeling with Oracle-managed data:** Uses an Oracle-managed set of supported feature types (such as buildings or water). These features are mapped to the label categories defined in the project.
- **Auto-labeling with user-managed data:** Uses user-managed data containing SDO\_GEOMETRY objects (that is, features) to generate labels aligned with geospatial raster chips.

### Labeling Types

AI Labeling in Spatial Studio supports different labeling types, depending on the machine learning or deep learning task:

#### **Image Classification**

A single label is applied to an entire geospatial raster chip (for example, *urban*, *forest*, *water*).

#### **Object Detection**

Labels are applied to bounding boxes that mark the location and type of objects within a geospatial raster chip (for example, detecting buildings or vehicles).

#### **Semantic Segmentation**

Labels are applied at the pixel level, assigning each pixel in a geospatial raster chip to a category (for example, distinguishing between vegetation, road, and water areas).

#### **Sparse Labeling (variant of Semantic Segmentation)**

Instead of labeling all pixels, only a subset of pixels is labeled across the geospatial raster chip (for example, annotating key sample points of roads or vegetation). This approach reduces annotation effort while still guiding model training.

#### **Instance Segmentation**

Similar to semantic segmentation, but separates individual objects of the same category (for example, labeling multiple distinct trees within the same chip).

#### **Nested Labels (Object Detection & Instance Segmentation)**

For the project types discussed under [Labeling Types](#), it is also possible to assign additional labels or attributes per instance. For example, in instance segmentation of buildings, each building polygon can include nested information such as *height*, *usage*, or other classification labels. This extends the concept of image classification to the level of individual detected objects.

## Overview of AI Labeling Page

The AI Labeling page allows you to create AI labeling projects, label chips, load and store labels, and share your AI labeling project with other users.

#### **Note**

Spatial Studio needs to be attached to a compute environment for AI Labeling. See [Create a Compute Environment](#) for more information.

The page displays all the AI Labeling projects created in your Spatial Studio instance:

Name	Public	Datasets	Labels	Labeling objective type	Last modified date	Project progress	Action
Instance segmentation buildings and trees [bruce]		buildings and water	SF Area Inst Segm with pixels	Instance segmentation	2022-07-26T23:41:16.426411	2 of 6 labeled	...
object detection buildings and trees [bruce]		buildings and water	SF Area Object Detection	Object detection	2026-05-11T16:36:12.567682404Z	5 of 6 labeled	Go to labeling
Project semantic segm with pixels [bruce]		PCI_IMAGE	Test semantic segmentation, pixels	Semantic segmentation	2026-05-13T17:11:56.977187823Z	1 of 4 labeled	Edit project
semantic segmentation buildings and trees [bruce]		buildings and water	Test semantic segmentation, pixels	Semantic segmentation	2022-07-26T23:41:16.426411	0 of 0 labeled	Load labels
Swimming pools Proj Classify image [bruce]		PCI_IMAGE	Classify swimming pools	Image classification	2022-07-26T23:41:16.426411	0 of 0 labeled	Store project
Swimming pools Proj Inst segm with pixels [bruce]		PCI_IMAGE	SF Area Inst Segm with pixels	Instance segmentation	2022-07-26T23:41:16.426411	5 of 4 labeled	Permissions
							Delete

You can perform the following actions on the AI Labeling page:

- You can create a new AI Labeling project, by clicking **Create Project**.
- You can filter to view projects that are either created by you, or shared with you, or both.
- You can perform the following actions by clicking **...** against any displayed project :
  - **Go to labeling:** Label chips within a project (see [Create Labels Manually](#) and [Create Labels with Auto-Label](#)).
  - **Edit project:** Edit an existing AI Labeling project.
  - **Load labels:** Load labels into your project (see [Load AI Labels](#)).
  - **Store project:** Store the entire project (see [Store AI Labels](#)).
  - **Permissions:** Configure project sharing and permissions (see [Sharing an AI Labeling Project](#)).
  - **Delete:** Delete a project.

## Get Started with AI Labeling

Learn to work with AI Labeling in Oracle Spatial Studio.

### Topics:

- [Prepare for AI Labeling](#)
- [Create an AI Labeling Project](#)
- [Create Labels Within an AI Labeling Project](#)
- [Store AI Labels](#)
- [Sharing an AI Labeling Project](#)

## Prepare for AI Labeling

Learn the prerequisite tasks required for creating an AI Labeling project.

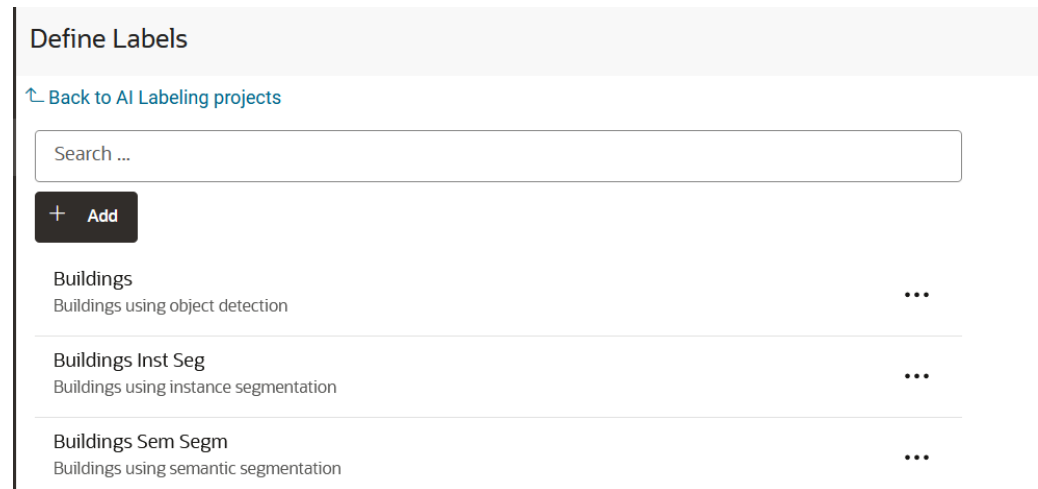
1. Ensure that you have geospatial raster chips available for labeling on the Datasets page in Spatial Studio.

GeoRaster datasets containing imagery can be created from one of the following options:

- **Oracle Spatial GeoRaster Database:**
  - [Create a Dataset by Loading Raster Images into Oracle Spatial GeoRaster](#)

- [Create a GeoRaster Dataset](#)
  - **Oracle Cloud Infrastructure (OCI) Object Storage:** [Create a Dataset Using a Pre-Authenticated Request URL](#)
2. Define labels in Spatial Studio.
    - a. Navigate to the **AI Labeling** page.
    - b. Click **Define Labels**.

The **Define Labels** page opens where you can view the existing labels or add a new label. For example:



- c. Click **Add** to create a label definition.

The **Add Labels** slider opens as shown:

## Add Labels

### General Information

Label Name Buildings
Description Buildings using object detection

Next	Cancel
------	--------

- d. Enter the **Label Name**, **Description**, and click **Next**.
- e. Select a **Labeling task type** from the drop-down and define the labels.

The supported AI Labeling task values are as shown:

- **Image Classification**: Add one or more instructions as required. For example:

## Add Labels

### Labels

Choose a labeling task type and specify labels of the task.

Labeling task type  
Image classification

Classify the main object category within an image.

### Instructions

Instruction format ×

Multiple choice  Single choice  Text

---

Compose Instruction  
Select what applies

Label option 1  
The swimming pool is big ×

Label option 2  
The swimming pool is suitable for children ×

[+ Add option](#)

Instruction format ×

Multiple choice  Single choice  Text

---

Compose Instruction  
Is the swimming pool clean?

Label option 1  
Yes ×

Label option 2  
No ×

[+ Add option](#)

Instruction format ×

Multiple choice  Single choice  Text

---

Compose Instruction  
Other labels:

[+ Add instruction](#)

**Add**

- **Object Detection:** Enter a **Label Name** and **Label color**. Optionally, add nested labels. For example:

### Add Labels

**Labels**

Choose a labeling task type and specify labels of the task.

Labeling task type  
Object detection

Identify the object category and locate the position using a bounding box for every known object within an image.

Double click on each row to edit.

Label Name	Labeling color	Nested Labels
<input type="text" value="Label name *"/> <input type="text" value="Building"/>	<input type="color" value="#008000"/>	<input checked="" type="checkbox"/> Add nested labels ⓘ <div style="border: 1px solid #ccc; padding: 5px; margin-top: 5px;"> <p>Instruction format</p> <p> <input type="radio"/> Multiple choice             <input checked="" type="radio"/> Single choice             <input type="radio"/> Text         </p> <hr/> <p>Compose Instruction * Is there water body near the building?</p> <p> <input type="radio"/> Label option 1 * Yes         </p> <p> <input type="radio"/> Label option 2 * No         </p> </div>

- **Semantic Segmentation:** Enter a **Label Name** and **Labeling color**. For example:

## Add Labels

### Labels

Choose a labeling task type and specify labels of the task.

Labeling task type  
Semantic segmentation

Identify the object category of each pixel for every known object within an image. Labels are class-aware.

Double click on each row to edit.

Label Name	Labeling color
Building	

[+ Add label](#)



[Add](#) [← Back](#) [Cancel](#)

- **Instance Segmentation:** Enter a **Label Name** and **Labeling color**. Optionally, add nested labels. For example:

## Add Labels

### Labels

Choose a labeling task type and specify labels of the task.

Labeling task type  
Instance segmentation

Identify each object instance of each pixel for every known object within an image. Labels are instance-aware.

Double click on each row to edit.

Label Name	Labeling color	Nested Labels
<input type="text" value="Building"/>	<input type="color" value="#008000"/>	<input type="checkbox"/>

Add nested labels ⓘ

[+ Add label](#)

- f. Click **Add**.

The label gets added and listed on the **Define Labels** page.

## Create an AI Labeling Project

You can create an AI Labeling project in Spatial Studio using defined labels.

Ensure that you meet all the prerequisites as described in [Prepare for AI Labeling](#). Perform the following steps to create an AI Labeling project:

1. Navigate to the **AI Labeling** page.
2. Click **Create Project**.

The **Create Project** slider opens as shown:

## Create project

### ▼ General information

Name  
Buildings

Description

Dataset  
LANDSAT5\_IMAGES [bruce] ▼

Labels  
Test semantic segmentation, pixels ▼

### ▼ Project configurations

Color balance  
None ▼

Geo-referenced

Bands

Red  
1

Green  
2

Blue  
3

Image chip size (pixels)

Width  
512

Height  
512

Create project

Cancel

3. Enter the project **Name** and optionally, **Description**.
4. Select the GeoRaster **Dataset** from the drop-down.

Note the following about the datasets:

- For a GeoRaster dataset created from Oracle Spatial GeoRaster database, you need to specify the chip size to control how the geospatial raster is split into chips for labeling.
  - For a GeoRaster dataset created from OCI Object Storage, chips are provided as part of the dataset. They may include georeferencing through embedded formats (GeoTIFF) or a world file.
  - Both the preceding dataset types can be georeferenced or non-georeferenced.
5. Select a label from the **Labels** drop-down.
  6. Configure the geospatial raster display.

- a. Select the bands for RGB rendering (default: bands 1, 2, and 3).
  - b. Optionally, apply normalization or enhancement functions from the **Color balance** drop-down.  
The supported values are:
    - Automatic linear stretch
    - Manual linear stretch
    - Piecewise linear stretch
    - Normalization
    - Equalization
  - c. Optionally, specify the **Image chip size** (Width and Height) if you are using a GeoRaster dataset created from Oracle Spatial GeoRaster database.
7. Click **Create Project**.
- The project gets created and is shown listed on the **AI Labeling** page.

## Create Labels Within an AI Labeling Project

You can add labels to GeoRaster image chips within an AI Labeling project.  
You can label chips using one of the following options.

### Topics:

- [Create Labels Manually](#)
- [Create Labels with Auto-Label](#)
- [Load AI Labels](#)

## Create Labels Manually

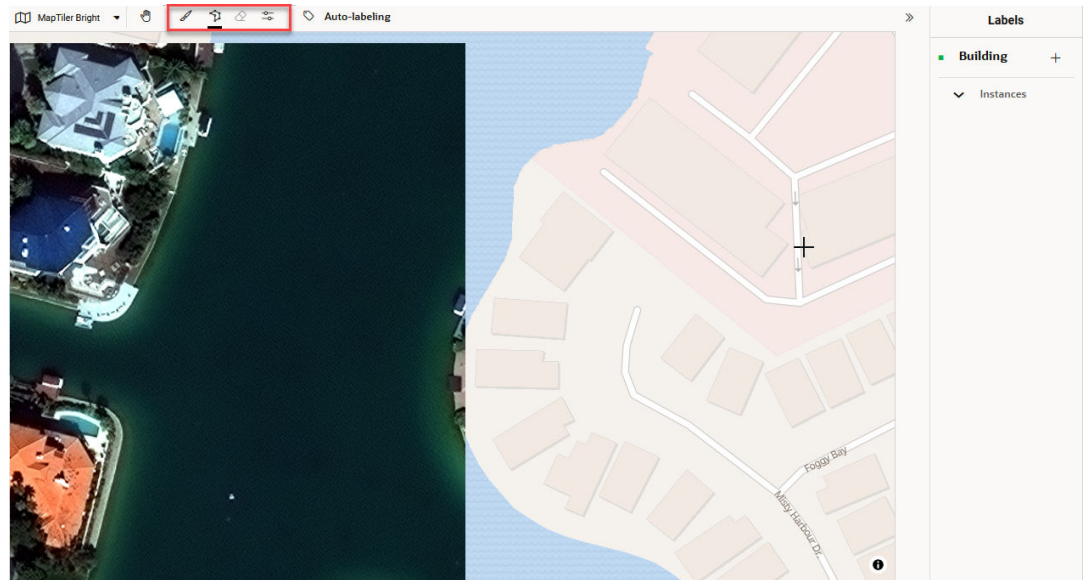
You can add labels to chips manually in Spatial Studio.

Perform the following steps to manually label a chip.

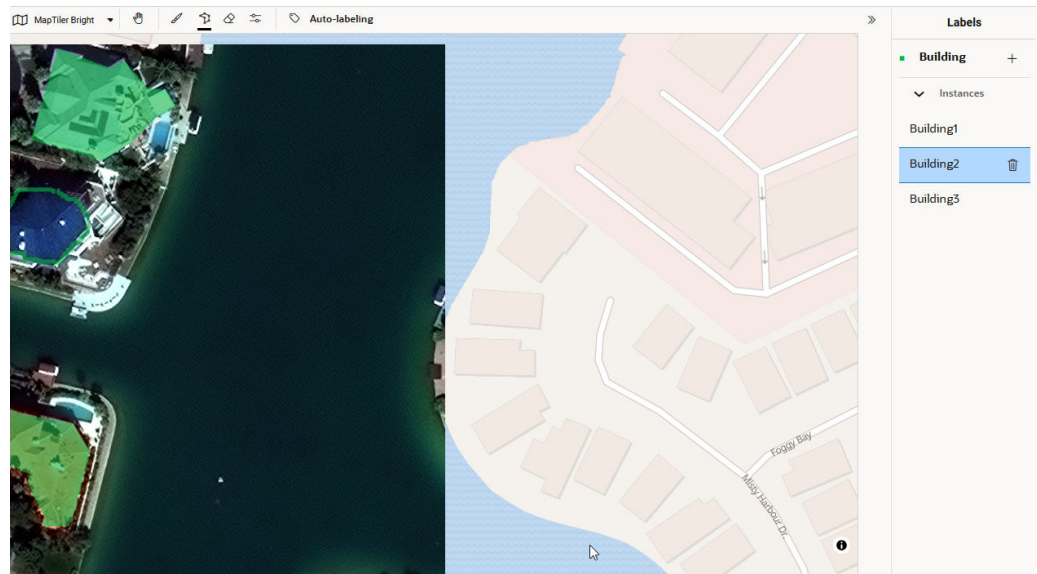
The following instructions assume that an AI Labeling project created using a dataset containing multiple image chips exists in Spatial Studio. Also, the related label to be applied onto the chips is already defined (see [Prepare for AI Labeling](#)).

1. Navigate to the **AI Labeling** page.  
The page displays all the AI Labeling projects created in your Spatial Studio instance.
2. Click to open the project you wish to start labeling.

Alternatively, click **⋮** against the desired project and select **Go to labeling**.  
The project opens displaying the first chip in the dataset. For example:



3. Click **View all images** (at the bottom of the page) to review the chips in the dataset.  
Note that you can logically delete or restore the chips within the project.
4. Select the chip for labeling and go back to the labeling page.
5. Label the chip manually as shown:
  - a. Perform the following step depending on your project type.
    - *Object Detection*: Click + next to the label name (on the right side of the page) to create a new instance. Labels are created, moved, resized, and deleted using bounding boxes.
    - *Instance Segmentation*: Click + next to the label name (on the right side of the page) to create a new instance. The drawing tools (Brush, Polygon, Eraser) for manual labeling appear at the top of the chip.
    - *Semantic Segmentation*: The drawing tools (Brush, Polygon, Fill Color, Eraser) are available without creating instances.
  - b. Choose the tool of your choice and manually mark the chip for labeling.  
For example the following image shows three labeling instances - two using polygons and one using brush on a chip that belongs to an AI Labeling project of type *Instance Segmentation*.



6. Click **Save** to store the labels along with the other Spatial Studio data in the database.
7. Repeat step-3 to step-6 for all the required chips in the project.

## Create Labels with Auto-Label

Spatial Studio allows you to automatically generate labels from existing data instead of drawing them manually.

Auto-labeling provides an initial set of annotations for geospatial raster chips that can then be reviewed and refined manually.

### Note

Auto-labeling is supported for georeferenced projects of type **Object Detection**, **Semantic Segmentation**, and **Instance Segmentation** only.

### Topics:

- [Auto-Label with Oracle-Managed Feature Data](#)
- [Auto-Label with User-Managed Geometry Data](#)

## Auto-Label with Oracle-Managed Feature Data

You can label chips within an AI Labeling project using Oracle-managed geometry data to automatically detect physical features in geospatial raster chips.

Category pairing is applied by pairing each project label category (for example, *building*, *road*, *water*) with a corresponding Oracle-managed feature type.

To auto-label chips, ensure that the project uses geo-referenced spatial data either in a geo format (for example, GeoTIFF) or with the corresponding world file.

The following instructions assume that an AI Labeling project created using a dataset containing multiple image chips exists in Spatial Studio.

1. Navigate to the **AI Labeling** page.

The page displays all the AI Labeling projects created in your Spatial Studio instance.

- Click to open the project you wish to start labeling.

Alternatively, click **\*\*\*** against the desired project and select **Go to labeling**. The project opens displaying the first chip in the dataset.

- Click **View all images** (at the bottom of the page) to review the chips in the dataset.

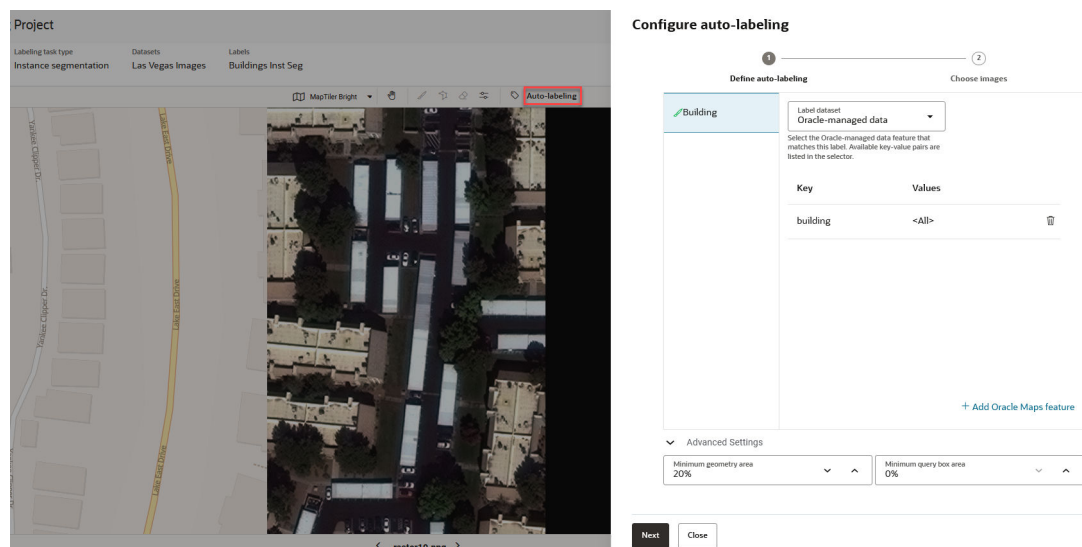
Note that you can logically delete or restore the chips within the project.

- Select the chip for labeling and go back to the labeling page.

The **Auto-labeling** tag gets enabled at the top of the chip (shown highlighted in the following figure).

- Click **Auto-labeling**.

The **Configure auto-labeling** workflow opens and displays the **Define auto-labeling** step as shown:



- Select **Oracle-managed data** from the **Label dataset** drop-down.

- Click **Add Oracle Maps feature**.

- Select the **Key** and **Values** from the drop-downs.

You can repeat this step to add as many labels.

- Optionally, configure the **Minimum geometry area** and **Minimum query box area** under **Advanced Settings**.

Note the following:

- Minimum Geometry Area:** For geometries partially outside the chip bounding box, the system calculates the percentage of the geometry's area that remains inside. If the percentage is less than the specified value, the geometry is ignored.
- Minimum Query Box Area:** For each geometry, the system calculates the percentage of the chip bounding box covered by the geometry. If the percentage is less than the specified value, the geometry is ignored.

- Click **Next**.

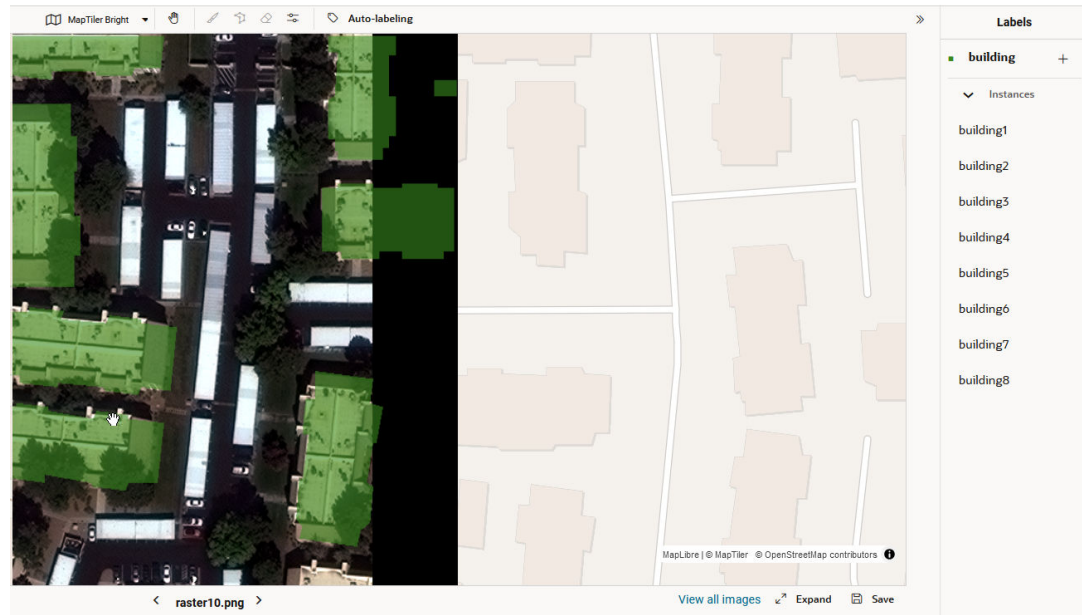
The **Choose images** step opens and displays all the chips in the project along with their labeling status.

11. Select one or more chips which you wish to label.
12. Click **Start auto-labeling**.

Once the process completes the labeling status will get displayed as **Finished**.

13. Click **Close**.

The chip(s) get auto-labeled as shown:



## Auto-Label with User-Managed Geometry Data

You can label chips within an AI Labeling project with user-managed datasets containing `SDO_GEOMETRY` objects in the Oracle Spatial database.

Geometries are matched against geospatial raster chips, and labels are created where geometries overlap chips.

- Category pairing is applied by pairing each project label category (for example, *building*) with a dataset column that stores `SDO_GEOMETRY` objects of that type.
- If you have **GeoJSON** or **Shapefiles**, these must first be uploaded into a Spatial Studio dataset; once imported, they can then be used for geometry-based auto-labeling.

To auto-label chips, ensure that the project uses geo-referenced spatial data either in a geo format (for example, GeoTIFF) or with the corresponding world file.

The following instructions assume that an AI Labeling project created using a dataset containing multiple image chips exists in Spatial Studio.

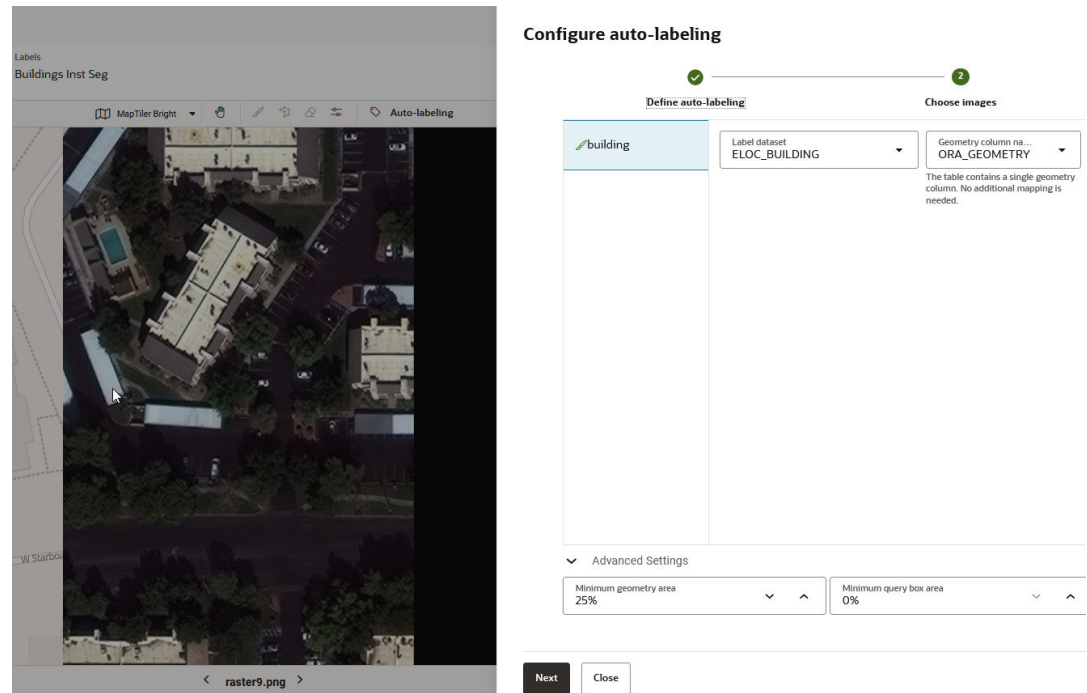
1. Navigate to the **AI Labeling** page.  
The page displays all the AI Labeling projects created in your Spatial Studio instance.
2. Click to open the project you wish to start labeling.  
Alternatively, click **⋮** against the desired project and select **Go to labeling**.  
The project opens displaying the first chip in the dataset.
3. Click **View all images** (at the bottom of the page) to review the chips in the dataset.

Note that you can logically delete or restore the chips within the project.

4. Select the chip for labeling and go back to the labeling page.  
The **Auto-labeling** tag gets enabled at the top of the chip.

5. Click **Auto-labeling**.

The **Configure auto-labeling** workflow opens and displays the **Define auto-labeling** step:



6. Select the dataset from the **Label dataset** drop-down.
7. Select the **Geometry column name**.
8. Optionally, configure the **Minimum geometry area** and **Minimum query box area** under **Advanced Settings**.

Note the following:

- **Minimum Geometry Area:** For geometries partially outside the chip bounding box, the system calculates the percentage of the geometry's area that remains inside. If the percentage is less than the specified value, the geometry is ignored.
- **Minimum Query Box Area:** For each geometry, the system calculates the percentage of the chip bounding box covered by the geometry. If the percentage is less than the specified value, the geometry is ignored.

9. Click **Next**.

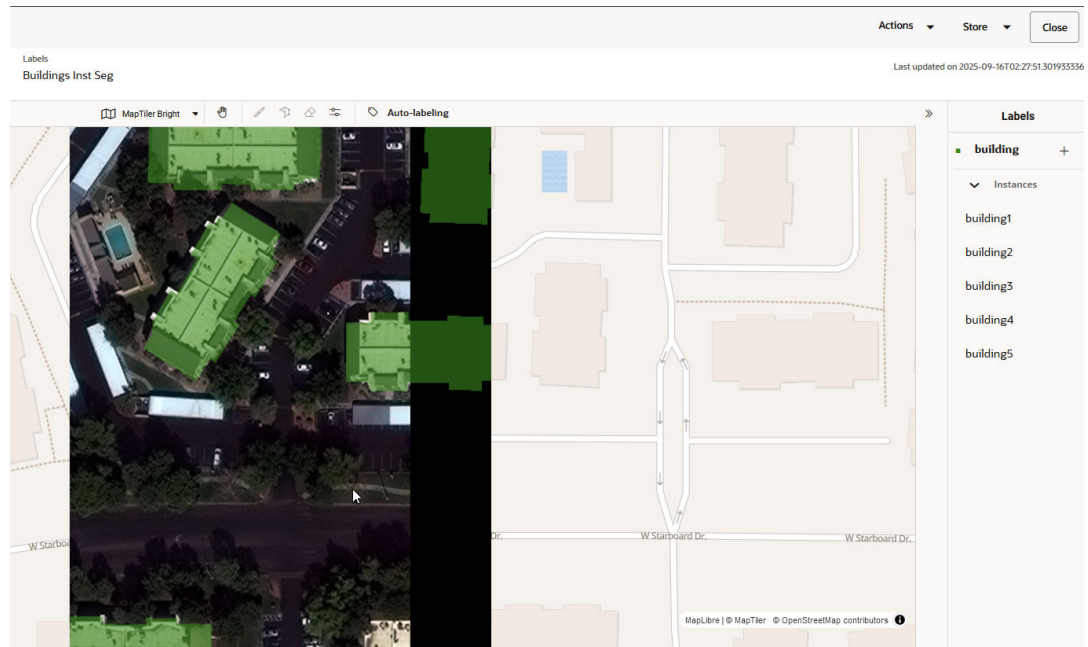
The **Choose images** step opens and displays all the chips in the project along with their labeling status.

10. Select one or more chips which you wish to label.
11. Click **Start auto-labeling**.

Once the process completes the labeling status gets displayed as **Finished**.

12. Click **Close**.

The chip(s) get auto-labeled as shown:



## Load AI Labels

You can load existing labels into your AI Labeling project.

You can upload individual files or a ZIP file. Individual files are usually recommended because they show more precise errors, for example, when only a few label files have formatting issues or need correction. When uploading a zip file, ensure that all the individual files are placed in the root folder, without subfolders.

The following file formats are supported for the labeling types (both uppercase and lowercase extensions are accepted):

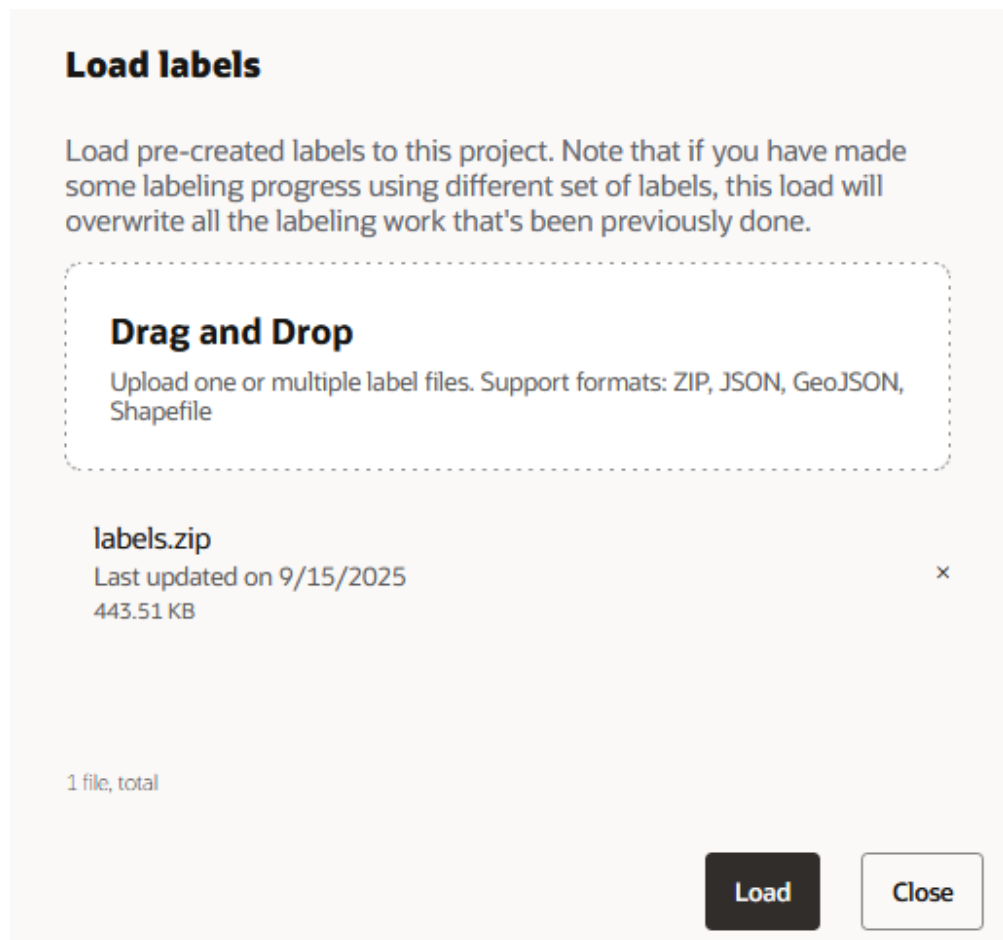
- **Object detection:** JSON (.json), GeoJSON (.geojson), Shapefile (.shp/.shx/.dbf/.prj), Pascal VOC (.xml), and YOLO (.txt)
- **Instance segmentation:** JSON, GeoJSON, and Shapefile
- **Semantic segmentation:** .png, .tiff, .geotiff, .gif, .bmp, .jpg, and .jpeg

It is important to note that the labels are matched to chips by name (for example, **chip\_0123.\*** → **chip\_0123**). Use a single label source per chip. For mask files, image dimensions must match the target chip.

Perform the following steps to load labels into an AI Labeling project.

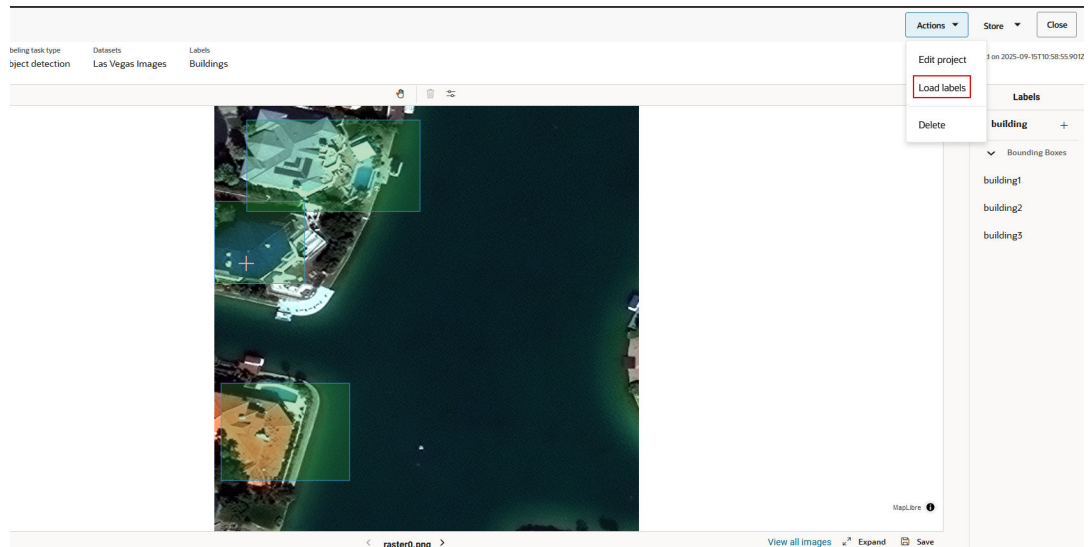
1. Navigate to the **AI Labeling** page.
2. Click **⋮** against the desired project and select **Load labels**.

Alternatively, click open the project and select **Load Labels** from the **Action** menu. The **Load labels** window opens as shown:



3. Click to upload the file (or through dragging and dropping the file) from your local system.
4. Click **Load**.
5. Click **Close**.

Labeling is applied to all the chips that are impacted by the loaded label. The following figure shows an example of a chip labeling through a loaded label. The chip belongs to an AI Labeling project of type object detection.



## Store AI Labels

Spatial Studio allows you to store the entire AI project or only the current chip.

The files can be stored in the database, Oracle Cloud Infrastructure (OCI) Object Storage, or the local system. They can be further used to continue the workflow in Spatial AI or used externally.

The stored file contains the following:

- Labels in the selected format(s).  
The following file formats are supported for the labeling types (both uppercase and lowercase extensions are accepted).
  - **Object detection:** JSON (.json), GeoJSON (.geojson), Shapefile (.shp/.shx/.dbf/.prj), Pascal VOC (.xml), COCO, KITTI, and YOLO (.txt)
  - **Instance segmentation:** JSON and COCO
  - **Semantic segmentation:** .png, .tiff, .geotiff, .gif, and .bmp
- Geospatial raster chips for the stored scope:
  - **Database:** Chips are stored as GeoRaster. If the project produces mask labels (semantic segmentation), those masks are also stored as GeoRaster.
  - **Object Store and Local file:** Chips are stored as-is. If a chip used a world file for georeferencing, it is stored as a GeoTIFF with embedded georeferencing.

Also, note the following:

- Chips that are logically deleted are excluded.
- Chips without labels are excluded unless explicitly saved with an empty label.

Perform the following steps to store an entire project or a chip only from an AI Labeling project.

1. Navigate to the **AI Labeling** page.
2. Click **...** against the desired project and select **Store Project** to store all the labeled project chips.

Alternatively, click open the project and choose **Store project** or **Store current labeled chip** as desired from the **Store** menu (at the top of the page). Depending on your choice, the **Store project** or **Store current labeled chip** window opens. For example:

### Store project

Destination  
Database

Select connection  
SPATIAL\_STUDIO

Table  
AI\_LABELING\_CONTENT\_CLOB

Format  
JSON

Store Cancel

3. Select the storage **Destination**.
4. Perform the following related steps depending on your choice in the preceding step.
  - **Database:**
    - a. Select the required **Connection**.
    - b. Enter the **Table** name.
    - c. Select the export **Format**.
  - **Local file:** Select the storage **Format**.
  - **Object store** (OCI Object Storage):

- a. Enter the **PAR URL**.  
To store in OCI Object Storage you require a Pre-Authenticated Request (PAR) URL created with access type *Permit object reads and writes to those with the specified prefix*.
  - b. Enter the **Prefix** for the objects.
  - c. Select the storage **Format**.
5. Click **Store**.  
The files is stored in the target destination.

## Sharing an AI Labeling Project

You can share your AI Labeling projects with other users in Spatial Studio.

When a project is made public, multiple users can work on the same dataset and labels collaboratively. This enables team-based labeling workflows and ensures all results are stored in a single shared project. However, ensure that the dataset referenced by the project is also public to share your project.

Perform the following steps to share your AI Labeling project.

1. Navigate to the **AI Labeling** page.
2. Click **⋮** against the desired project and select **Permissions**.  
The **Sharing and Permissions** window opens.
3. Select the **Public** checkbox.
4. Click **OK**.

See [About Published Projects](#) for the actions that are supported on published projects.

# 4

## Work with Datasets

You can create, edit, and delete datasets in Spatial Studio on the **Datasets** page.

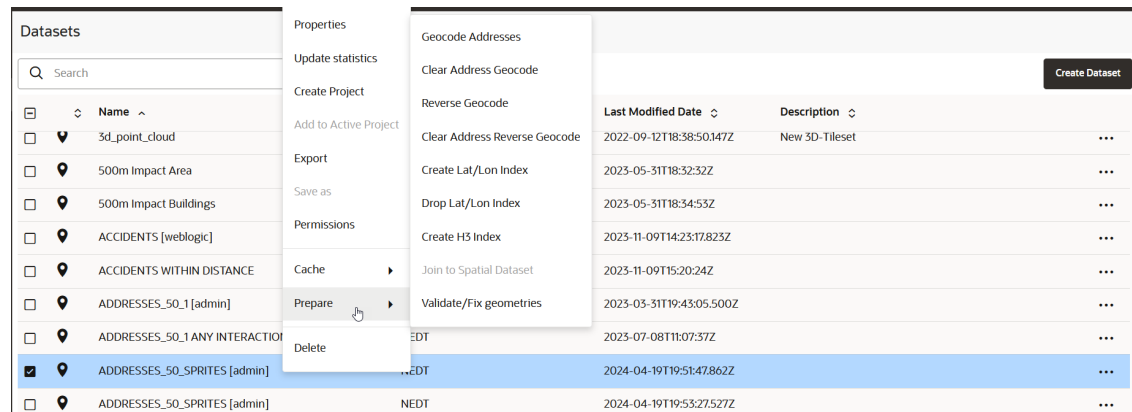
### Topics:

- [Overview of Datasets Page](#)
- [Create a Dataset on Datasets Page](#)
- [Generate a Spatial Analysis Dataset](#)
- [Manage Datasets](#)

## Overview of Datasets Page

The Datasets page lets you view and edit existing datasets, and also create new ones.

The following figure shows the Datasets page:



Datasets that are displayed on the **Datasets** page belong to one of the following two categories:

- Manually created by clicking **Create Dataset** or when you perform a **Save as** operation with the **Create Dataset** option enabled. This dataset can then be added to the project for visualization.
- Automatically created when you perform spatial analysis, save selected features, or store pins as a map layer. This dataset gets instantly added to the map visualization and also appears listed in the **Datasets** page. Such a dataset is known as a spatial analysis dataset.

You can perform the following actions on the Datasets page:

- You can manually create a new dataset, by clicking **Create Dataset**.
- You can filter to view datasets that are either created by you, or shared with you, or both.
- By clicking **\*\*\*** against any displayed dataset or by right-clicking a dataset row, you can perform the following actions:
  - **Properties:** View or modify properties of the dataset

- **Update Statistics:** Update the dataset statistics (refer to [Update Statistics for Datasets](#))
- **Create Project:** Create a new project using the dataset
- **Add to Active Project:** Add the dataset to the project in the Active Project page
- **Export:** Export the dataset (in GeoJSON or CSV file format)
- **Save as:** Make a new copy of the dataset
- **Permissions:** Configure dataset sharing and permissions
- **Cache:** Control map tiles pre-caching activities (refer to [About Cache in Spatial Studio](#))
- **Prepare:** Prepare a dataset for any of the following options:
  - \* **Geocode Addresses:** Add geocoded information such as geographic coordinates to the dataset
  - \* **Clear Address Geocode:** Remove geocoded information from the dataset
  - \* **Reverse Geocode:** Add address information from a set of geographic coordinates to the dataset
  - \* **Clear Address Reverse Geocode:** Remove address information from the dataset
  - \* **Create Lat/Lon Index:** Create latitude/longitude index
  - \* **Drop Lat/Lon Index:** Remove latitude/longitude index
  - \* **Create H3 Index:** Prepare an H3 aggregation dataset
  - \* **Join to Spatial Dataset:** Prepare a non-spatial dataset for map visualization by joining to a spatial dataset
  - \* **Validate/Fix geometries:** Validate the geometries in the dataset and also fixes the geometries where it is possible for Spatial Studio to do so in an automatic manner.
- **Delete:** Delete the dataset

## Create a Dataset on Datasets Page

Spatial Studio allows you to create datasets using different options from the Datasets page.

The following figure describes the supported options to create a dataset:

## Create Dataset

Create a dataset from one of the following

Database table/view

Select Connection  
MY\_DEFAULT\_CONNECTION

GeoJSON URL

OGC Web Map Service

OCI pre-authenticated request URL

Upload data and create a dataset from one of the following

Local file

File URL

Cesium formats

Upload imagery data and create a GeoRaster dataset from PAR URL

Imagery file via PAR URL

Create

Cancel

As seen in the preceding figure, you can create a dataset from the following sources:

- [Create a Dataset from Database Tables or Views](#)
- [Create a GeoJSON URL Dataset](#)
- [Create an OGC WMS Dataset](#)
- [Create a Dataset Using a Pre-Authenticated Request URL](#)
- [Create a Dataset by Uploading a File](#)
- [Create a Dataset Using a File URL](#)
- [Create a Dataset by Loading Raster Images into Oracle Spatial GeoRaster](#)

The following sections explain in detail the steps to create a dataset using the supported options:

## Create a Dataset from Database Tables or Views

You can create a dataset from tables and views on your Autonomous AI Database instance.

Perform the following steps to create a dataset using the default database connection:

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.

The **Create Dataset** window opens.

3. Select the **Database table/view** option.
4. Select the default connection from the **Select Connection** drop-down.
5. Click **Create**.

The **Select items to create datasets** window opens listing all the tables, views and GeoRaster data present in the database.

**Select items to create datasets**

Search ...

MY\_DEFAULT\_CONNECTION

- Tables
- Views
- GeoRasters

Dataset name

OK Cancel

6. Enter a **Dataset name**.
7. Select an item from the list and click **OK**.

✓ **Tip**

You can also use the **Search** box to quickly locate your table. This is especially useful or even necessary if your database connection has many tables, as the drop-down list only shows up to 500 tables or views.

The new dataset is added and listed on the Datasets page.

## Create a GeoJSON URL Dataset

You can create a dataset by specifying a GeoJSON URL.

It is important to note the following prior to creating a GeoJSON URL dataset:

- A GeoJSON URL based dataset accesses its data directly from the source URL. There is no database table managed in Spatial Studio for this dataset.
- A GeoJSON URL based dataset does not support Spatial Analysis.
- A GeoJSON URL based dataset is subject to the same upload size limit, or 100MB, whichever is smaller.
- If a GeoJSON URL does not support CORS (Cross-Origin Resource Sharing), then Spatial Studio will act as a proxy to the browser requesting the GeoJSON URL data.

Perform the following steps to create a GeoJSON URL dataset:

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.  
The **Create Dataset** window opens.
3. Select the **GeoJSON URL** option.
4. Specify the **GeoJSON URL** to access GeoJSON data from an external domain for map visualization.

### Note

Ensure you add the external domain used for accessing GeoJSON data to the list of entries in the Safe Domains list.

5. Click **Create**.  
**Create dataset from GeoJSON** window opens.
6. Optionally, enter a **Dataset name**.
7. Click **Submit**.  
The GeoJSON URL dataset gets created with the warning, `No key column was found`. You must resolve the warning in order to use the dataset as a map layer for visualization.

## Create an OGC WMS Dataset

Spatial Studio allows you to define datasets that are based on the `GetMap` responses from any external OGC (Open Geospatial Consortium) WMS (Web Map Service) services.

Prior to creating a WMS dataset, ensure that the required OGC WMS connection is created in Spatial Studio.

Perform the following steps to create an OGC WMS dataset:

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.  
The **Create Dataset** window opens.
3. Select **OGC Web Map Service**.

4. Select the **WMS Connection** to be used from the drop-down list.
5. Explore all the available WMS map layers from the external WMS server and select the required one.

You can **Shift+Click** to select more than one layer. The external WMS server combines multiple layers into a single image as a response to Spatial Studio's requests for the new WMS dataset.

6. Enter the **Dataset name**.
7. Click **OK**.

The OGC WMS dataset gets created and is displayed on the **Datasets** page. When this WMS dataset is displayed on a map visualization, Spatial Studio will obtain and display the images for both the selected layers.

## Create a Dataset Using a Pre-Authenticated Request URL

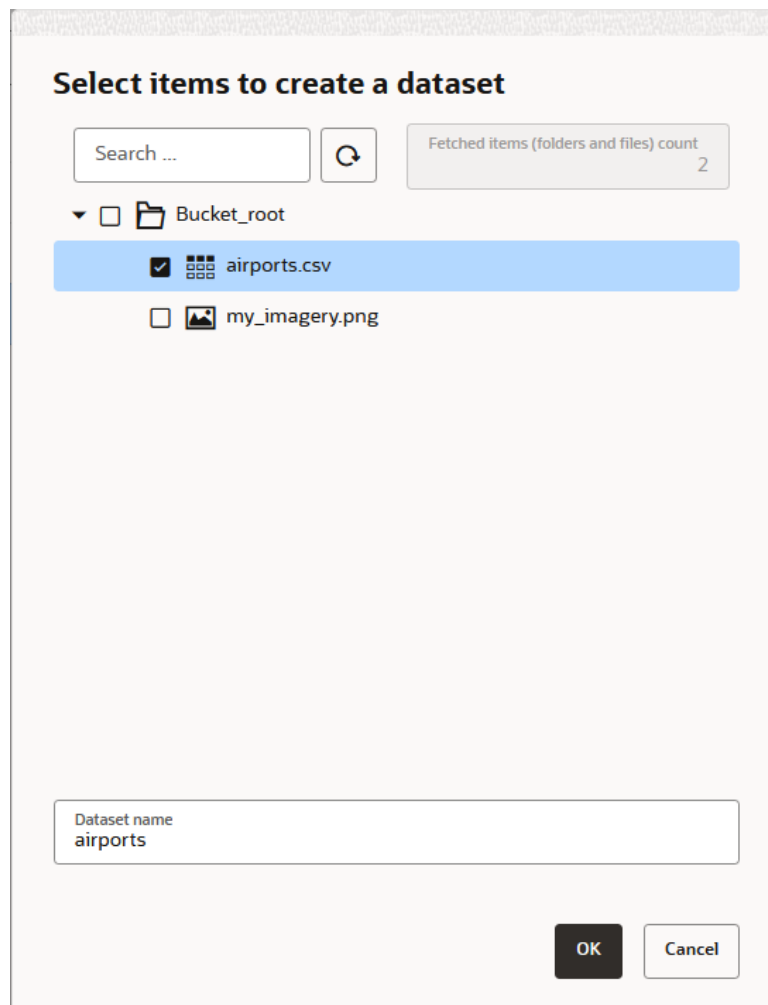
You can create a dataset by specifying the pre-authenticated request (PAR) URL to an object storage bucket on your Autonomous AI Database instance.

As a prerequisite, ensure that Spatial Studio is attached to a compute environment. See [Create a Compute Environment](#) for more information.

Perform the following steps to create a PAR URL dataset:

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.  
The **Create Dataset** window opens.
3. Select the **OCI pre-authenticated request URL** option.
4. Specify the **PAR URL** to access all the objects in the storage bucket.
5. Click **Create**.

The **Select items to create a dataset** opens as shown:



6. Select the object file(s) for creating the dataset.

For instance, geospatial rasters stored in object storage can be accessed as collections of tiles. Therefore, you can select all the required image tiles at this step.

7. Click **OK**.

The dataset get created and is displayed on the **Datasets** page.

The PAR URL details and the object storage files used for creating the dataset can be viewed in the **Storage token dataset** tab in **Dataset Properties**.

## Create a Dataset by Uploading a File

You can create a dataset by uploading a file in a format supported by Spatial Studio.

The supported file formats are as follows:

- Excel file
- Shapefile
- GeoJSON file
- CSV file
- KML file

**Note**

Compute environment is required if you are uploading a large file that exceeds 50 MB. See [Create a Compute Environment](#) for more information.

Also, note the following:

- WKT or GeoJSON geometry text values in Excel or CSV files are supported. If you are uploading a file with WKT text values, then only WKT strings representing geodetic coordinates (longitude and latitude) are supported.
- Three dimensional coordinates are supported in GeoJSON files.

1. Navigate to the **Datasets** page.

2. Click **Create Dataset**.

The **Create Dataset** window opens.

3. Select the **Local File** option.

4. Upload any one of the supported file types.

5. Click **Create**.

The **Create Dataset** window opens displaying the data columns.

6. Select a value in **Upload to connection** drop-down.

7. Optionally, review and edit any other parameters as required.

8. Click **Submit**.

The new dataset gets added and listed on the Datasets page.

## Upload a Shapefile

You can create a dataset by uploading a shapefile.

A shapefile contains the geospatial data which can be referenced in multiple files with specific file extensions. The following lists a few selected files that contribute to shapefile format:

- **.shp** - Stores the geometry data
- **.shx** - Stores the index of the geometry
- **.dbf** - Stores the attribute information of geometry features
- **.prj** - Stores the coordinate system information
- **.cpg** - Specifies the character set to be used

Note that shapefiles containing WKT v2 projection files are supported in Spatial Studio.

1. Navigate to the **Datasets** page and click **Create Dataset**.

2. Select **Local File**.

3. Click  to upload the shape file.

The **File Upload** window opens.

4. Select all the required files from your system.

**Note**

It is mandatory to upload .shp, .shx, and .dbf files.

The **Create dataset from shapefile** dialog opens as shown:

**Figure 4-1 Create dataset from shapefile**

COMPNT_NM	CREATE_DT	VERSION
BOTSHABELO	20180306	1.2.3
KHUBUSIDRIFT	20180306	1.2.3
STUTTERHEIM	20180306	1.2.3
MOTHERWELL	20180306	1.2.3
KWADWESI	20180306	1.2.3
CRADOCK	20180306	1.2.3
NOENIEPUT	20180306	1.2.3
INDWE	20180306	1.2.3
ROSSOUW	20180306	1.2.3
ELANDS HEIGHT	20180306	1.2.3
MACLEAR	20180306	1.2.3
WOLWEFONTEIN	20180306	1.2.3

5. Select the connection to upload the shapefile from the **Upload to connection** drop-down list.
6. Optionally, change the **Table name**.
7. Optionally, change the destination **Dataset name**.
8. Optionally, select the **Coordinate System** to be used.
  - If your shapefile includes a .prj file referencing a custom Geographic Coordinate System (GEOGCS), then Spatial Studio will assign a best-matched geodetic SRID from the target Spatial database, as shown in the preceding figure.
  - If your shapefile does not contain a .prj file, then the system uses the default EPSG:4326 GEOGCS.
9. Optionally, select the required **Character set**.

Spatial Studio automatically detects the character set to be used in the following order of priority:

- Extracts the `charset-name` from a .cpg file, if present.
- Uses the character set specified in the .dbf file header.
- Otherwise, uses the default ISO-8859-1.

You can preview the file attributes using the detected character set. However, you can still choose to switch to a different **Character set** and preview the refreshed contents.

10. Click **Submit**.

The dataset gets created from a shapefile.

## Create a Dataset Using a File URL

You can create a dataset by specifying the file URL of an external server which hosts the geospatial file.

Perform the following steps to create a dataset using an external file URL:

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.  
The **Create Dataset** window opens.
3. Select the **File URL** option.
4. Specify the **File URL** to access the geospatial data from an external domain.  
The following file types are supported:
  - Excel spreadsheet
  - CSV file
  - KML file
  - Shape files contained in one zip file
5. Click **Create**.  
The **Create Dataset** window opens displaying the data columns.
6. Select a value in **Upload to connection** drop-down.
7. Optionally, review and edit any other parameters as required.
8. Click **Submit**.  
The new dataset gets added and listed on the Datasets page.

## Create a Dataset by Loading Raster Images into Oracle Spatial GeoRaster

You can upload raster data files, such as remote sensing images and digital elevation models, into Oracle Spatial GeoRaster on Autonomous AI Database. Optionally, you can create a GeoRaster dataset using this uploaded data.

See [Spatial GeoRaster Developer's Guide](#) for more information on Oracle GeoRaster feature.

Spatial Studio provides a wizard based on an *Extract, Transform, and Load* (ETL) process for creating Oracle GeoRaster objects from geospatial imageries.

## Prerequisites for Uploading Raster File

Learn the prerequisite tasks required for uploading raster data in your Autonomous AI Database.

1. Obtain the georeference information of the raster data to be uploaded.  
A raster data file's georeference information may fall into one of the following scenarios:
  - The georeference information is self-contained in the raster data file itself, and its spatial reference system (or SRID) is recognized and supported by Oracle database.
  - The raster data file has a companion world-file containing the required parameters, and SRID is known. You can then provide this SRID and the world-file's content.

- The raster image is georectified, and the SRID and bounding box values are known. You can then provide the SRID, and the data file's upper-right and lower-left corners' coordinates.
2. Copy the raster files to Oracle Cloud Infrastructure Object Storage.  
See [Putting Data into Object Storage](#) in Oracle Cloud Infrastructure documentation for more information.
  3. Obtain the pre-authenticated request (PAR) URL for the bucket or to a specific file in the bucket.  
See [Creating a Pre-Authenticated Request in Object Storage](#) in Oracle Cloud Infrastructure documentation for more information.
  4. Create a compute environment in Spatial Studio. See [Create a Compute Environment](#) for more information.

## Use the GeoRaster Dataset Creation Wizard

You can upload raster images into Oracle Spatial GeoRaster database using the **GeoRaster dataset creation** wizard.

Before uploading a raster file, ensure you meet the prerequisites described in [Prerequisites for Uploading Raster File](#).

Perform the following steps to access and use the **GeoRaster dataset creation** wizard:

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.  
The **Create Dataset** window opens.
3. Select the **Imagery file via PAR URL** option.

Upload imagery data and create a GeoRaster dataset from PAR URL

**Imagery file via PAR URL**

Enter a PAR URL for a file or for a bucket

PAR URL for a file or a bucket

Required

Imagery file's relative path to its storage bucket (not needed for a file URL)

Relative file path in bucket

4. Enter the **PAR URL** for a file or for a bucket in your Object store.
5. Enter the **Relative file path in bucket**.  
Note that this step is not required if you entered the file URL in the preceding step.
6. Click **Create**.

The **GeoRaster dataset creation** workflow opens and the **Raster file info** step is displayed as shown:

### GeoRaster dataset creation

Previous 1 — 2 — 3 — 4 — 5 — 6 Next

**Raster file info**    **Dataset creation parameters**    GeoRaster parameters    GeoReference parameters    Additional parameters    Confirm parameters

Raster file info

Raster file name  
my\_imagery.png

Output from gdalinfo command line  
Driver: PNG/Portable Network Graphics  
Files: none associated  
Size is 1529, 915  
Image Structure Metadata:  
  INTERLEAVE=PIXEL  
Corner Coordinates:  
Upper Left ( 0.0, 0.0)  
Lower Left ( 0.0, 915.0)  
Upper Right (1529.0, 0.0)  
Lower Right (1529.0, 915.0)

Spatial Studio runs the **gdalinfo** command (from GDAL package) at the backend and the command output is displayed in **Output from gdalinfo command line**. The command retrieves the basic metadata about the raster data file. You can check and view the imagery information at this step. This includes details such as the imagery dimensions, number of bands, image pixel storage structure, georeference information if applicable, and so on.

If errors are reported in **Output from gdalinfo command line**, then you need to exit the current uploading process and first resolve the reported issues. Issues are commonly related to improper configuration of GDAL SDK and Oracle Instant Client packages due to which Spatial Studio cannot find them from the expected file system folders.

- Click **Next** only if no errors are reported in the **gdalinfo** command output.

The **Dataset creation parameters** step is displayed as shown:

### GeoRaster dataset creation

Previous 1 — 2 — 3 — 4 — 5 — 6 Next

**Raster file info**    **Dataset creation parameters**    GeoRaster parameters    GeoReference parameters    Additional parameters    Confirm parameters

Dataset creation parameters

Create GeoRaster dataset

Raster dataset name  
WIND\_PNG\_GEOR

Dataset description  
New GeoRaster dataset

8. Optionally, switch ON the **Create GeoRaster dataset** toggle.

When this option is switched OFF, only the raster file will be uploaded to the database, and the GeoRaster dataset will not be created in Spatial Studio. You can then later create the GeoRaster dataset from the database as more options are available for a database-based GeoRaster dataset. See [Create a GeoRaster Dataset](#) for more information.

9. Enter the **Raster dataset name** and **Dataset description**.
10. Click **Next**.

The **GeoRaster parameters** step is displayed as shown:

### GeoRaster dataset creation

Previous

✓  
Raster file info

✓  
Dataset creation parameters

3  
GeoRaster parameters

4  
GeoReference parameters

5  
Additional parameters

6  
Confirm parameters

Next

#### GeoRaster parameters

Upload GeoRaster to connection  
 SPATIAL\_STUDIO [\$system]

Create a new GeoRaster table or choose an existing one

Create new GeoRaster table   
  Choose existing GeoRaster table

New GeoRaster table name  
 WIND\_PNG\_GEOR

GeoRaster column name  
 GEOR\_OBJ

SRID for this GeoRaster column's geometry metadata  
 1032662

Key column name  
 IMAGE\_KEY

Key value (type of NUMBER)  
 100

Description column name  
 DESCRIPTION

Description text  
 uploaded from file MY\_IMAGERY\_PNG

Create new raster data table or choose an existing one

Create new RDT table   
  Choose existing RDT table

New raster data table name  
 WIND\_PNG\_RDT

11. Select a connection object using the **Upload GeoRaster to connection** drop-down to store the raster data.
12. Choose to upload the raster file to a new GeoRaster table or append the file to an existing GeoRaster table.
  - **Upload the raster file to a new GeoRaster table**

- a. Select **Create new GeoRaster table**.  
The GeoRaster table has the following hard-coded values:
  - i. *GEOR\_OBJ*: The **GeoRaster column name** of type *SDO\_GEORASTER*.
  - ii. *<SRID>*: The **SRID** for the GeoRaster column's geometry metadata.
  - iii. *DESCRIPTION*: The **Description column name** of type *VARCHAR2*.
  - iv. *IMAGE\_KEY*: The **Key column name** of type *NUMBER*.
- **Append the raster file to an existing GeoRaster table**
  - a. Select **Choose existing GeoRaster table**.
  - b. Select the values for the following drop-down lists:
    - **Choose a GeoRaster table name**
    - **Choose a GeoRaster column name**
    - **Choose the key column name**
    - **Choose the description column name**
13. Enter **Key value** and **Description text** for the GeoRaster table.
14. Choose **Create a new RDT table** or **Choose existing RDT table** as it applies.
15. Enter **New raster data table name** or **Choose an RDT table name** depending on your choice in the previous step.
16. Click **Next**.  
The **GeoReference parameters** step is displayed.  
The uploaded raster must have known georeference information in order to be stored in Oracle database and then be displayed in Spatial Studio.
17. Select a value from the **Select a geo-reference option** drop-down.  
The options for this drop-down can vary depending on the spatial reference system (SRS) detected by Spatial Studio in the metadata of the raster file. The supported scenarios are:
  - **Scenario 1: Self-contained Georeference information in the Raster Image File**  
If the raster image has self-contained georeference information (such as a geo-tiff image that contains the georeference details), then the **Use from raster file** option is automatically applied.  
  
You may directly accept and utilize this self-contained georeference information, and no other user inputs are needed as shown.

**GeoRaster dataset creation**

Previous ✓ ✓ ✓ **4** 5 6 Next

Raster file info    Dataset creation parameters    GeoRaster parameters    **GeoReference parameters**    Additional parameters    Confirm parameters

GeoReference parameters

Select a geo-reference option  
Use from raster file

Override spatial reference system

Raster columns: 1,500    Raster rows: 1,500

It is also possible that a valid self-contained georeference information in the raster image happens to be a user-defined coordinate reference system and therefore not supported by Oracle Spatial. In such a case, the GDAL package may import the image into Oracle database but will assign it with an unsupported SRID (for example, a value of 999999 or 0). Although `gdal_translate` can upload it into Oracle database, Spatial Studio will not be able to generate the required metadata due to the absence of the required georeference information. As a result, this upload process will eventually fail for such a kind of data file.

If you observe such an error (in the server logs) while uploading, then you must perform the following steps:

- a. Get a valid spatial reference identifier (SRID) that corresponds to the spatial reference system found in the imagery data.  
For this, you can raise a service request with My Oracle Support or refer to [Oracle Spatial Developer's Guide](#) for the steps to create a custom SRID.
  - b. Repeat all the previous steps (step 1 to step 16) to upload the raster image.
  - c. Enable the **Override spatial reference system** switch in the preceding figure for the **GeoReference parameters** step.  
The raster data file is then treated as not containing georeference information and thus requires you to provide the details.
  - d. Follow the steps for [Scenario 2](#) or [Scenario 3](#) as it applies to you.
- **Scenario 2: Georeference information Provided in a World-File**  
If the raster image has a companion world-file (for example, raster file `sf1.jpg` has a companion `sf1.wld` file), and both are stored in the same folder, then select the **Enter World-File content** georeference option as shown.

### GeoRaster dataset creation

Previous ✓ ✓ ✓ **4** 5 6 Next

Raster file info   Dataset creation parameters   GeoRaster parameters   **GeoReference parameters**   Additional parameters   Confirm parameters

GeoReference parameters

Enter raster image SRID  
26943

Select a geo-reference option  
Enter World-File content

Enter the world-file content here (6 numbers, one on each line)

Required

Raster columns  
1,529

Raster rows  
915

- a. **Enter raster image SRID:** Enter the SRID for the spatial reference system.
  - b. **Enter the world-file content here:** Enter the world file's contents. Note that each parameter takes one line and six parameters occupy six consecutive lines.
- **Scenario 3: Georectified Raster Image with Known Bounding Box Values**  
If the raster image is already georectified and you know its SRID and bounding box values, then select the **Enter Imagery bounding box coordinates for a Valid SRID** georeference option as shown.

### GeoRaster dataset creation

Previous ✓ ✓ ✓ **4** 5 6 Next

Raster file info    Dataset creation parameters    GeoRaster parameters    **GeoReference parameters**    Additional parameters    Confirm parameters

GeoReference parameters

Enter raster image SRID  
4326

Select a geo-reference option  
Enter imagery bounding box coordinates

Upper-right corner's X  
1,529

Upper-right corner's Y  
0

Lower-left corner's X  
0

Lower-left corner's Y  
915

Raster columns  
1,529

Raster rows  
915

- a. **Enter raster image SRID:** Enter the SRID for the spatial reference system.
  - b. **Upper-right corner's X, Upper-right corner's Y:** Enter the upper-right corner's coordinates.
  - c. **Lower-left corner's X, Lower-left corner's Y:** Enter the lower-left corner's coordinates.
18. Click **Next** to provide additional GeoRaster parameters.

The **Additional parameters** step is displayed as shown:

### GeoRaster dataset creation

Previous ✓ ✓ ✓ ✓ **5** 6 Next

Raster file info    Dataset creation parameters    GeoRaster parameters    GeoReference parameters    **Additional parameters**    Confirm parameters

Additional parameters

Raster column block size  
512

Raster row block size  
512

Raster band block size  
4

Raster pyramid levels to generate  
2

Blocking option  
Optimal padding

Compress option  
None

Provide a value for NODATA

Value for NODATA  
-9999

Required

19. Optionally, modify the default parameters (if required) to fine tune the GeoRaster storage related parameters.

If you are aware that there is a special value for raster cells indicating NODATA, then turn on the **Provide a value for NODATA** switch and provide its value.

20. Click **Next** to confirm the inputs.

You may scroll down the text area and view all the parameters entered or selected in the previous steps. You may choose to go to any earlier steps to modify inputs.

21. Click **OK**.

The server will initiate a backend process to upload the raster data files into the database, and then optionally create a dataset in Spatial Studio. The application displays a task completion notification and you can also verify the same in the Jobs page.

## Create a GeoRaster Dataset

Spatial Studio allows you to create Georaster datasets.

You can create a GeoRaster dataset using the following steps.

The instructions assume that the GeoRaster data is already existing on your Autonomous AI Database instance.

1. Navigate to the **Datasets** page and click **Create Dataset**.
2. Click **Database table/view**, select the default **Connection** and click **Create**.
3. Expand the connection folder and click open **GeoRasters**.
4. Select the required **GeoRaster** table and click **OK**.

The **Geo-raster Configuration** dialog opens.

5. Choose a **Selection Mode**.

The values for the selection mode are:

- Single Raster
- Virtual Mosaic

6. Select the GeoRaster column for visualization if you have chosen the **Single Raster** mode. Otherwise, you can skip this step.

### Note

If you have chosen the **Virtual Mosaic** mode, all the Georaster columns are included in the visualization.

7. Optionally, enable **Wind Animation** if the raster image is encoded with velocities in the red (x-axis) and green (y-axis) channels, and you wish to visualize wind animation.

See About Wind Animation for more information.

8. Provide the following **Data Range** values: **Min velocity in x axis**, **Max velocity in x axis**, **Min velocity in y axis**, and **Max velocity in y axis** only if you enabled **Wind Animation** in the preceding step.

9. Click **OK**.

The GeoRaster dataset is configured and the newly created GeoRaster dataset is displayed as a row in the Datasets page.

## Create a Wind Animation Dataset

You can create a wind animation dataset which can be used for visualizing wind speeds and dynamic flow on a map.

As a prerequisite for creating a wind animation dataset, ensure that:

- The base wind image is generated. See [Generate a Base Wind Image From a NOAA Dataset](#) for an example.
- The generated base wind image is loaded as a GeoRaster to Oracle Database. See [Use the GeoRaster Dataset Creation Wizard](#) for more information.

Perform the following steps to create a wind animation dataset:

1. Navigate to the **Datasets** page.
2. Click **Create Dataset**.  
The **Create Dataset** window opens.
3. Click **Database table/view**, select a **Connection** and click **Create**.
4. Click **GeoRasters**, select the **GeoRaster** table containing the base image, and click **OK**.

The **Geo-raster Configuration** dialog opens as shown:

**Geo-raster Configuration - GEOR\_WIND2**

Selection Mode  
Single Raster

Choose one of the available GeoRaster columns and select the raster row from the table

GEORASTER  
Wind Animation

Data Range:

Min velocity in x axis: -23.7055  
Max velocity in x axis: 23.1145  
Min velocity in y axis: -24.3096  
Max velocity in y axis: 21.1404

SGTECH_DATA_RANGE	ID	GEORASTER
[-23.7055 23.1145 -24.3096 21.1404]	2024040300	RasterID:2024040300, RasterDataTable:GEOR_WIND2_RDT

OK Cancel

5. Set the **Selection Mode** to *Single Raster*.
6. Switch ON the **Wind Animation** toggle.

7. Enter the following **Data Range** values: **Min velocity in x axis**, **Max velocity in x axis**, **Min velocity in y axis** and **Max velocity in y axis**.

Note the following:

- These values are obtained at the time of generating the base wind image. See [Generate a Base Wind Image From a NOAA Dataset](#) for an example.
- These values need to be set only the first time you create a wind animation dataset from this GeoRaster table. Once saved, these parameters will be stored in the GeoRaster table. Hence, the future datasets will not require manual input of the **Data Range** values, unless you choose to update them.

8. Click **OK**.

The wind animation dataset gets created and is displayed on the **Datasets** page.

#### Related Topics

- [About Wind Animation](#)  
You can create and visualize wind animations that depict the direction of flow between various locations.

## Generate a Spatial Analysis Dataset

Spatial Studio stores the results of a spatial analysis operation in a spatial analysis dataset. Also, storing selected geographic features or pins on a map layer gets saved as a new spatial analysis dataset.

When you perform any new spatial analysis operation (such as filtering, combining, transforming existing datasets, and so on) against a data source in map visualization, the results of the analysis are generated into a spatial analysis dataset. Similarly, when you store selected geographic locations or pins on a map layer, the spatial data gets stored as spatial analysis datasets. These datasets get instantly added to the map visualization project and appear under **Analysis** in the Active Project page. You can also view these datasets on the **Datasets** page.

## Save Selected Features on a Map Into a Dataset

You can save selected features on a map layer into a new spatial analysis dataset.

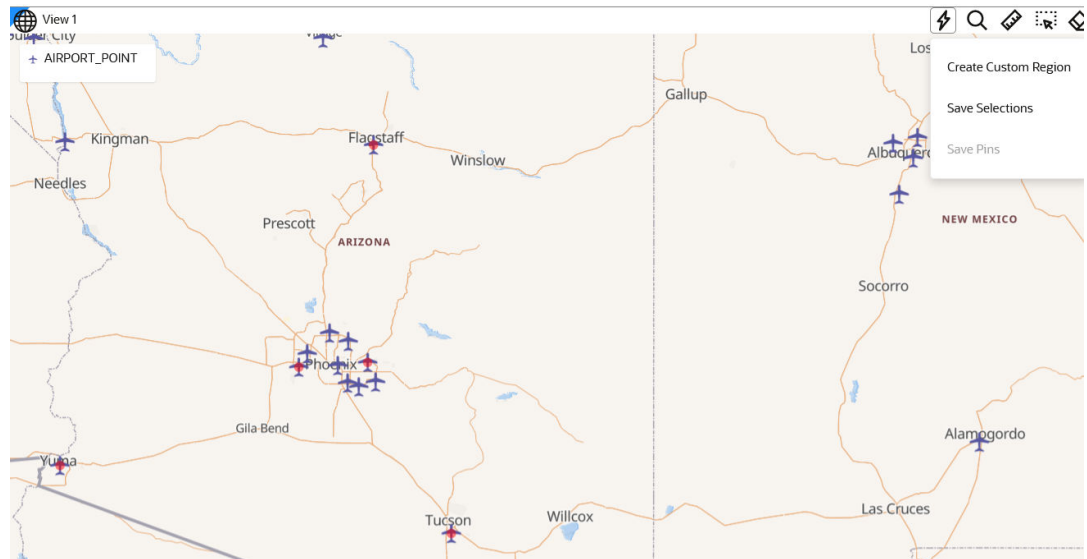
The following steps enable you to save selected features on a map layer into a dataset.

The instructions assume that you have a project opened on your Active Project page.

1. Select the required features to be saved to the dataset.

If you are using a Windows system, you can select multiple features using the keyboard shortcut `Ctrl+Click`.

2. Click the **Actions** icon on the map tool bar.
3. Select **Save Selections** from the drop-down menu.



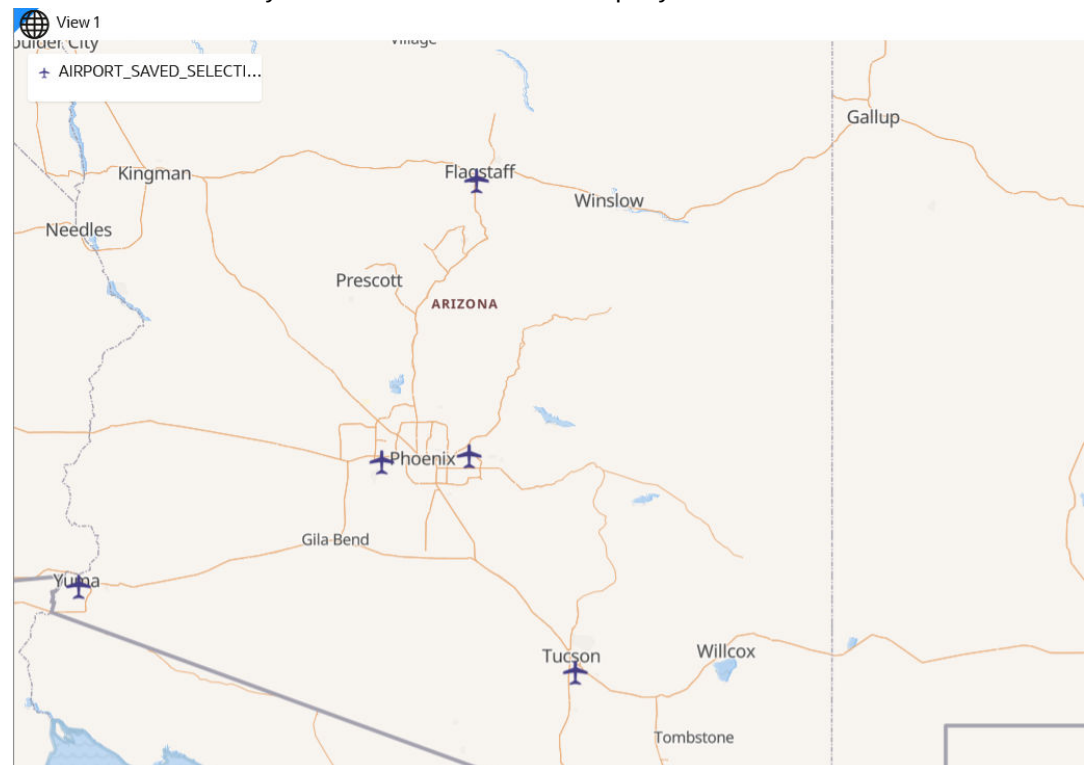
The **Save selections** dialog opens.

4. Enter the **Analysis name**.
5. Select the required columns from the **Save Selections From** drop-down list.
6. Click **Run**.

The new (analysis) dataset containing the saved selections is created and gets listed under **Analyses** on the left pane in the **Active Project** page. It also appears on the table in the **Datasets** page.

7. Verify the selection, by dragging and dropping the analysis dataset on the map view.

You can now view only selected features on the map layer:



## Save Pins on a Map Into a Dataset

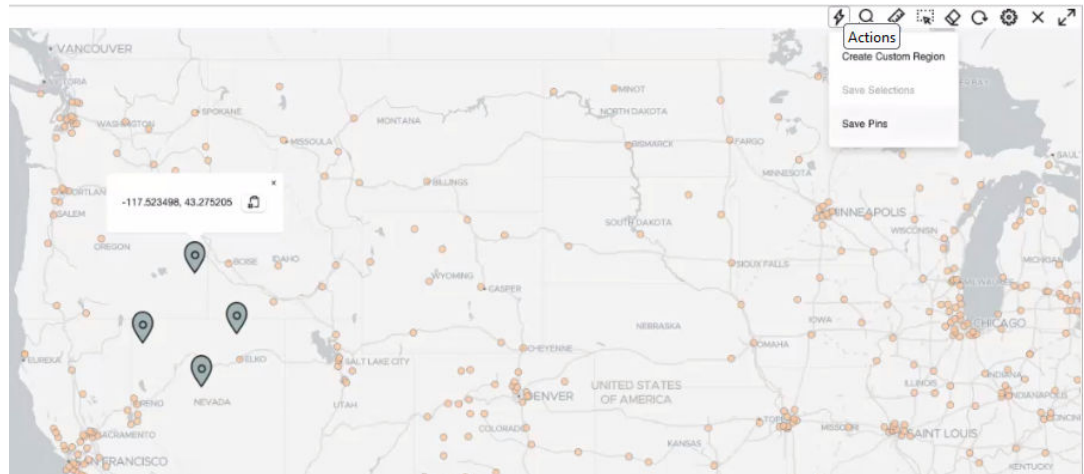
You can save all the pins that you dropped on a map layer into a spatial analysis dataset.

This dataset containing the stored pins can later be used in various spatial analyses.

The following steps enable you to save multiple pins on a map layer into a dataset.

The instructions assume that you have a project opened on your Active Project page and the map layer displayed for visualization contains multiple pins.

1. Click the **Actions** icon on the map tool bar.
2. Select **Save Pins** from the drop-down menu.



The **Save pinned places** dialog opens.

3. Enter the **Analysis name**.
4. Select the required **Connection** for saving the dataset.
5. Click **Run**.

The new dataset containing the pins is created and gets listed under **Analyses** on the left pane in the **Active Project** page. It also appears on the table in the **Datasets** page.

6. Verify the saved pins, by dragging and dropping the analysis dataset on the map view.

The saved pins are displayed as points and not as a pin location on the map layer. This is because the pins get saved to a regular point type dataset. You can now perform various spatial analyses on the map using this dataset layer.

## Manage Datasets

You can explore and manage the datasets on the **Datasets** page.

### Topics:

- [Export a Dataset to GeoJSON](#)
- [Geocode a Dataset](#)
- [Reverse Geocode a Dataset](#)
- [Prepare an H3 Aggregation Dataset](#)

- [Enable Spatiotemporal for a Dataset](#)
- [Enable Wind Animation For an Existing GeoRaster Dataset](#)
- [Prepare a Non-Spatial Dataset for Analysis](#)
- [Update Statistics for Datasets](#)
- [About Cache in Spatial Studio](#)

## Export a Dataset to GeoJSON

You can export a dataset from Spatial Studio to GeoJSON.

It is possible that your dataset can contain multiple geometry columns. In such a case, Spatial Studio allows you to select a specific geometry column for the export operation.

The instructions assume that a dataset containing the coordinates details is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the **dataset name** which you want to export.
3. Select **Export**.

The dataset **Export** dialog opens as shown:

**CUSTOMER\_DATA : Export**

File Format:  
GeoJSON

Simplification

Simplify Geometry Shapes

Decimal places in coordinates:  
5

Select a geometry column:  
GC\_GEOMETRY

Columns to Include:

Select All Unselect All

POSTALCODE

LONGITUDE

COUNTRY

FIRST\_NAME

ID

LAST\_NAME

LATITUDE

OK Cancel

4. Select **GeoJSON** from the **File Format** drop-down list.
5. Optionally, increase or decrease the **Decimal places in coordinates** as required.
6. **Select a geometry column** as required.
7. Select the required columns for the export.
8. Click **OK**.
9. Save the `.zip` file containing the GeoJSON data on your system.

## Geocode a Dataset

Geocoding is the process of deriving the latitude and longitude coordinates from location details that are geo address types.

You can geocode a dataset in Spatial Studio to store the resulting latitude and longitude information as a `SDO_GEOMETRY` column. Optionally, you can also store them in latitude and longitude numeric columns in the underlying database table referenced by the dataset.

Prior to geocoding a dataset, if the Spatial Studio server is running behind a firewall, then ensure you have the correct **Web Proxy** information configured in the Console page. This is because the Spatial Studio application uses an external Oracle hosted geocoding service which is on the public internet.

### Note

Compute environment is required if you are geocoding a dataset with more than 500 records. See [Create a Compute Environment](#) for more information.

You can perform the following steps to geocode a dataset.

The instructions assume that a dataset containing location columns such as address details is already existing in Spatial Studio.

1. Navigate to the **Datasets** page.
2. Right-click on the **dataset name** on which you want to apply geocoding.  
Ensure that the dataset has a valid key column defined.
3. Select **Geocode Addresses** from the **Prepare** context menu.

**Geocode Addresses** dialog opens as shown:

**CUSTOMER\_DATA: Geocode Addresses**

Use address components to create geometries

Setup Status

Save coordinates in columns  Single column address

Latitude column LATITUDE Longitude column LONGITUDE

Verify or adjust address components to be used to geocode

Address Components	Column	Values
State/Province	STATE	California Florida Georgia
Postal Code	POST_CODE	12262 28256 28284 31136 32868
--- Select ---	ID	1 2 3 4 5 6 7 8 9 10
--- Select ---	LAST_NAME	Caudle De Domenici Goady Happert
--- Select ---	FIRST_NAME	Andreana Caleb Christine

You have not selected Country as an address component in your data. If ... United States

Apply Close

4. Click the **Setup** tab.
5. Perform one of the following depending on whether the address attributes are stored in a single column or multiple columns:
  - **Single Column Address**
    - a. Switch ON the **Single column address** toggle.



**CUSTOMER\_DATA: Geocode Addresses**

Use address components to create geometries

Setup **Status**

Summary	Ambiguous (231)	Partial Match (0)	Unknown (92)	Failures
<p><b>Summary</b></p> <p>Geocoded: YES</p> <p>Number of rows: 1000</p> <p>Matched: 677</p> <p>Ambiguous: 231</p> <p>Partial: 0</p> <p>Unknown: 92</p>				
<p><b>Failed rows info</b></p> <p>Number of failed rows: 0</p> <p><a href="#">Retry failed rows</a></p>				
<p>Query all unmatched rows:</p> <pre>SELECT * FROM CUSTOMER_DATA dst JOIN SGTECH\$TABLEB6F686CEC230FE23F937BC4CC6E9C245 temp ON dst.ID = temp.ID WHERE temp.GC_STATUS != 'MATCH'</pre>				
<p><b>i</b> Geocoding status is stored in a companion metadata table for this dataset. You may purge this geocoding metadata to save storage. However the geocoding issues summarized above will no longer be available and geocoding would need to be cleared and performed again to recapture this information.</p> <p><a href="#">Purge geocode result metadata</a></p>				

[Close](#)

- On successful completion of a geocoding job, you can verify that geocoding has been applied by viewing the latitude and longitude columns in the dataset properties and in the input source database table along with the `GC_GEOMETRY` column of data type `SDO_GEOMETRY`.

## Reverse Geocode a Dataset

Reverse geocoding is the process of deriving the address information from a set of latitude and longitude coordinates.

You can reverse geocode a dataset in Spatial Studio to add address information to the dataset's table using the following steps.

### **Note**

Reverse Geocoding is supported only in point or latitude and longitude datasets.

The instructions assume that a dataset containing the coordinates details is already existing in your database schema.

- Navigate to the **Datasets** page.

2. Right-click on the **dataset name** on which you want to apply reverse geocoding.
3. Select **Reverse Geocode** from the **Prepare** context menu.
4. Optionally, select and modify the required **Location attributes**.

The Input text fields for Location attributes are the column names to be created in the underlying database table for the target dataset.

5. Select the **Advanced** option as required.

The default **Reverse geocode to named roads only** option ensures that for all latitude and longitude coordinates that do not match a named road, the closest street or road name will be obtained while geocoding.

6. Click **Apply**.

You can monitor the **Reverse geocode dataset** background task on the **Jobs** page. A successful completion of the job indicates that reverse geocoding is applied for the data in the dataset.

You can verify that reverse geocoding has been applied to your dataset by viewing the additional address related columns in the dataset properties.

### CUSTOMER\_DATA: Reverse Geocode

Derive location attributes from point locations

**Point locations:**

Lat-Lon Columns

Latitude column LATITUDE	▼
Longitude column LONGITUDE	▼

**Location attributes:**

<input checked="" type="checkbox"/>	Street STREET
<input checked="" type="checkbox"/>	House number HOUSE_NUMBER
<input checked="" type="checkbox"/>	Settlement (City, Town) SETTLEMENT
<input checked="" type="checkbox"/>	Municipality (County, District) MUNICIPALITY
<input checked="" type="checkbox"/>	Region (State, Province) REGION
<input checked="" type="checkbox"/>	Postal Code POSTAL_CODE
<input type="checkbox"/>	Country COUNTRY

**Advanced:**

Reverse geocode to named roads only (default)

Allow reverse geocode to unnamed roads

**Apply** **Close**

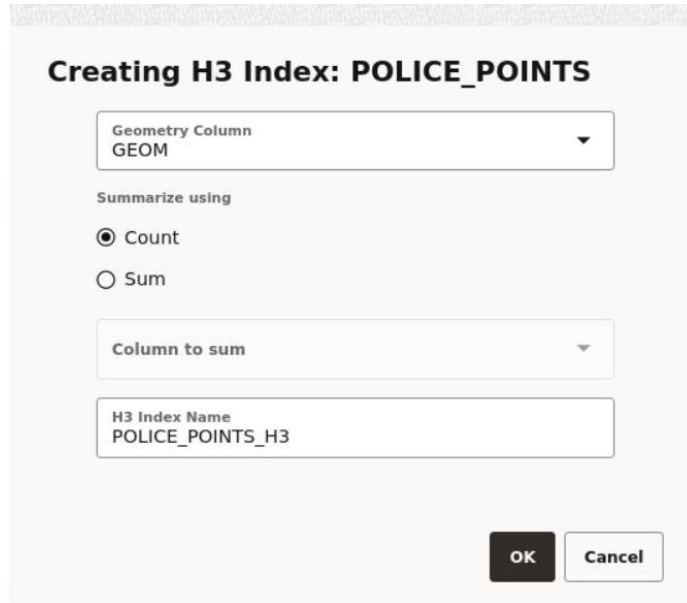
## Prepare an H3 Aggregation Dataset

You can prepare an H3 aggregation dataset by performing the following steps.

The instructions assume that a dataset containing geometric data columns is already loaded to Spatial Studio.

1. Navigate to the **Datasets** page.  
All the datasets loaded to Spatial Studio are shown listed on this page.
2. Select the required dataset **name** and right-click to open the context menu.
3. Click **Create H3 Index** on the **Prepare** submenu.

The **Creating H3 Index** dialog opens as shown:



**Creating H3 Index: POLICE\_POINTS**

Geometry Column  
GEOM

Summarize using

Count

Sum

Column to sum

H3 Index Name  
POLICE\_POINTS\_H3

OK Cancel

4. Select the **Geometry Column** for H3 aggregations.
5. Click a **Summarize using** option.  
The values for summarizing are:
  - **Count:** buckets the number of datapoints in each hexagon
  - **Sum:** adds up the values for a specific column in the data set, for all the points that fall in a specific hexagon
6. Select the **Column to sum**, if you have chosen **Sum** to summarize your dataset. Otherwise, you can skip this step.
7. Optionally, modify the **H3 Index Name**.
8. Click **OK**.

An H3 aggregation dataset is created and added as a new row in the Datasets page.

## Enable Spatiotemporal for a Dataset

In order to visualize and animate spatiotemporal data, you must enable **Spatiotemporal** for the dataset on the Datasets page.

Spatial Studio supports visualization and animation of spatiotemporal map layers using a Cesium Timeline widget (see [Overview of the Cesium Timeline Widget](#)). These map layers can listen to the timeline only if you enable **Spatiotemporal** on the underlying datasets.

## Characteristics of a Spatiotemporal Dataset

Spatial Studio considers a dataset to contain spatiotemporal data if it belongs to any one of the following types.

- **Live Spatiotemporal Dataset:** A dataset which meets the following characteristics is known as a **Live** dataset:
  - The dataset is based on a geometry table or view with a geometry column or pair of latitude/longitude columns.
  - The dataset has one or more entities (that represent an object in the dataset) which are uniquely identified by one of the columns.
  - The dataset's underlying table or view contains a column of the type `TIMESTAMP` or `DATE` (or a qualifying field in the GeoJSON response), that stores the UTC datetime of the entities as they are being observed and recorded.
  - The dataset's underlying table or view must have ongoing inserts with recently obtained location data of entities being observed or monitored.

Spatial Studio considers all the different dataset rows of the same *entity id* as entries representing the entity with different `TIMESTAMP` values. However, they may or may not have varying location coordinates or geometries. Hence, these live spatiotemporal datasets can again be classified as shown:

- **Moving Objects:** For each entity, if the location or geometry change with changing `TIMESTAMP` values, then these datasets are called moving objects datasets. In this case, a trail layer (if it is a qualifying geometry) gets added, which shows the trajectory of the moving object as a line string by fetching data for last *N* seconds (or higher time unit).
  - **Non-Moving Objects:** For each entity, if only certain properties change (and not the location or geometry) with changing `TIMESTAMP`, then these are called non-moving objects datasets. In this case, no trail layer gets added as only the properties change with time.
- **Non-Live Spatiotemporal Dataset:** A dataset with the following characteristics is known as a **Non-Live** dataset:
    - The dataset is based on a geometry table or view with a geometry column or pair of latitude/longitude columns.
    - The dataset's underlying table or view contains a `TIMESTAMP` or `DATE` type column that contains historic time values.

These datasets can again be classified as shown:

- **Moving Objects:** Similar to a **Live** dataset, if this dataset contains entities (that uniquely represent an object in the dataset) with varying `TIMESTAMP` values, then a trail layer gets added. The trail layer shows the trajectory of the moving object as a line string by fetching data for last *N* seconds (or higher time unit).
  - **Non-Moving Objects:** In this configuration, the dataset is just treated to have various rows with different `TIMESTAMP` values (not grouped by any entity id).
- **Time-enabled WMS Dataset:** If a WMS Service offers a time dimension for an image layer selected in a WMS dataset, then that WMS Dataset can be configured as spatiotemporal.
  - **GeoJSON URL (external) Dataset:** These types of datasets can be configured to refresh periodically based on an interval value.

## Configure Spatiotemporal for Live Moving Objects Dataset

Perform the following steps to configure spatiotemporal for a live dataset with moving objects. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.

The **Dataset Properties** dialog opens.

3. Click the **Spatiotemporal** tab.

The following dialog is displayed:

**Dataset Properties - BOATS**

Overview Columns Settings **Spatiotemporal**

Enable Spatiotemporal

Timestamp (or Date) Column  
TIME\_REPORTED

Data is live

Moving objects

Entity ID Column  
BOAT\_ID

Data Change Rate  
3,000

Altitude Column

Optional, only be used in a Cesium visualization

Live Spatiotemporal dataset's geometry and time (i.e., UTC TIMESTAMP or DATE) columns are often constantly updated by insertion.

Apply Cancel

4. Switch ON **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.
  - Both date-type and timestamp-type columns are supported.
  - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.
6. Switch ON **Data is live**.
7. Switch ON **Moving objects**.
8. Select the **Entity ID Column** that identifies a set of unique entities.
 

The **Entity ID Column** is not a unique column as each entity can have many recordings of its locations in the same table.
9. Specify **Data Change Rate** to indicate the approximate frequency of the live feed updates in the table.
10. Optionally, select the **Altitude Column** for Cesium Map Visualization only.
11. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

### Related Topics

- [Visualize Live Moving Objects Dataset](#)  
You can visualize live moving objects on a map in Spatial Studio.

## Configure Spatiotemporal for Live and Non-Moving Objects Dataset

Perform the following steps to configure spatiotemporal for a dataset containing live real-time data on non-moving objects. Although the data attributes of the different entities can vary with time, the entity locations do not change. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.  
The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.
4. Switch **ON** **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.
  - Both date-type and timestamp-type columns are supported.
  - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.
6. Switch **ON** **Data is live**.
7. Switch **OFF** **Moving objects**.
8. Select the **Entity ID Column** that identifies a set of unique entities.  
The **Entity ID Column** is not a unique column as each entity can have many recordings of its locations in the same table.
9. Specify **Data Change Rate** to indicate the approximate frequency of the live feed updates in the table.
10. Optionally, select the **Altitude Column** for Cesium Map Visualization only.
11. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

### Related Topics

- [Visualize Live and Non-Moving Objects Dataset](#)  
You can visualize a spatiotemporal dataset having ongoing inserts of real-time data, but the locations of the data entities do not change.

## Configure Spatiotemporal for Non-Live Moving Objects Dataset

Perform the following steps to configure spatiotemporal for a dataset containing non-live data on moving objects. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.  
The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.

The following dialog is displayed:

**Dataset Properties - HISTORICAL\_DATA**

Overview Columns Settings Spatiotemporal

Enable Spatiotemporal

Timestamp (or Date) Column  
TIME

Data is live

Moving objects

Entity ID Column  
BOAT\_ID

Time Unit  
Seconds

Apply Cancel

4. Switch **ON** **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.
  - Both date-type and timestamp-type columns are supported.
  - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.
6. Switch **OFF** **Data is live**.
7. Switch **ON** **Moving objects**.
8. Select the **Entity ID Column** that identifies a set of unique entities.
 

The **Entity ID Column** is not a unique column as each entity can have many recordings of its locations in the same table.
9. Select the **Time Unit**.
10. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

#### Related Topics

- [Visualize Non-Live Moving Objects Dataset](#)  
You can visualize moving objects with historic timestamp values on a map in Spatial Studio.

## Configure Spatiotemporal for Non-Live and Non-Moving Objects Dataset

Perform the following steps to configure spatiotemporal for a dataset containing non-moving objects with different timestamp values. The instructions assume that such a dataset is already existing in your database schema.

1. Navigate to the **Datasets** page.
2. Right-click on the required spatiotemporal dataset and click **Properties**.  
The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.

The following dialog is displayed:

**Dataset Properties - DIRECTORY**

Overview Columns Settings **Spatiotemporal**

Enable Spatiotemporal

Timestamp (or Date) Column  
REGISTRATION\_DATE

*Only UTC timestamp (or date) values are supported*

Data is live

Moving objects

Time Unit  
Years

Apply Cancel

4. Switch **ON** **Enable Spatiotemporal**.
5. Select the **Timestamp (or Date) Column**.
  - Both date-type and timestamp-type columns are supported.
  - If using a timestamp-type column, then note that Spatial Studio supports only UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) time zone for visualizing moving objects.
6. Switch **OFF** **Data is live**.
7. Switch **OFF** **Moving objects**.
8. Select the **Time Unit**.

The data will be filtered as per the selected time unit.

Also, note that the filtering is applied at the dataset level. This implies that all the layers created out of this dataset will have the same filtering when added to the timeline.

9. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

#### Related Topics

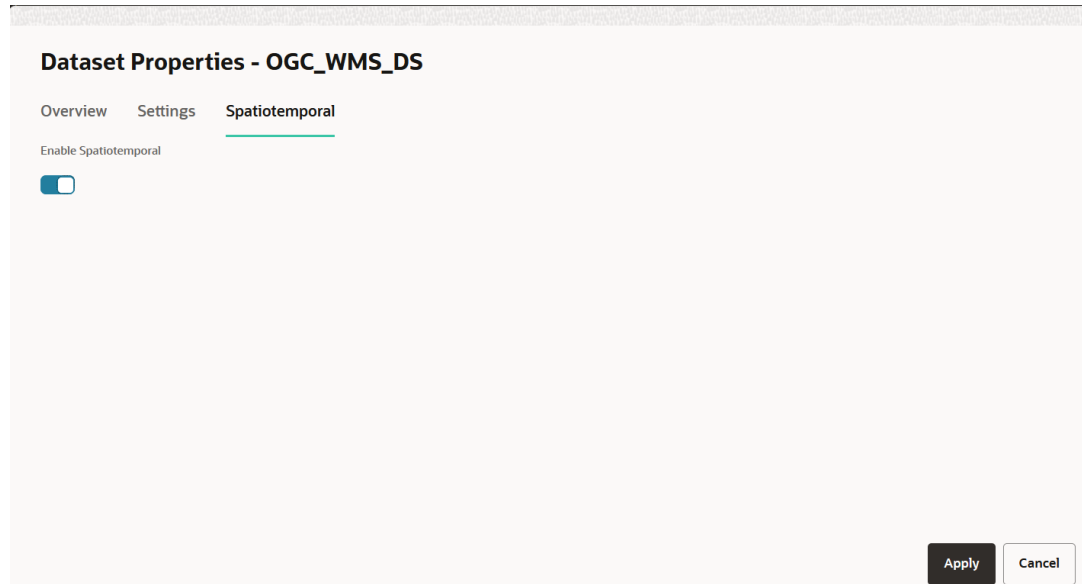
- [Visualize Non-Live and Non-Moving Objects Dataset](#)  
You can visualize a spatiotemporal dataset that simply contains different timestamp values in each row which are not grouped by any entity ids.

## Configure Spatiotemporal for OGC WMS Datasets

Perform the following steps to configure spatiotemporal for an OGC WMS dataset.

1. Navigate to the **Datasets** page.
2. Right-click on the required OGC WMS dataset and click **Properties**.  
The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.

The following dialog is displayed:



4. Switch **ON** **Enable Spatiotemporal**.
5. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization.

#### Related Topics

- [Visualize OGC WMS Maps as a Dataset](#)  
You can visualize an OGC (Open Geospatial Consortium) WMS (Web Map Service) dataset on a map.

## Configure Spatiotemporal for GeoJSON URL Datasets

Perform the following steps to configure spatiotemporal for a GeoJSON URL based dataset.

1. Navigate to the **Datasets** page.
2. Right-click on the required GeoJSON URL dataset and click **Properties**.  
The **Dataset Properties** dialog opens.
3. Click the **Spatiotemporal** tab.
4. Switch **ON** **Enable Spatiotemporal**.
5. Click **Apply**.

Your dataset is now enabled for spatiotemporal data visualization. Also, note that the dataset will be considered **Live** by default.

#### Related Topics

- [Visualize GeoJSON URL Datasets with Spatiotemporal Data](#)  
You can visualize GeoJSON URL based datasets that contain spatiotemporal data.

## Enable Wind Animation For an Existing GeoRaster Dataset

You can enable wind animation for an existing GeoRaster dataset only if the raster image is encoded with the red (R) and green (G) channels representing the x and y velocities, respectively.

1. Navigate to the **Datasets** page.
2. Right-click on the required GeoRaster dataset and click **Properties**.

The **Dataset Properties** dialog opens as shown.

The screenshot shows the 'Dataset Properties - GEOR\_WIND2' dialog box. It has several tabs: Overview, Columns, Settings, Spatiotemporal, and GeoRaster. The 'GeoRaster' tab is selected. The dialog is divided into several sections:

- GeoRaster Columns:** GEORASTER
- GeoRaster Data Table:** GEOR\_WIND2\_RDT
- GeoRaster ID:** 2024040300
- GeoRaster band count:** 3
- GeoRaster statistics:** min: 0, max: 253, mean: 81.6781481481482, median: 103, mode: 0, std: 62.8089415531106
- GeoRaster ColorMap:** None
- Wind Animation:** A toggle switch is currently turned ON.
- Data Range:** Four input fields are present:
  - Min velocity in x axis: -23.7055
  - Max velocity in x axis: 23.1145
  - Min velocity in y axis: -24.3096
  - Max velocity in y axis: 21.1404

At the bottom right, there are 'Apply' and 'Cancel' buttons.

3. Click the **GeoRaster** tab.
4. Switch **ON** the **Wind Animation** toggle.
5. Optionally, modify the following **Data Range** values: **Min velocity in x axis**, **Max velocity in x axis**, **Min velocity in y axis**, and **Max velocity in y axis**.
6. Click **Apply**.

## Prepare a Non-Spatial Dataset for Analysis

Spatial Studio allows you to prepare a non-spatial dataset for mapping and analysis by joining to a spatial dataset.

Note the following highlights about joining two datasets:

- You can only join a non-spatial dataset to a spatial dataset and not conversely.
- It is essential that the non-spatial data in one dataset is linked to the spatial data in the other dataset through a common primary key column.

- You can choose the columns for the newly created joined dataset from the attributes of the datasets associated in the join operation.

The instructions assume that a spatial dataset and a non-spatial dataset having a common primary key data is already existing in your database schema.

- Navigate to the **Datasets** page.
- Right-click on the non-spatial **dataset** which you want to join to a spatial dataset.
- Select **Join to Spatial Dataset** from the **Prepare** context menu.

The following window opens:

**Join Non-spatial Dataset to Spatial Dataset**

Prepare a non-spatial dataset for mapping and spatial analysis by joining to a spatial dataset

Name of join result dataset  
US\_STATES\_POPULATION\_JOINED

Non-spatial dataset \*  
US\_STATES\_POPULATION

Spatial dataset \*  
US\_STATES(SSUSER)

Non-spatial dataset join-column \*  
CODE

Spatial dataset join column \*  
STATE\_CODE

▼ **Select columns from non-spatial dataset**

<input type="checkbox"/>	Column Name	Data Type
<input checked="" type="checkbox"/>	POPULATION	NUMBER
<input type="checkbox"/>	NAME	VARCHAR2

▼ **Select columns from spatial dataset**

<input type="checkbox"/>	Column Name	Data Type
<input checked="" type="checkbox"/>	LONGITUDE	NUMBER
<input type="checkbox"/>	STATE_CODE	VARCHAR2

OK Cancel

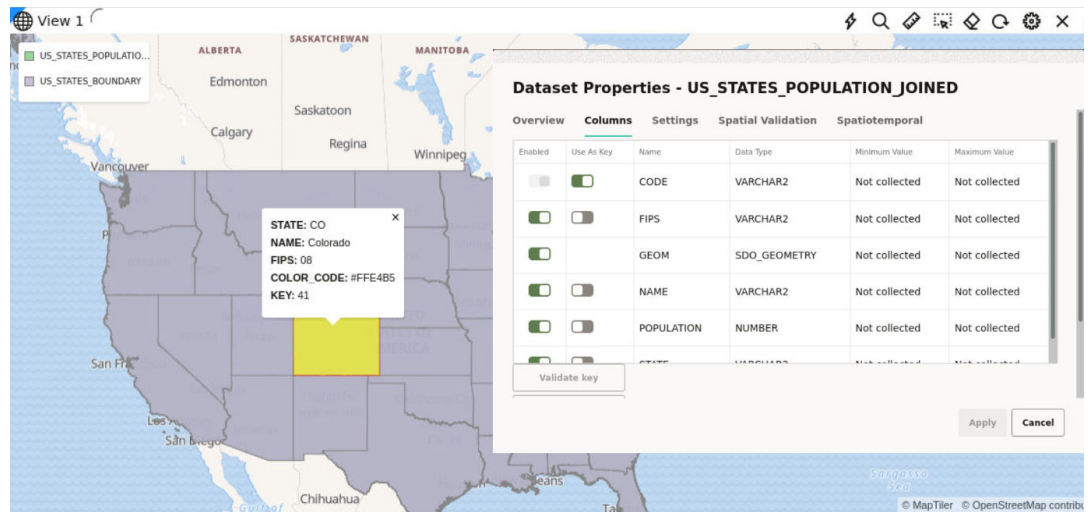
- Optionally, enter a dataset name for **Name of join result dataset**.
- Select the **Spatial dataset** for the join.

On selection, the primary key associated with the spatial dataset is validated against the non-spatial dataset key. If the datasets key values are not suitable for a join operation, then the following error is displayed:

Dataset key columns to join must be the same data type

- Optionally, select the required columns for the joined result dataset from the non-spatial and spatial datasets.
- Click **OK**.

The joined dataset is created and it appears as a row on the Datasets Page. This dataset will contain all the column properties selected from both the spatial and non-spatial datasets. You can verify the properties of the joined dataset both in the **Dataset Properties** window on the Datasets page and when using the dataset for map visualization and analysis on the Active Projects page, as shown:



## Update Statistics for Datasets

The **Update statistics** feature in Spatial Studio gathers statistics of the dataset columns.

To gather the dataset statistics, right-click on the dataset and select **Update statistics**. For all datasets (except view-based and spatial analysis datasets), this action triggers a single background job which collects the relevant statistical data. Once the job completes successfully on the Jobs page, you can verify the updated statistical data by viewing the **Dataset Properties**.

However, for view-based and spatial analysis datasets, gathering statistics is a two-step process. It implies that two background jobs are triggered:

1. **Gather dataset statistics [basic]:** This job collects the basic statistics such as **Name** and **Data Type** of columns in a dataset. When this job completes successfully, the job in step-2 is triggered.
2. **Gather dataset statistics [full]:** This job collects more detailed statistics such as **Minimum Value**, **Maximum Value**, **Bounding Box**, and unique column values. As long as this job is in the *Processing* status, the view-based dataset may show incomplete information for the **Minimum Value** and **Maximum Value** columns in the **Dataset Properties** dialog:

### Dataset Properties - BIG\_TABLE\_VW

Overview **Columns** Settings Spatiotemporal Spatial Validation

Enabled	Use As Key	Name	Data Type	Minimum Value	Maximum Value
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CREATED	DATE	Not collected	Not collected
<input checked="" type="checkbox"/>	<input type="checkbox"/>	DATA_OBJECT_ID	NUMBER	Not collected	Not collected
<input checked="" type="checkbox"/>	<input type="checkbox"/>	GENERATED	VARCHAR2	Not collected	Not collected
<input checked="" type="checkbox"/>	<input type="checkbox"/>	ID	NUMBER	Not collected	Not collected
<input checked="" type="checkbox"/>	<input type="checkbox"/>	LAST_DDL_TIME	DATE	Not collected	Not collected

Buttons: Validate key, Create Key Column, Apply, Cancel

Once the job status is Done, the **Dataset Properties** reflects the gathered statistics.

### Dataset Properties - BIG\_TABLE\_VW

Overview **Columns** Settings Spatiotemporal Spatial Validation

Enabled	Use As Key	Name	Data Type	Minimum Value	Maximum Value
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CREATED	DATE	2021-10-14T23:53:36Z	2022-07-23T20:04:39Z
<input checked="" type="checkbox"/>	<input type="checkbox"/>	DATA_OBJECT_ID	NUMBER	143	114965
<input checked="" type="checkbox"/>	<input type="checkbox"/>	GENERATED	VARCHAR2	N	Y
<input checked="" type="checkbox"/>	<input type="checkbox"/>	ID	NUMBER	349	3345541
<input checked="" type="checkbox"/>	<input type="checkbox"/>	LAST_DDL_TIME	DATE	2021-10-14T23:54:04Z	2022-09-21T20:03:40Z

Buttons: Validate key, Create Key Column, Apply, Cancel

**Info:** A Key column is required for many operations and must have unique values and no nulls. When you assign a Key, the column is validated. If no database constraint exists Spatial Studio will create one.

Note that for any type of dataset, you must always ensure that this background job completes successfully before performing advanced styling or visualization of a dataset.

## About Cache in Spatial Studio

All vector tiles generated for all datasets are cached to the file system by default.

This cache process automatically begins when the you first load a dataset for map visualization and start panning the map or zoom in and out on the map. Therefore, the next time the same dataset is visualized, all the corresponding map layers load faster as the relevant tiles have been already generated and are ready to be loaded. All these generated vector tiles will be saved under:

```
<user_home_folder>/ .sgtech/cache/CACHE_<cache_id>
```

The `<cache_id>` which is part of the folder name is an integer value, calculated based on the dataset id and the geometry column being encoded in the vector tiles. A metadata file will be saved inside each cache folder to provide human-readable information about where the tiles belong to in a `tiles.json` file. A sample structure of the metadata file is as shown:

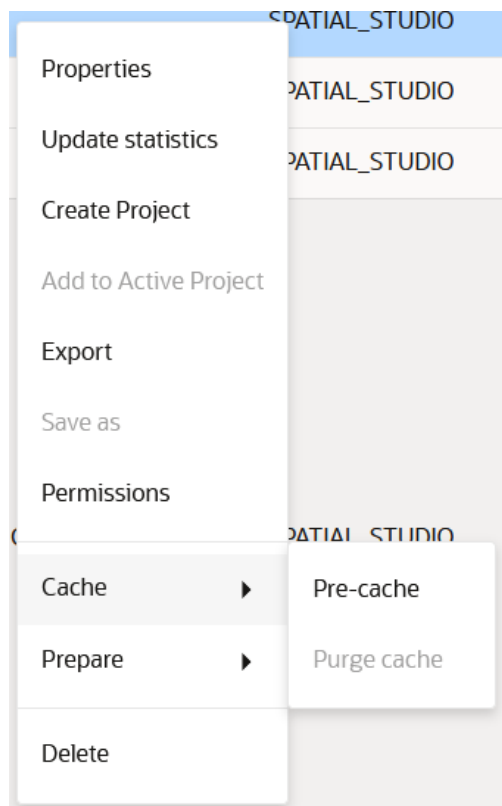
```
{  
  "DatasetName" : "DATASET NAME",  
  "DatasetId" : "8da55629d3ca71aa37d859422a847257",  
  "GeometryColumn" : "GEOM_COL_NAME"  
}
```

Each vector tile will be encoded and saved to a file that follows a name pattern as shown:

```
<zoom_level>_<x_axis>_<y_axis>.dat
```

All the variables in the preceding name pattern are replaced by an integer and denote the world position where the tile needs to be loaded when looking at a certain viewport of the world map.

The cache options (**Pre-cache** and **Purge cache**) for a dataset can be accessed from the **Datasets** page as shown:



## Pre-Cache

You can trigger a pre-caching task to start generating vector tiles even before a map is loaded with the dataset for visualization.

You can access the **Pre-cache** option as shown in this [Figure](#).

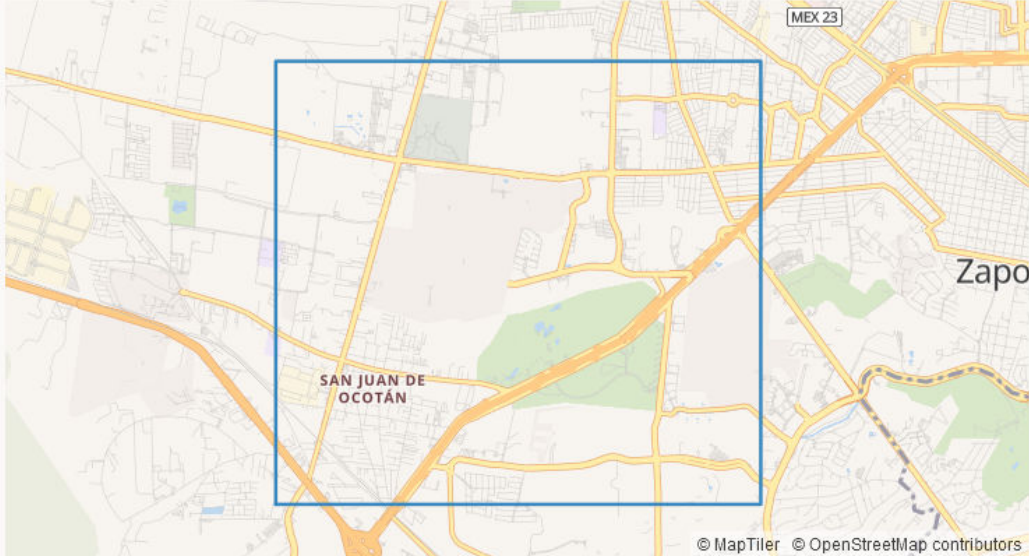
Pre-caching can infer where the data is located and suggest the data bounds for caching. In case if the information is not available, then you can interactively select the part of the world that needs to be included in the pre-caching task. Spatial Studio also suggests the zoom levels that are best suited for the data. However, you can always override this and configure your own choice for the **Zoom levels**.

### Pre-cache

Bounding Box

Interactive (press Shift and drag the mouse)

Use data bounds



Bounding Box  
-103.463426,20.7,-103.416585,20.74

Zoom levels

Automatic

Custom

1    2    3    4    5

6    7    8    9    10

11    12    13    14    15

**Apply**   Cancel

**Note**

Based on the complexity of the data and the number of zoom levels to pre-cache, this task could take from a couple of minutes to several hours. Therefore, be cautious on what you opt to include in this process as the database connections and CPU usage could heavily be impacted by this task.

The pre-cached tiles are saved in the file system, following the name pattern discussed in the earlier section. Extra information about the bounding rectangle and zoom levels that were pre-cached are included in the `tiles.json` file as shown:

```
{
  "DatasetName" : "DATASET NAME",
  "DatasetId" : "8da55629d3ca71aa37d859422a847257",
  "GeometryColumn" : "GEOM_COL_NAME",
  "ZoomLevels" : [ 13, 14, 15 ],
  "BoundingBox" : [ -103.455841, 20.708551, -103.421479, 20.73044 ]
}
```

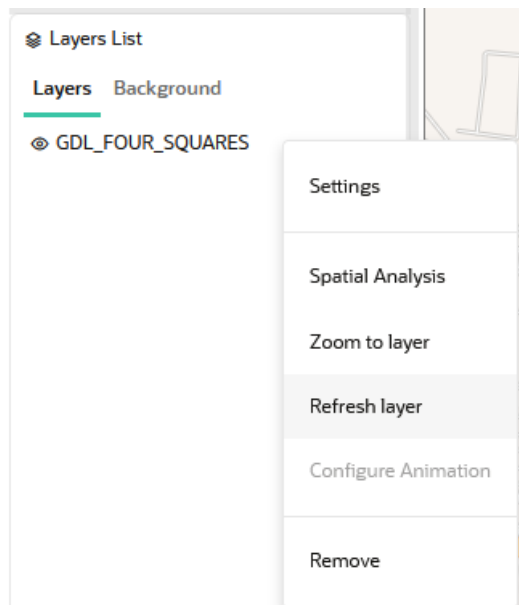
## Purge Cache

You can wipe the cached tiles by calling the **Purge cache** option.

You can access the **Purge cache** option as shown in this [Figure](#).

This option is helpful whenever the database data changes causing the already generated vector tiles to become stale.

Alternatively, you can also select the **Refresh layer** option for each dataset layer that is added to the map visualization in the **Active Project** page as shown:



This indirectly triggers a **Purge cache** operation, before generating the vector tiles again.

You must perform a cache purge or layer refresh whenever you apply any of the following changes to a dataset:

- Change the key column of a dataset
- Enable or disable columns of a dataset
- Change the contents of your dataset's source table

Otherwise, you will be viewing stale data on the map and interacting with this data may also result in errors.

# 5

## Work with Connections

Spatial Studio gains access to the data on your Autonomous AI Database Serverless instance through the `MY_DEFAULT_CONNECTION` object.

You can also create a single custom connection to another Autonomous AI Database instance with or without a wallet. In addition, creating an external connection to an OGC WMS service is also supported.

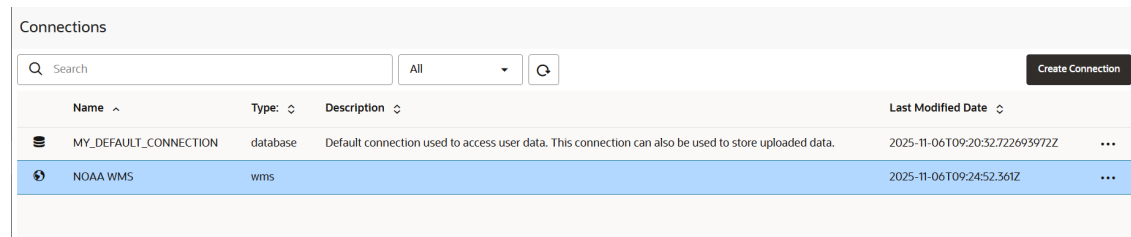
### Topics:

- [Overview of Connections Page](#)
- [Create an OGC WMS Connection](#)
- [Create a Connection to an Autonomous AI Database Instance](#)

## Overview of Connections Page

The Connections page displays all the existing connections and also allows you to create a new OGC (Open Geospatial Consortium) WMS (Web Map Service) connection.

The following figure shows the **Connections** page:



Name	Type	Description	Last Modified Date
MY_DEFAULT_CONNECTION	database	Default connection used to access user data. This connection can also be used to store uploaded data.	2025-11-06T09:20:52.722693972Z
NOAA WMS	wms		2025-11-06T09:24:52.361Z

Spatial Studio automatically creates a default connection object (`MY_DEFAULT_CONNECTION`) through which you can access data on your Autonomous AI Database Serverless instance.

You can also create a new connection to an OGC WMS service.

When a new data source connection is created, GeoRaster will be automatically enabled if it was not already enabled in the database schema. You can also perform the following actions by clicking the hamburger icon against any displayed connection or by right-clicking a connection row:

- **Properties:** To view the properties of the connection in the **Overview** tab. You can control the generation of vector tiles and H3 hexagons with the **Use on-DB Vector Tile Generation** and **Use on-DB H3 Generation** toggles in the **Settings** tab.

Spatial Studio by default relies on the Autonomous AI Database server's built-in capabilities to generate the vector tiles and H3 hexagons. Therefore, you must typically keep these toggles ON. In rare situations, you may want to switch OFF these toggles in order to debug potential bugs introduced by a new Autonomous AI Database patch. When set to OFF, Spatial Studio generates vector tiles and H3 hexagons in the mid-tier instead of within the database server.

- **Edit:** To update the connection details.

**Note**

You cannot edit the `MY_DEFAULT_CONNECTION` object on the Connections page.

- **Test Connection:** To validate the connection.
- **Delete:** To delete the connection along with all its datasets.

**Note**

You cannot delete the `MY_DEFAULT_CONNECTION` object.

## Create an OGC WMS Connection

You can create a new connection to an external OGC (Open Geospatial Consortium) WMS (Web Map Service) service.

This enables you to create an OGC WMS dataset which can be used in map visualizations. Note that a WMS service or server typically offers many individual map layers that can be combined in different orders. The full list of available map layers, as well as many other important supported functionalities are all advertised by the WMS server through a standard WMS `GetCapabilities` response.

When you create a new WMS connection, Spatial Studio will be querying such capabilities against the external WMS server using the standard `GetCapabilities` call. Based on the result of such a query, you will later be able to choose the required WMS map layers that must be included when creating a new Spatial Studio WMS dataset.

You can perform the following steps to create an OGC WMS connection:

1. Navigate to the **Connections** page.
2. Click **Create Connection**.  
The **Create Connection** dialog opens.
3. Select **OGC Web Map Service** as the connection type and click **Next**.  
The **Create Connection** dialog open as shown:

**Create Connection**

Name  
NOAA WMS

Description

WMS URL  
https://nowcoast.noaa.gov/geoserver/observations/wea

WMS VERSION  
1.3.0

OK Cancel

4. Enter the connection **Name**.
5. Optionally, enter a **Description**.
6. Enter the **WMS URL** to connect to the WMS service.

Also, note the following:

- Ensure that the **WMS URL** is added to the **Safe Domains** list.
- You can use one of the following two formats for the WMS URL:
  - A complete `GetCapabilities` request, including the version of the WMS specification (1.3.0 is recommended). For instance:  
`https://nowcoast.noaa.gov/geoserver/observations/weather_radar/ows?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetCapabilities`
  - The base URL of the WMS server. For instance:  
`https://nowcoast.noaa.gov/geoserver/observations/weather_radar/ows`

7. Optionally, select the **WMS VERSION**.
8. Click **OK**.

The OGC WMS connection gets created. This **wms** type connection is displayed on the **Connections** page.

Also, the new WMS connection stores the names of all the available map layers (hosted by the WMS service) and a host of other information based on the **GetCapabilities** response as a part of its metadata.

9. Right-click on the newly created connection, select **Test connection**, and verify that the connection tests successfully.

## Create a Connection to an Autonomous AI Database Instance

You can create a custom connection to an Autonomous AI Database instance in Spatial Studio.

1. Navigate to the **Connections** page.
2. Click **Create Connection**.  
The **Create Connection** dialog opens.
3. Select **Oracle Autonomous Database** as the connection type and click **Next**.

The **Select ADB authentication type** dialog opens.

4. Select an authentication type as desired and click **OK**.

Depending on your choice, perform one of the following to create a custom connection to your Autonomous AI Database instance:

### Note

You can create only one custom connection to your Autonomous AI Database instance at a time. If you wish to create another one, then you must delete any existing custom connection.

- **Wallet-based:** See [Use a Wallet-Based mTLS Connection](#) for more information.
- **Wallet-less (TLS):** See [Use a Walletless TLS Connection](#) for more information.

## Use a Wallet-Based mTLS Connection

You can create a Spatial Studio connection to an Autonomous AI Database instance using a wallet-based mutual Transport Layer Security (mTLS) authentication.

Before you begin, ensure you meet the following prerequisites:

- Download and save the wallet for your Autonomous AI Database instance from the Oracle Cloud Infrastructure (OCI) console. See [Download Client Credentials \(Wallets\)](#) for more information.
- The instructions in this section assume that you have already performed the steps described in [Create a Connection to an Autonomous AI Database Instance](#) and you chose to create a **Wallet-based** connection.

You can then continue to perform the following steps to set up a cloud connection to your Autonomous AI Database instance using the downloaded wallet.

1. Drag and drop your saved wallet file or click to upload the wallet from your system in the **Upload wallet** dialog.
2. Click **OK**.

The **Create Connection** dialog opens as shown:

**Create connection**

Name  
Wallet\_based\_conn

Description

User  
spatial\_user

Password  
●●●●●●●●●●

Service  
[Dropdown menu]

Proxy host

Proxy port

OK Cancel

3. Optionally, change the default Spatial Studio connection **Name**.
4. Optionally, enter a **Description**.
5. Enter the Autonomous AI Database **User** name and the **Password** for the user.
6. Select the appropriate **Service** from the drop-down list.
7. Optionally, enter the **Proxy Host** and **Proxy Port** details.
8. Click **OK**.

The connection to the Autonomous AI Database instance gets created and is displayed on the **Connections** page.

## Use a Walletless TLS Connection

You can create a Spatial Studio connection to an Autonomous AI Database instance using a walletless Transport Layer Security (TLS) authentication.

Before you begin, ensure you meet the following prerequisites:

- Obtain the connection string for your **Autonomous AI Database** instance:
  1. Navigate to your **Autonomous AI Database** details page and locate the **Network** section.

2. Specify an access control rule.
  - a. Click **Edit** next to the **Access Control List (ACL)**.
  - b. Click **Add access control** and add the IP address of your client machine to configure an access control rule.
  - c. Click **Save**.
3. Disable Mutual TLS (mTLS) Authentication if it is not already disabled.
  - a. Click **Edit** next to the **Mutual TLS (mTLS) Authentication**.
  - b. Uncheck **Require mutual TLS (mTLS) authentication**.
  - c. Click **Save**.
4. Obtain the database connection string.
  - a. Click **Database Connection** on the **Autonomous AI Database** details page.
  - b. Select **TLS** under TLS Authentication to view the list of connection strings.
  - c. Copy the required **Connection String**.  
The connection string follows a format as shown:

```
(description=(retry_count=20)(retry_delay=3)(address=(protocol=tcps)
(port=1522)(host=<host_name>.oraclecloud.com))
(connect_data=(service_name=<service_name>.adb.oraclecloud.com))
(security=(ssl_server_dn_match=yes))
```

- The instructions in this section assume that you have already performed the steps described in [Create a Connection to an Autonomous AI Database Instance](#) and you chose to create a **Wallet-less (TLS)** connection.

You can then continue to perform the following steps to set up a cloud connection to your Autonomous AI Database instance in the **Create Connection** dialog.

### Create connection

Name  
adbs\_tls\_conn

Description

---

Connection string  
(description= (retry\_count=20)(retry\_delay=3)(address=

User  
spatial\_user

Password  
●●●●●●●●●●●●●●●●

Proxy host

Proxy port

OK Cancel

1. Optionally, change the default Spatial Studio connection **Name**.
2. Optionally, enter a **Description**.
3. Enter the **Connection string** obtained at the beginning of the section.
4. Enter the Autonomous AI Database **User** name and the **Password** for the user.
5. Optionally, enter the **Proxy Host** and **Proxy Port** details.
6. Click **OK**.

The connection to the Autonomous AI Database instance gets created and is displayed on the **Connections** page.

# 6

## Work with Jobs

You can view the list of background jobs that run in Spatial Studio on the **Jobs** page.

### Topics:

- [Overview Jobs Page](#)

## Overview Jobs Page

The Jobs page displays details of all the background jobs that run in Spatial Studio.

The following figure shows a layout of the Jobs page:

Type	Object	Created By	Start Time	End Time	Status	
Resource container creation check		SPATIAL\$TEST_ADMIN	Today, 10:07 AM	Today, 10:07 AM	Done	...
Resource container deletion check		SPATIAL\$TEST_ADMIN	Yesterday, 11:22 PM	Yesterday, 11:22 PM	Done	View Details ...
Resource container creation check		SPATIAL\$TEST_ADMIN	Yesterday, 11:21 PM	Yesterday, 11:22 PM	Done	Terminate ...
Resource container deletion check		SPATIAL\$TEST_ADMIN	Yesterday, 10:33 PM	Yesterday, 10:33 PM	Done	Retrieve File ...
Resource container creation check		SPATIAL\$TEST_ADMIN	Yesterday, 10:29 PM	Yesterday, 10:29 PM	Done	...

You can perform the following actions on the Jobs page:

- Select a job to be displayed in the grid: **Active, Past** or **All**.
- View details of a specific job.
- Terminate a job.

Also, note the following about terminating a job:

- You can terminate a **Processing** or **Pending** job.
- You can terminate all job types except **Create lon-lat index** jobs.
- Upon termination of a job, partial execution results of the job are maintained. You can choose to clear the partial results. For example, you can perform **Clear Address Geocode** after terminating a **Geocode** job.
- Only jobs related to H3 aggregations such as **Build H3 Index** are completely rolled back when terminated.

The grid table displays the following properties for each job entry row:

- **Type:** The job type, such as "Geocode", "Reverse geocode dataset" and so on.
- **Object:** The entity being altered by the job, which can be a Dataset, Table, Index or other.
- **Created by:** The user that submitted the job.

**Note**

System maintenance jobs are created by “\$system” account

- **Start Time:** The scheduled next run time for jobs with `Pending` status or the actual job start time for any other job status.
- **End Time:** The time at which a job completed.
- **Status:** Indicates the state or progress of a job, which can be:
  - Pending
  - Processing
  - Done
  - Error
  - Terminating
  - Terminated

By clicking **\*\*\*** against any job row, you can perform the following actions :

- **View Details:** To view extra information, such as the step at which a `Processing` job is currently running or error details for `Error` or `Terminated` jobs. Also, you can terminate a `Processing` job by clicking **Terminate** when viewing the job details.
- **Terminate:** To terminate a `Processing` or `Pending` job directly. It remains disabled for any other job status.

# 7

## Work with Console

If you are a Spatial Studio administrator, you can manage custom basemaps, configure safe domains, and manage system notifications on the **Console** page.

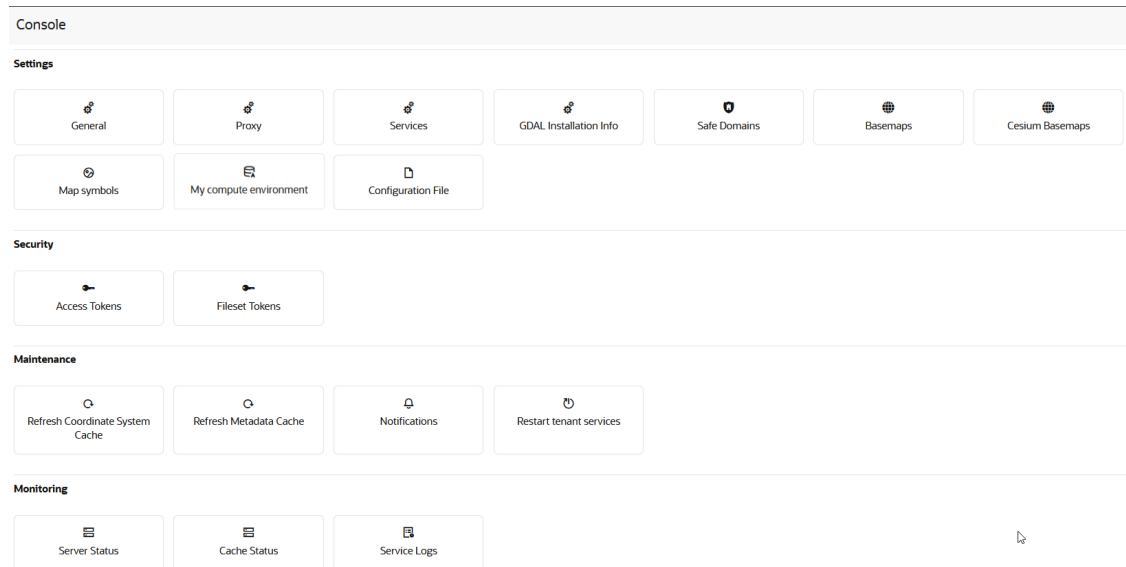
### Topics

- [Overview of Console Page](#)
- [Configure Custom Branding](#)
- [Configure Zip Upload Settings](#)
- [Manage Safe Domains](#)
- [Add a Custom Basemap](#)
- [Edit a Custom Basemap](#)
- [Upload a Map Symbol](#)
- [Create a Compute Environment](#)
- [Set Cache and Dataset Files Upload Size Limits](#)
- [Create and Manage Tokens](#)
- [Manage System Notifications](#)
- [View and Manage Server Logs](#)

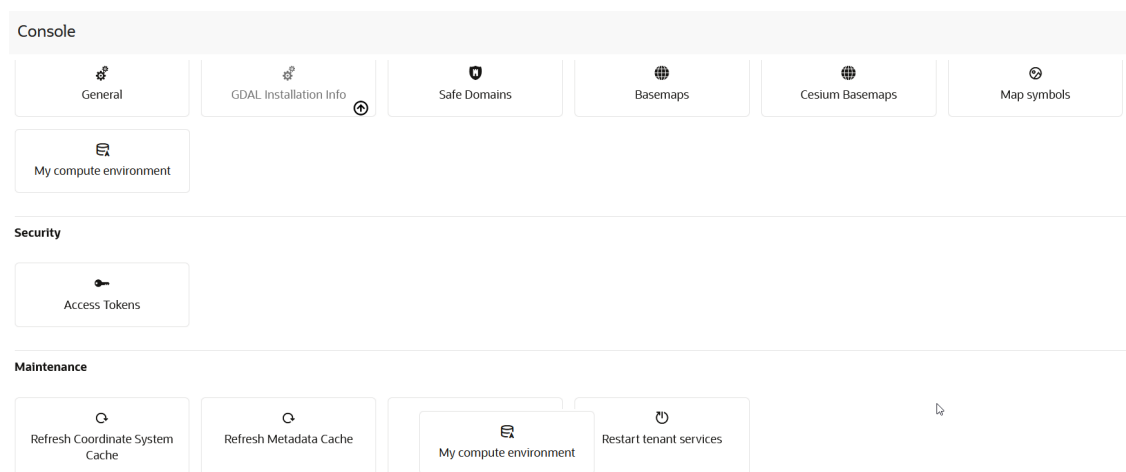
## Overview of Console Page

The Console menu link directs you to the Console page. The following shows the Console page layouts in two scenarios:

**Layout of the Console page when Spatial Studio is attached to the compute environment while logged in as a Spatial Studio ADMIN user**



### Layout of the Console page when Spatial Studio is not attached to the compute environment while logged in as a Spatial Studio ADMIN user



As seen in the preceding figure, the Console menu options are limited when working in Spatial Studio without a compute environment.

#### **Note**

If you are logged in as an administrator of Spatial Studio, then you can access all the supported Console menu options. Otherwise, you can access only the **Map symbols** and **My compute environment** options (under **Settings**), and **Access Tokens** (under **Security**).

The following sections describe the supported Console menu options under different categories:

## Settings

- **General:** This slider allows changing the GeoCoding service URL, the geocoding batch size, and the web proxy used by the Studio server. It also allows you to customize the front end branding area of the application.
- **GDAL Installation Info:** This slider allows you to verify the GDAL SDK and Oracle Instant Client installations and to view the location path on the server for these installations.
- **Safe Domains:** This slider allows the administrator to manage the white listing of the domains (host names or IP addresses) that are considered safe for loading various types of the resources from the Studio application. See [Manage Safe Domains](#) for more information.
- **Basemaps:** This slider allows a quick view of the existing custom basemaps, and in adding or editing custom basemaps. Custom basemaps can be made of either raster or vector tiles, typically hosted on a third party tile server. Additionally, you can also create a custom basemap using a WMS OGC web service.
- **Cesium Basemaps:** This slider gives you a quick view of the existing custom basemaps used exclusively for the 3D Cesium Map visualization. It also allows you to add new basemaps to be used by the 3D Map visualizations.
- **Map symbols:** This slider allows you to upload custom map symbols in Spatial Studio. This option is available for both Spatial Studio administrators and regular users.
- **My compute environment:** This slider enables you to create a new dedicated compute environment to meet your task requirements when working with Spatial Studio. See [About the Compute Environment in Spatial Studio](#) for more information.
- **Configuration File:** This slider allows you to configure the cache size and maximum dataset size for upload. See [Set Cache and Dataset Files Upload Size Limits](#) for more information.

### Note

Each listed host entry for Basemaps and Cesium Basemaps must be present as one of the entries in the Safe Domains list. If the host basemap comes from a domain that is not present in the Safe Domains list, then the basemap may not render correctly when visualizing the map.

## Security

**Access Tokens:** This slider allows you to create different types of access tokens. This option is available for both Spatial Studio administrators and regular users. See [Create and Manage Tokens](#) for more information.

## Maintenance

- **Refresh Coordinate System cache:** Use this only when needed to rebuild the text index of the repository database schema's supported Spatial Reference Well Known Text (WKText) definitions. For the shapefile upload, this WKText index is used to automatically match the best SRID.
- **Refresh Metadata Cache:** Spatial Studio typically caches all of the frequently used metadata such as the definitions of Datasets, Connections, and Projects. Sometimes it is required to refresh the whole cache in case some cached metadata becomes stale or out of sync in rare events.

- **Notifications:** You can use this option to set up one or more system notifications. These notifications are displayed across the top of the Spatial Studio application once a user logs in.
- **Restart tenant services:** You can click this button to perform a soft reboot of the Spatial Studio application without using command lines at the terminal. This action will internally restart all components of the system. It can be helpful in resolving issues such as problems with database connections due to extended network outages, jobs that appear to be stuck, or when the system is not functioning properly. Note that this process may take a few seconds to complete.

### Monitoring

- **Server Status:** This section provides read-only information about the general health and system status of the Spatial Studio server.
- **Cache Status:** This section provides the details of the cache maintained by Spatial Studio.
- **Service Logs:** This section allows loading and viewing a desired number of server-side logs. To reduce the clutter, you can filter the result using the desired logging level. It also allows the administrator to change the logging level. See [View and Manage Server Logs](#) for more information.

## Configure Custom Branding

As a Spatial Studio administrator, you can use the **Brand Manager** feature in Spatial Studio to upload your brand logo and change the application title as desired. The following steps enable you to configure custom branding.

1. Navigate to the **Console** page.
2. Click **General** under **Settings**.

The **Brand Manager** slider opens as shown.

## General

### Brand Manager

Banner style  
Default

Application title  
Spatial Studio

### Application logo

  
Drop logo file or click to browse

Application logo name  
Oracle

### Preview

ORACLE Spatial Studio

Save Changes

Cancel

3. Select **Custom** from the **Banner style** drop-down list.  
The following two banner styles are supported:
  - **Default:** This is the default configuration which uses **Oracle** branding.
  - **Custom:** Custom configuration allows you to apply your organization's branding.
4. Change the **Application title** as desired.  
The default value is **Spatial Studio**.
5. Upload your own **Application logo**.
6. Enter your **Application logo name**.
7. Preview your changes and click **Save Changes**.

Note that you need to refresh your page to see the custom brand changes.

## Configure Zip Upload Settings

Spatial Studio allows you to create datasets by uploading zip files. As a Spatial Studio administrator, you can set the size limits for these zip files.

Perform the following steps, to change the zip upload settings.

1. Navigate to the **Console** page.
2. Click **General** under **Settings**.  
The **General** slider opens.
3. Click the **Advanced Settings** collapse icon to open the **Zip Upload Settings** as shown:

The screenshot shows the 'Advanced Settings' section with a 'Zip Upload Settings' sub-section. It contains three input fields, each with a value and up/down arrows:

- Maximum inflate multiplier: 100
- Maximum unzipped item size (MB): 10,000
- Maximum unzipped total size (MB): 10,000

At the bottom of the panel are two buttons: 'Save Changes' (dark grey) and 'Cancel' (white with grey border).

4. Change any of the following default configuration options as required.
  - **Maximum inflate multiplier:** Maximum allowed multiplier when inflating files.
  - **Maximum unzipped item size (MB):** Maximum size for an item in the zip file.
  - **Maximum unzipped total size (MB):** Maximum size of the zip file (with all the entries unzipped to the disk).
5. Click **Save Changes**.

## Manage Safe Domains

As an administrator, you can add a domain of a custom basemap or a WMS service to the Content Security Policy directives of your Spatial Studio application. Alternatively, you can edit or delete an existing safe domain.

### Note

If you make any changes to the safe domains list, then it is important that you refresh or reload the browser page to reload the new Content Security Policy.

1. Navigate to the **Console** page.
2. Click **Safe Domains** under Settings.

The list of safe domains to which Spatial Studio has access is displayed as shown:

### Safe Domains

Safe domains that Studio has access to

Domain Name	Connect	Image	Script	Font	CSS Style	
http://elocation.oracle.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="x"/>
https://earthquakes.usgs.gov	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="x"/>
https://nowcoast.noaa.gov	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="x"/>
https://elocation.oracle.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="x"/>
http://maps.oracle.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="x"/>
https://maps.oracle.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="button" value="x"/>

Save Changes
Add...
Cancel

You can choose to perform one of the following actions:

- **Adding a safe domain**

- a. Click **Add**.

A new row gets added to the end of the safe domains table list.

- b. Double-click the **Domain Name** cell of the empty new row to enter the new domain.

Ensure that you enter only the domain part of an external URL (that is, the protocol, host name or IP address, and port) from which you will be fetching the resources. For instance, `https://wms.mycompany.com:8080` or `https://wms.mycompany.com`.

Note that the protocol is a part of the domain and should be based on the URL of the remote service. For instance, if you defined a WMS data source or a custom base map in Spatial Studio, and the URL to the WMS server or the custom base map's tile server starts with `https://`, then you must use `https://`. If it starts with `http://`, then use `http://`. In case if both the protocols are used (maybe one is used to fetch some resources while the other is used for a different type of resource), then you need to add the domain twice, one with the `http://` protocol and another with the `https://` protocol. Spatial Studio performs safe domain validation strictly based on the value you added to the list.

- c. Select the appropriate check boxes.

The check boxes represent [Content Security Policy](#) fetch directives.


- **Connect:** This corresponds to the CSP `connect-src` directive, and indicates whether Spatial Studio is allowed to interact with the domain via script interface (such as AJAX calls).
- **Image:** this corresponds to the CSP `img-src` directive, and indicates whether Spatial Studio is allowed to fetch images from the domain.
- **Script:** this corresponds to the CSP `script-src` directive, and indicates whether Spatial Studio is allowed to import or load scripts hosted by the specified domain.
- **Font:** this corresponds to the CSP `font-src` directive, and indicates whether Spatial Studio is allowed to load font data from the specified domain.
- **CSS Style:** this corresponds to the CSP `style-src` directive, and indicates whether Spatial Studio is allowed to load stylesheet from the specified domain.

It is important to understand what type of resources you will be fetching from the specific domain. For instance, if you select the check box **Script**, then it implies that you are enabling your browser to fetch Java Script type resources from the domain.

In case if you are adding a safe domain for a WMS data source, then you likely need to enable the following check boxes:

- **Connect:** This is required because Spatial Studio needs to interact with a remote WMS data source to check its capabilities using AJAX calls.
- **Image:** This is needed because eventually Spatial Studio needs to fetch individual WMS map images from the remote WMS server.

Note that when a check box is selected, the domain URL gets added to a list of all the allowed URLs for the corresponding CSP directive. For instance, consider that the domain `https://www.mycompany.com` is added as a safe domain with the **Connect** check box selected. Then, when you reload Spatial Studio, the CSP header loaded by the browser will now include `https://www.mycompany.com` in its `connect-src` directive's list of domain values.

- d. Click **Save Changes**.
  - e. Ensure to refresh or reload the browser page.
- **Editing a safe domain**
    - Double-click the required safe domain table row and edit the required details.
    - Click **Save Changes**.
    - Ensure to refresh or reload the browser page.
  - **Deleting a safe domain**
    - Double-click the required safe domain row in the table.
    - Click  and confirm delete by clicking **OK**.
    - Click **Save Changes**.
    - Ensure to refresh or reload the browser page.

## Add a Custom Basemap

The following steps enable you to add a custom basemap.

1. Navigate to the **Console** page.

2. Click **Basemaps** under Settings.  
The **Basemaps** window listing all the available basemaps opens.
3. Click **Add Basemap** and click on one of the following basemap types:
  - XYZ Raster tiles
  - OGC WMS
  - Vector tiles
4. Enter **Name** and **URL** for the selected basemap type.
5. Optionally enter **Attribution** and **API Key**.

✔ **Tip**

Once you have entered all the required fields, you can preview the basemap by clicking **Quick View**.

6. Click **Save** to add the base map.

For example, the following figure show the **OGC WMS** basemap configuration window:

**OGC WMS**

Add an OGC WMS basemap.

**i** The WMS service must support coordinate system EPSG:3857. The service URL entered below should be a normal WMS request with "bbox={bbox-epsg-3857}"

Name  
Weather

Attribution

OGC WMS URL  
https://my.sample.com/{apikey}/mywms?bbox={bbox-epsg-3857}&service=WMS&...

API Key

Quick View

Save Cancel

**Note**

It is important to add the domain name to **Safe Domains** in order to enable the Spatial Studio application to access the required service for the basemap.

## Edit a Custom Basemap

The following steps enable you to edit a custom basemap.

1. Navigate to the **Console** page.
2. Click **Basemaps** under Settings.

The **Basemaps** window listing all the available basemaps opens.

3. Click **\*\*\*** against the required custom basemap and click **Edit** from the context menu.

**Note**

**Edit** is disabled for predefined Spatial Studio maps.

The custom basemap configuration details are displayed for editing as shown:

**Raster XYZ Basemap**

Edit a raster XYZ basemap

Name  
Weather

Attribution

XYZ tile server URL  
https://nowcoast.noaa.gov/arcgis/services/nowcoast/

API Key

Quick View

Save Cancel

4. Modify the required parameters, such as **Name**, **Attribution**, **URL** or **API Key**.
5. Click **Save**.

The custom basemap details are modified and the updates are shown in the **Basemaps** window.

## Upload a Map Symbol

You can upload custom map symbols (or icons) and also 3D models (in .glb format), which you can use in a Map or Cesium-Map visualization.

Also, note the following:

- All uploaded symbols are assigned a globally unique ID. The application always references the symbol using its unique ID, and not by its name. The name of the symbol is used only for display purposes in the application.
- When a regular user (non-administrator) uploads a map symbol, the symbol is visible and accessible only for that specific user and does not become public.
- When an administrator uploads a map symbol, the symbol is accessible in a read-only manner to everyone in the organization. The symbol will show up in the symbol list of any regular Spatial Studio user along with their own symbols.
- Regular users can **Rename** and **Delete** only their own custom map symbols.
- If two different users upload an image file with the same name, then the symbols do not get overwritten as each symbol is referenced by its unique ID.
- When an owner attempts to delete a custom map symbol, Spatial Studio performs a referential check to ensure that the particular symbol is not used in any map visualization.
- The **Copy symbol ID** option can be used when the user wants to explicitly assign and apply different custom symbols to different groups of data, in which case the symbol ID needs to be stored in the source data table in its own column.

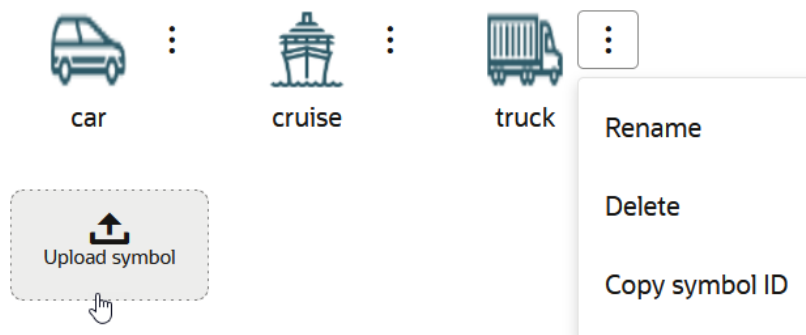
The following steps enable you to add a custom map symbol in Spatial Studio.

1. Navigate to the **Console** page.
2. Click **Map symbols** under **Settings**.

The **Map symbols** slider opens as shown.

### Map symbols

▼ Custom symbols




3. Click the **Custom symbols** collapse icon and click **Upload symbol**.

4. Select the required image file in your system for the upload.

It is important to note the following:

- Only .png, .gif, .jpg, and .glb file formats are supported.
- Each file cannot exceed 2 MB in size.

5. Optionally, change the **Symbol name**.

6. Click  to add the custom map symbol.

Once it is uploaded, you can style your data points on a map visualization using the new symbol. See [Apply Custom Map Symbols to a Map Layer](#) for more information.

## Create a Compute Environment

You can configure a new compute environment in Spatial Studio.

1. Navigate to the **Console** page.
2. Click **My compute environment** under **Settings**.

The **My compute environment** slider opens as shown:

## My compute environment

Memory size (GB)10▼ ▲



3. Optionally, adjust the **Memory size** in GB.

The default value is 10 GB.

4. Click **Create**.

Spatial Studio gets attached to the newly created compute environment. The **Attached** status is displayed in green on the top right of the header.

It is recommended that you reload the application page to ensure consistency with the newly established configuration.

## Set Cache and Dataset Files Upload Size Limits

You can enable and configure the in-memory cache of your Spatial Studio objects. In addition, you can define the size limit for dataset files uploaded in Spatial Studio.

1. Navigate to the **Console** page.

2. Click **Configuration File** under **Settings**.

The **Configuration File** slider opens.

### Configuration File

▼ Cache ⓘ

Enabled



Max Entries ⓘ

Max Age Seconds ⓘ

▼ Upload ⓘ

Max Dataset Size ⓘ

Save Changes

Close

3. Perform the following actions as applicable.

- **To enable and configure Cache Size**

Set the following options as required:

- **Enabled:** Toggle to switch ON or OFF the caching of vector tiles. By default, cache is enabled.
- **Max Entries:** Maximum number of entries to be cached. Default value is *20,000* entries.
- **Max Age Seconds:** Maximum time (in seconds) since the last update after which an entry will be removed. Default value is *900* seconds.

- **To configure Dataset Files Upload Size**

Set **Max Dataset Size** which determines the maximum combined size of dataset files allowed in an upload request. Default value is *2000* files.

4. Click **Save Changes**.

## Create and Manage Tokens

Spatial Studio allows you to create different types of access tokens.

The following describes the supported token types:

- **Access Tokens:**

- **General-purpose token:** Full access to all resources. The token grants read-only or read-write access as required.  
In most cases you should avoid using a general-purpose token as it grants too much access. Instead, generate and use a specific token that applies to your scenario.
- **Streaming-only token:** Access only to REST endpoints related to dataset streaming. Also, the token grants read-only access that be used only with `HTTP GET` methods.
- **Streaming and tile refreshing token:** The scope of this token is extended to refresh the existing vector tiles of the streaming dataset on the recent updates.
- **Embedding Published Projects token:** This token allows embedding of private published projects.

See [Generating an Access Token](#) to create the preceding access tokens.

- **Access-Generator token:** This is a special type of token that is used to (programmatically) create short-lived access tokens (of types shown in the preceding list under Access Tokens).  
This token cannot be created or deleted directly. You can only copy the system generated access-generator token. Note that the system generates this token on a per-user basis. This implies that different Spatial Studio users will have different access-generator tokens.  
Also, you can request Spatial Studio to regenerate the access-generator token for you.
  - See [Copy the Access-Generator Token](#) to copy the token.
  - See [Generate Access Tokens Programmatically](#) for using the access-generator token.

## Generating an Access Token

To generate an access token:

1. Navigate to the **Console** page.
2. Click **Access Tokens** under **Security**.

The **Access Tokens** slider opens and the existing tokens are displayed.

3. Click **Create New Token**.

**Create A New Access Token** dialog opens as shown:

**Create A New Access Token**

Create A New Token

Name  
Streaming-Only Token

Valid for (minutes)  
120

Resource type:

All resources

Dataset streaming only

Dataset streaming and tile refreshing

Embedded published projects

Allowed action:

Read Only

Read Write

OK Cancel

4. Enter the token **Name**.
5. Enter the time **Valid for (minutes)** after which the token expires.  
If you specify -1, then Spatial Studio will never expire the token, unless you explicitly revoke it.
6. Select **Resource type**.
7. Optionally, select the **Allowed action** for granting access to a general-purpose token.
8. Click **OK** to create the token.  
The token gets created successfully.

## Generate Access Tokens Programmatically

Your web application can also create or obtain a short-lived access token from Spatial Studio programmatically, by using an Access-Generator Token.

The following provides the Spatial Studio REST API endpoint details to create an access token:

**Endpoint:** /spatialstudio/oauth/v1/user/token?  
name=<NAME>&validTime=<MINUTES>&action=<ACTION>&resourceType=<RESOURCE>

**Required HTTP Request Header:** Name of the header must be **Authorization** and its value must start with **Bearer** followed by a space, then followed by a valid access-generator token string.

The following table describes the query parameters used in the preceding endpoint.

**Table 7-1 Query Parameters**

Query Parameters <sup>1</sup>	Data Type	Description
name	Up to 128 chars (non-null)	Specifies the name of the token to be created.
validTime	An integer x, where $-1 \geq x \geq 9999$	Specifies for how many minutes the new token remains valid. <b>Note:</b> A value of $-1$ indicates that the token will not expire.
action	enum[read_only, read_write]	Specifies the actions the new token is allowed to perform.
resourceType	enum[dataset_streaming, dataset_streaming_refreshing, embedded_published_project, all]	Specifies the types of resources the new token is allowed to access (act on).

<sup>1</sup> All the query parameters are mandatory.

It is important to note that currently only five different types of tokens can be created with the following combinations of `action` and `resourceType`:

- `action=read_only&resourceType=all`
- `action=read_write&resourceType=all`
- `action=read_only&resourceType=dataset_streaming`
- `action=read_write&resourceType=dataset_streaming_refreshing`
- `action=read_only&resourceType=embedded_published_project`

Any other combination of `action` and `resourceType` (outside the valid combinations shown in preceding list) will be rejected.

The following shows a sample request (using `Curl` command line) to obtain an access token that allows a web application to get the streaming access to a dataset as well as allowing the refreshing of the dataset's vector tiles.

```
curl -X POST 'http://localhost:8080/spatialstudio/oauth/v1/user/token?
name=test123&validTime=60&action=read_write&resourceType=dataset_streaming_refres
hing' --header 'Authorization: Bearer $GENERATOR_TOKEN'
```

The preceding request returns a JSON document containing the new token. Its value is stored in the `token` field in the response:

```
{"name": "test123", "token": "eyJ0eXAiOiJzZ3R1Y2...", ... }
```

## Copy the Access-Generator Token

Perform the following steps to copy the access-generator token:

1. Click  on the top right corner of the page.

2. Click **Access Tokens** from the drop-down menu.  
The **Access Tokens** dialog opens.
3. Click **Show Access-Generator Token**.  
The **Access-Generator Token** dialog opens which shows the existing access-generator token.
4. Click **Copy Token** to copy the token string.
5. Optionally, click **Regenerate Token** to request the system to regenerate the access-generator token, and then copy the token.

## Manage System Notifications

As the Spatial Studio administrator, you can create, edit, or delete system notifications. Spatial Studio supports two types of notifications:





- **Banner:** These notifications are typically used to display informative message such as planned downtime, scheduled updates, and so on. Banner type notifications are displayed across the top of the web application page, just above the built-in Spatial Studio application banner.
- **Show Stopper:** These are messages that will be displayed when the Spatial Studio server is not servicing any requests such as when being investigated for emergency issues or breaches.

You can manage the system notifications as shown in the following steps:

1. Navigate to the **Console** page.
2. Click **Notifications** under Maintenance.



The **Notifications** window listing all the configured notifications opens.

### Notifications

Title	Message	Notification Type	Expiration Date	Action
	System Upgrade	BANNER	4/10/23, 12:00 AM	 
Temporarily Unav...	Emergency Server Issues	SHOW_STOPPER	4/4/23, 12:00 AM	 

3. Perform any one of the following required actions.
  - **Create a New Notification**
    - a. Click **Create**.
    - b. Select the **Notification Type**.
    - c. Enter **Severity**, **Expiration Date (in UTC)**, and **Message** for banner notifications.
    - d. Enter **Title**, **Expiration Date (in UTC)**, and **Message** for show stopper notifications.
    - e. Click **OK**.

The new notification appears in the **Notifications** dialog.

- **Edit a Notification**  
Click  against a notification to edit the message details.
- **Delete a Notification**  
Click  against a notification to delete the notification.

## View and Manage Server Logs

As the Spatial Studio administrator, you can always view the most recent log messages generated by the server in your Spatial Studio application.

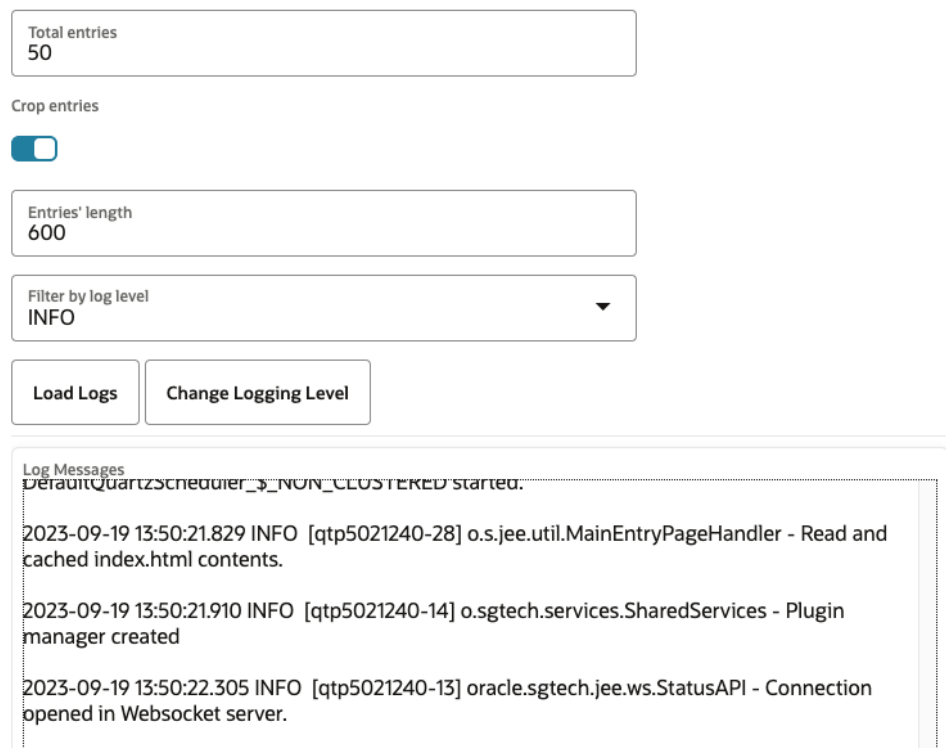
Perform the following steps to view and manage these server logs.

1. Navigate to the **Console** page.
2. Click **Service Logs** under Monitoring.

The **Service Logs** slider opens as shown.

**Figure 7-1 Service Logs**

### Service Logs



The screenshot shows the 'Service Logs' configuration panel. It includes a 'Total entries' field set to 50, a 'Crop entries' toggle switch that is currently turned off, an 'Entries' length field set to 600, and a 'Filter by log level' dropdown menu set to 'INFO'. Below these are two buttons: 'Load Logs' and 'Change Logging Level'. The log messages section displays three entries:

```

Log Messages
DefaultQuartzScheduler_3_NON_CLUSTERED started.
2023-09-19 13:50:21.829 INFO [qtp5021240-28] o.s.jee.util.MainEntryPageHandler - Read and
cached index.html contents.
2023-09-19 13:50:21.910 INFO [qtp5021240-14] o.sgtech.services.SharedServices - Plugin
manager created
2023-09-19 13:50:22.305 INFO [qtp5021240-13] oracle.sgtech.jee.ws.StatusAPI - Connection
opened in Websocket server.

```

3. Optionally, configure any of the following fields to customize the logs that are fetched from the server.
  - **Total entries:** This limits how many log messages or records will be loaded from the server.
  - **Crop entries:** If switched ON, then any log message with a very long string will be cropped when viewed.

- **Entries' length:** This determines the crop length.
  - **Filter by log level:** This drop-down list allows you to filter the server logs so that only those logged at the selected level or higher (more severe in nature) will be fetched from the server for display.  
The supported log levels are:
    - ERROR
    - WARN
    - INFO
    - DEBUG
    - TRACE
  - **Load Logs:** Click this button to reload the logs from the server when you change any of the preceding configurations.
4. Optionally, click **Change Logging Level** to change the server's logging level.

**Change Logging Level** window opens as shown.

The **Change Logging Level** button allows the administrator user to dynamically change the logging level used by the server without restarting it.

Sometimes it may become necessary to change the logging level, so that the Spatial Studio server can log more or less messages, or generate `DEBUG` or `TRACE` level messages for a specific functional area in order to diagnose a certain issue. By default, Spatial Studio uses the `INFO` log level, which means only log messages generated at the level `INFO`, `WARN`, or `ERROR` will be written to the log file (default location is `<OS_USER_HOME_DIR>/ .sgtech/ logs/sgtech.log`).

- Optionally, change any of the following configuration.
  - **Package name:** This specifies the area of the server that will be affected by the new logging level. If you specify `ROOT` (the default value), then the new logging level will affect all areas or functions of the Spatial Studio server. However, you can also enter a specific Java package name (maybe based on suggestions from your Oracle Support team), such as `oracle.sgtech.jee.api` when debugging issues related to Spatial Studio instance's REST API end points. When a specific

package name is entered, then the new log level will only take effect when code from that package is executed.

- **New Log Level:** This drop-down list allows you to select the new log level to be applied to the server's specific package or the entire server (default `ROOT`).

- b. Click **OK**.

Note that the log files may take a while to be filled with the messages logged at the new level.

# 8

## Work with Visualization

You can visualize your spatial data in Oracle Spatial Studio using three different modes of visualization - **Table**, **Map**, and **Cesium-Map**.

You can save your visualization as a Project in Spatial Studio. You can rework on a project or publish a project to share the results with other users.

### Topics:

- [Use a Table Visualization](#)
- [Use a Map Visualization](#)
- [Configure a Map Visualization](#)
- [Filter Data on a Map Layer](#)
- [Add Interactions to a Map Visualization](#)
- [Changing the Pitch and Bearing of a Map](#)
- [Search Locations and Features on a Map](#)

## Use a Table Visualization

Spatial Studio allows you to visualize your data from the dataset in tables.

To display your data in a tabular view, you must perform the following steps.

The instructions assume that the dataset for visualization is already added to the project in the Active Project page.

1. Click the **Visualizations** tab on the left pane in the Active Project page.  
This lists the various visualization options.
2. Click and drag **Table** from the list to the visualization window on the right to create a table visualization.  
This opens an empty layer in the visualization window.
3. Click the **Data** tab on the left pane in the Active Project page.  
This lists all the **Datasets** that are loaded for the project.
4. Click and drag the desired **dataset** from the list to the empty layer on the right.

### Note

You can view only one dataset in a table view. If you want to view multiple datasets, you must create one table view for each dataset.

This opens the data in tabular format for visualization as shown:

Accidents									Actions	Save
View 2	VEHICLE_NUM	HOUSE_NUMBER	COUNTRY	POSTAL_CODE	SETTLEMENT	STREET	MUNICIPALITY	REGION		
<input type="checkbox"/>	2		ZA	3610	Kloof		eThekwin	KWAZULU		
<input type="checkbox"/>	4		ZA	8301	Kimberley	N12	Sol Plaatje	NORTHERN		
<input type="checkbox"/>	7		ZA	0560	Mookgopong	R101	Modimolle-Mookgopong	LIMPOPO		
<input type="checkbox"/>	10		ZA	null	Nelson Mandela Bay	Bengwana Rd	Nelson Mandela Bay	EASTERN CAPE		
<input type="checkbox"/>	12		ZA	0081	Pretoria	M6	Tshwane	GAUTENG		
<input type="checkbox"/>	14		ZA	null	Breede Valley	R60	Breede Valley	WESTERN CAPE		
<input type="checkbox"/>	17		ZA	7530	Oude Westhof		Cape Town	WESTERN CAPE		
<input type="checkbox"/>	19		ZA	7806	Llandudno		Cape Town	WESTERN CAPE		
<input type="checkbox"/>	21	1357	ZA	0019	Kirkney	Van der Hoff Rd	Tshwane	GAUTENG		
<input type="checkbox"/>	23		ZA	0200	Fortina AH		Tshwane	GAUTENG		

You can easily scroll up or down the table to view the data rows as the table supports infinite scrolling.

5. Optionally, click the table **Settings** and enable **Show only selected features** to display the table rows for only the features selected on the map.

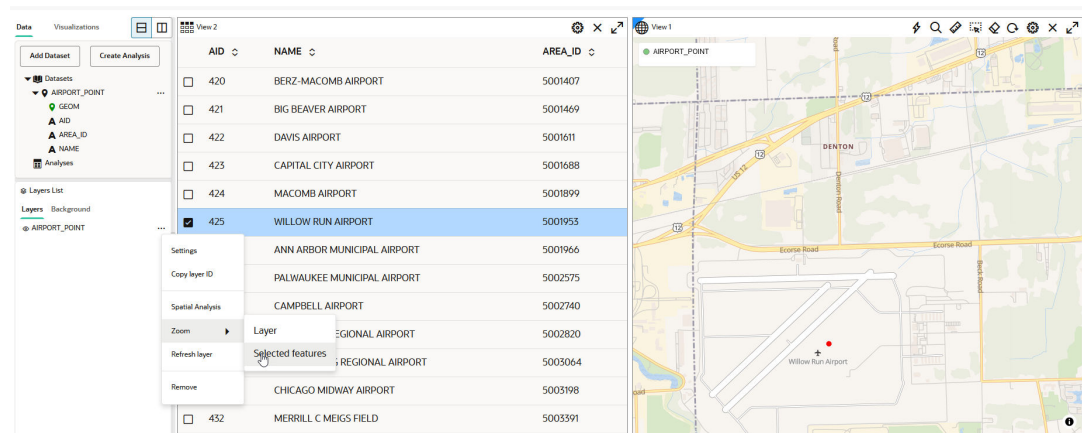
For example, the following figure shows both a map and table visualization. The **Show only selected features** setting is enabled for the table. Therefore, the table displays only three rows of data corresponding to the three selected features (shown highlighted) on the map.

The screenshot displays a dual-view interface. On the left, a table with columns 'AID' and 'AREA\_ID' shows three rows selected (checked): 160 (2005490), 161 (2005541), and 179 (2007101). A 'Visualization Settings' dialog box is overlaid on the table, with the 'Show only selected features' toggle switch turned on. On the right, a map shows a geographical area with several points marked, corresponding to the selected features in the table.

6. Optionally, you can directly zoom map on the selected features from the table visualization as shown in the following steps:
  - a. Select the required table rows.
  - b. Click on the map to get the map focus.
  - c. Click **\*\*\*** against the corresponding map layer in the **Layers** list of the **Layers** tab.

d. Click **Zoom** and select **Selected Features** in the context menu.

The map zooms in on the selected table row(s), which are highlighted as shown in the following example visualization:



## Use a Map Visualization

Spatial Studio supports several types of map visualizations such as geometry data visualization (points, lines, polygons), GeoRaster data visualization, hexagonal data visualization using H3 aggregations, and so on.

### Topics:

- [Visualize a Point Map](#)
- [Visualize GeoRaster Data on a Map](#)
- [Visualize Spatiotemporal Datasets](#)
- [Visualize OGC WMS Maps as a Dataset](#)
- [Visualize Data With H3 Aggregations](#)
- [Visualize Custom Map Regions](#)
- [Visualize a Wind Animation Dataset](#)

## Visualize a Point Map

Spatial Studio allows you to visualize the location of geographic data as points on maps.

To display your geographic data as maps, you must perform the following steps.

The instructions assume that the dataset for visualization is already added to the project in the Active Project page.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

This lists the various visualization options.

2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

A default base map is displayed with no data visualization layers.

3. Click the **Data** tab on the left pane in the Active Project page.

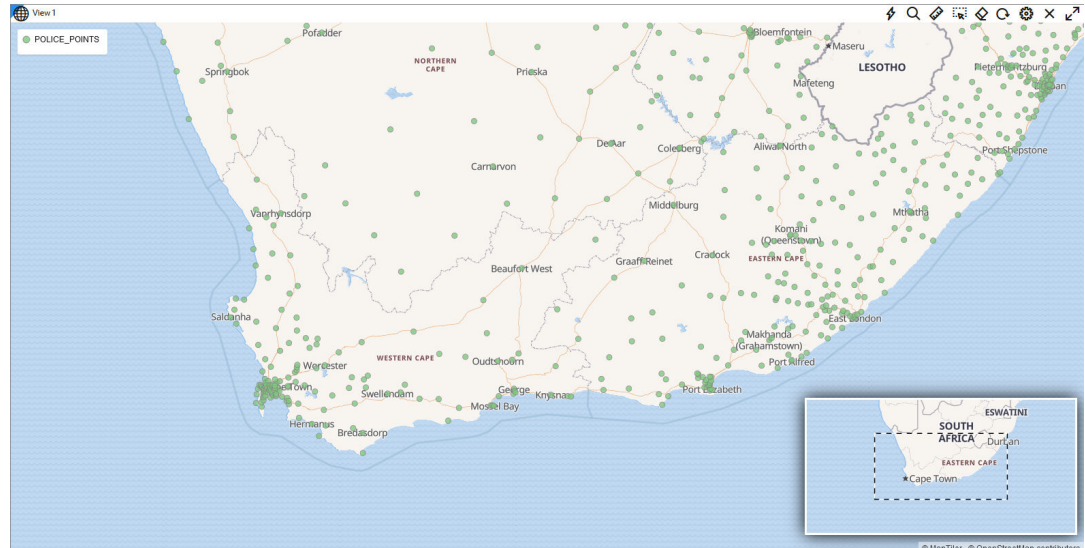
This lists all the **Datasets** that are loaded for the project.

4. Click and drag the desired **dataset** from the list to the map view on the right.

✓ **Tip**

You can drag and drop multiple datasets in a single action to your map view.

The map layer displays the data points for visualization.



5. Optionally, you can click **Settings** in the map tool bar and enable **Show minimap** in the **Visualization Settings** dialog.

An inset map showing the overview of the main map is displayed as shown in the preceding figure.

i **See Also**

[Apply a Render Style For a Point Layer](#) to render your map using different rendering styles.

## Visualize GeoRaster Data on a Map

Oracle Spatial Studio allows you to visualize GeoRaster data stored in spatial GeoRaster type in Oracle Database. Geo-referenced raster data, including satellite imagery, aerial photos from drones, and gridded data, is very useful for mapping applications. It can be directly analyzed, or layered with vector data as a background map for additional context. See *Spatial GeoRaster Developer's Guide* for more information on GeoRaster data.

You can visualize georaster data on a map using the following steps.

The instructions assume that the GeoRaster dataset is already added to the project in the Active Project page. To create a GeoRaster dataset, see [Create a GeoRaster Dataset](#) for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

This lists the various visualization options.

2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

A default base map is displayed with no data visualization layers.

3. Click the **Data** tab on the left pane in the Active Project page.

This lists all the **Datasets** that are loaded for the project.

4. Click and drag the desired **GeoRaster dataset** from the list to the map view on the right.

A GeoRaster layer is created on the map as shown:



#### ✓ Tip

You can enhance your visual display by modifying your Layer Settings using the **Style** tab and **Raster** tab.

Spatial Studio also supports visualization of 3D terrains on a map using GeoRaster Digital Elevation Model (DEM) data. See [Apply Style for a GeoRaster Layer](#) for more information.

## Visualize Spatiotemporal Datasets

You can visualize spatiotemporal datasets using the Cesium Timeline widget.

The following sections provide more information on the Cesium Timeline widget and the supported visualizations.

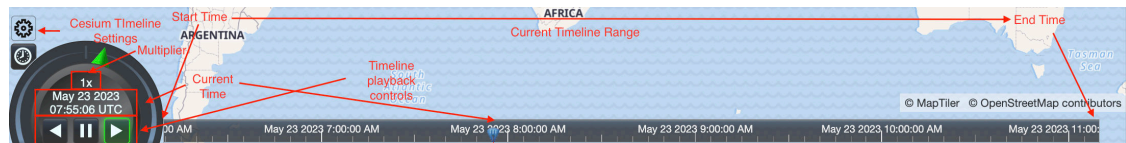
## Overview of the Cesium Timeline Widget

Spatial Studio provides a new standalone Cesium Timeline widget.

The Cesium Timeline widget in Spatial Studio provides the following capabilities:

- Dataset filtering.
- Serves as a hub for controlling all kinds of spatiotemporal data (such as live, historic, moving objects, and so on).  
The only exception being the GeoJSON URL based datasets. These datasets do not cater to Cesium timeline as the external URLs may not have the capability to provide GeoJSON corresponding to a time value, but are rather simply refreshed to provide newer values every x seconds.
- Offers a scalable solution to add multiple layers of different dataset types at once that can be time-synced as required.

The following figure shows the Cesium Timeline Widget on a map visualization in Spatial Studio.



The key concepts of the Cesium Timeline are as follows:

- **Cesium Timeline Modes:** The timeline supports two modes of operation. If even one layer corresponding to a **live** dataset is listening to the timeline, then the mode of operation is **LIVE**. Otherwise, the mode of operation is always **HISTORIC**.
- **Cesium Clock Start Time:** Starting point of the current range of timeline. This is the point in time from which the Cesium clock starts ticking.
- **Cesium Clock Stop Time:** Ending point of the current range of timeline. This is the point in time until which the Cesium clock ticks. However upon reaching the end, the timeline behavior depends on the mode:
  - **LIVE:** The timeline will move ahead by updating the start time and stop time values as per the current time.
  - **HISTORIC:** The timeline will loop back to the start time.
- **Cesium Clock Current Time:** The current time frame of the clock. It begins at the Cesium clock start time and ticks every 500ms. Optionally, you can slide the pointer on the timeline manually to set your current time.  
Also note the following with respect to the type of the spatiotemporal dataset:
  - **Live Spatiotemporal Dataset:** The Cesium clock current time value for such datasets is configured to always be pointing to current UTC time (unless manually changed).
  - **Non-Live Spatiotemporal Dataset:** If no other dataset is added to the timeline, then the Cesium clock for such a dataset automatically sets its range to minimum and maximum of the timestamp column, and the Cesium clock current time starts from the minimum value.
- **Multiplier:** Multiplies to the interval at which the clock ticks (500ms) in order to make the clock jump ahead or rewind accordingly.
- **Timeline Playback Controls:**
  1. **Pause:** Stops the timeline from animating and throwing tick events. The timeline pauses at current timeline frame.
  2. **Forward and Backward Play Buttons:** Makes the timeline animate in the chosen direction and includes the multiplier value ( $\pm \text{Multiplier} * 500\text{ms}$ )
- **Cesium Timeline settings:** Allows you to control the timeline settings.

### Related Topics

- [Configure Cesium Timeline Settings](#)  
You can configure custom settings for the Cesium timeline.
- [About Map Layers and the Timeline](#)  
Learn more about the spatiotemporal map layers and the Cesium timeline.

## Configure Cesium Timeline Settings

You can configure custom settings for the Cesium timeline.

Perform the following steps to configure the Cesium Timeline settings in your map visualization.

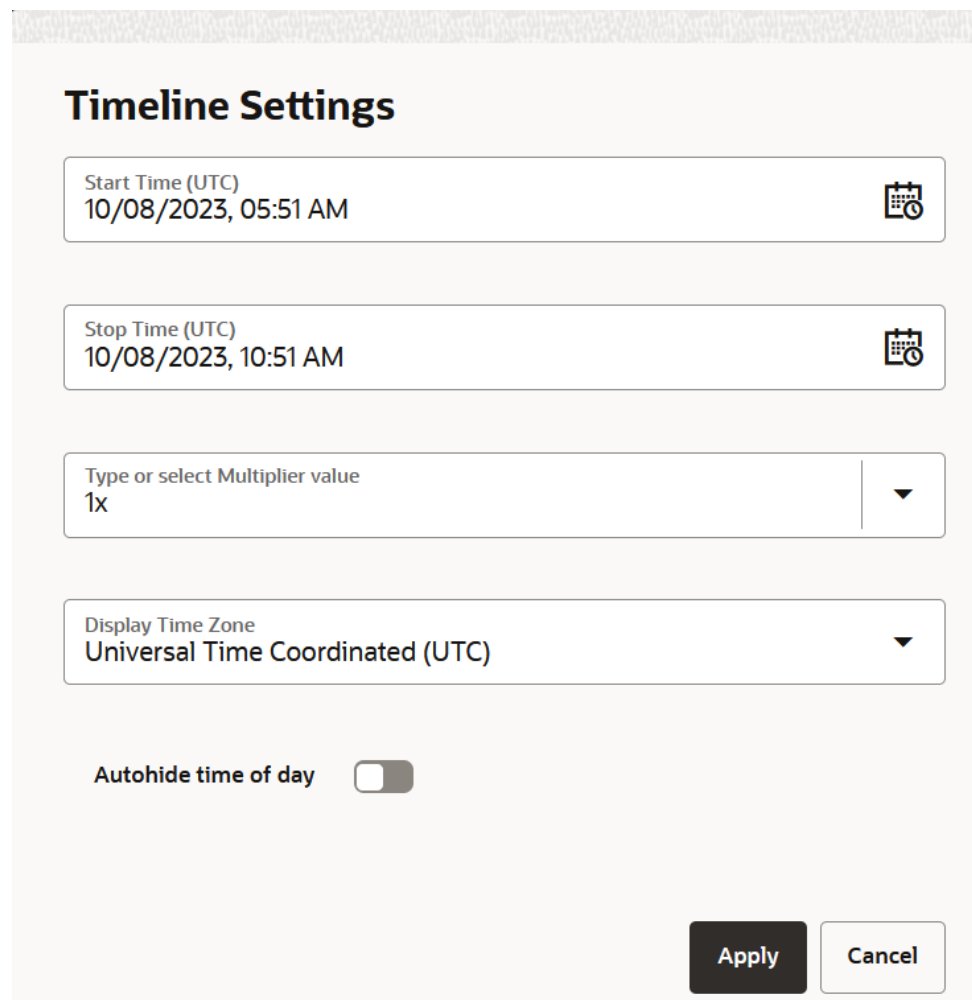
The instructions assume that you have a project linked to a spatiotemporal dataset and the project is opened on your Active Project page.

1. Click the **Settings** icon in your map tool bar.
2. Switch **ON** the **Show timeline** toggle and click **OK**.

The Cesium Timeline widget appears at the bottom of the map visualization canvas.

3. Click  on the timeline to configure the Cesium timeline settings.

The **Timeline Settings** dialog opens as shown:



**Timeline Settings**

Start Time (UTC)  
10/08/2023, 05:51 AM

Stop Time (UTC)  
10/08/2023, 10:51 AM

Type or select Multiplier value  
1x

Display Time Zone  
Universal Time Coordinated (UTC)

Autohide time of day

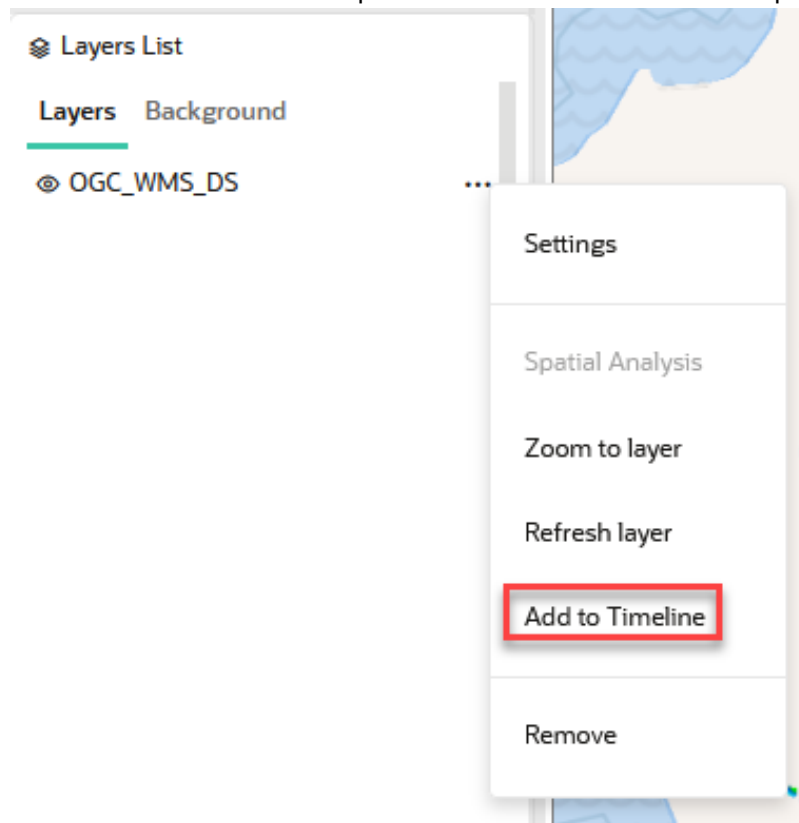
Apply Cancel

- a. Select the **Start Time** and **Stop Time** to set the timeline range.
- b. Enter or select a multiplier value from the **Type or select Multiplier value** list box.  
You can use a preset (Second, Minutes, Hours, Days, Weeks, Month, Year) multiplier or type a value such as 15 or 15x.
- c. Select the **Display Time Zone** in which you want the Cesium timeline to display its current time and timeline labels.
- d. Optionally, switch **ON** the **Autohide time of day**.  
If you opt to autohide time of day, then the time values from the timeline labels are hidden if the timeline range selected is greater than a week.
- e. Click **Apply**.

## About Map Layers and the Timeline

Learn more about the spatiotemporal map layers and the Cesium timeline.

- In order to add a map layer to the timeline, you must first enable spatiotemporal in the underlying dataset for the map layer. See [Enable Spatiotemporal for a Dataset](#) for more information.
- You can then add one or more spatiotemporal map layers to the Cesium timeline by performing the following steps:
  - Click the **Settings** icon in your map tool bar and switch **ON** the **Show timeline** toggle to view the Cesium timeline widget at the bottom of the map visualization canvas.
  - Select the **Add to Timeline** option in the context menu of the map layer as shown:



The map layer gets added to the timeline.

- Note the following if you add multiple map layers to the timeline:

- Each of these map layers respond to the timeline events independently. Therefore, you can configure each map layer to have its own properties (such as refresh time) and they then accordingly respond to the listener events. As the timeline events are thrown at every 500ms tick interval, each layer can have its own refresh time (more than 500ms) as to when they want to respond to these events.
- Also, in case of the map layers for datasets with historic timestamp values, all layers will loop back as per the current timeline range. This may either correspond to the first layer added to the timeline or it can be a custom range that you set in the timeline settings.
- If a layer corresponding to a live dataset is added to the timeline, then irrespective of the historic dataset layers listening to the timeline already, the timeline will never loop back and will keep moving forward.
- If you make any changes to the underlying dataset properties of a map layer, which is already added to the timeline, such as:
  - \* Disabling the **Enable Spatiotemporal** toggle
  - \* Toggling **Data is Live** and **Moving Objects**Then, the listener gets removed from the timeline. In such cases, it is recommended that you remove the layer from the timeline and add it again after changing the properties.
- If you change the **Time Unit** property of a standard filtering dataset, then this will take effect immediately and the filtering on the map visualization will adhere to the new **Time Unit** value.

## Visualize Live Moving Objects Dataset

You can visualize live moving objects on a map in Spatial Studio.

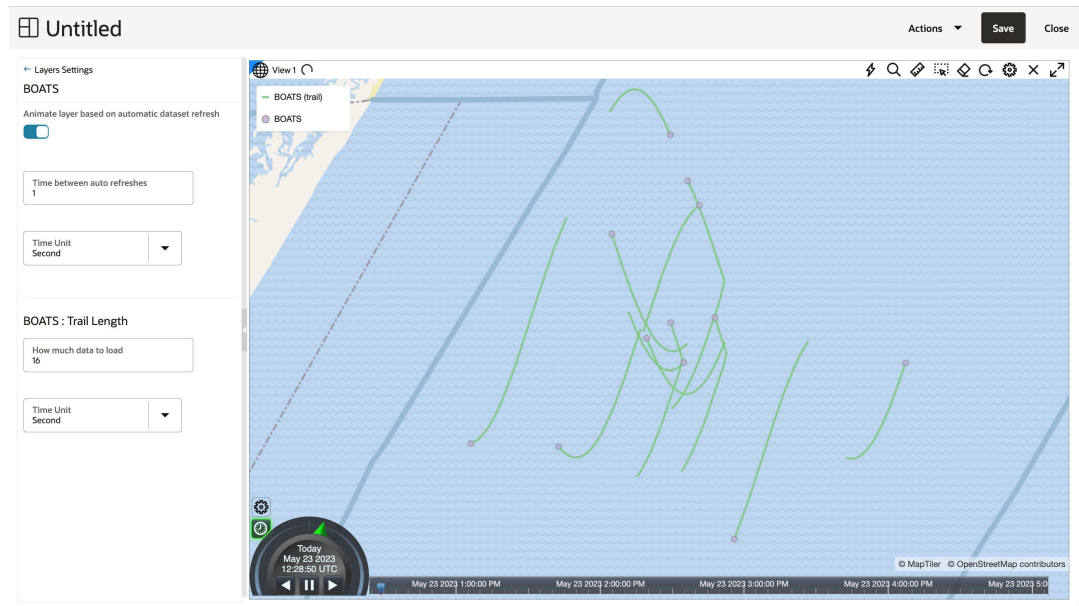
The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See [Configure Spatiotemporal for Live Moving Objects Dataset](#) for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.  
This lists the various visualization options.
2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.  
A default base map is displayed with no data visualization layers.
3. Click the **Data** tab on the left pane in the Active Project page.  
This lists all the **Datasets** that are loaded for the project.
4. Click and drag the desired spatiotemporal dataset from the list to the map view on the right.  
Two map layers belonging to the dataset are created on the map. The second layer representing the trails of the moving object is added automatically in Spatial Studio. See [Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset](#) for more information on the two map layers.
5. Click the **Settings** icon in your map tool bar.
6. Switch ON the **Show timeline** toggle and click **OK**.  
The Cesium timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.

- Click **...** against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**,

Adding a map layer to the timeline will point to the current UTC time and the layer is now listening to the timeline events. However, the timeline is not operational at this step. Optionally, repeat this step to add multiple layers (of different spatiotemporal datasets) to the timeline and listen to its events.

- Configure animation for the map layer by following the steps in [Configure Animation for Moving Objects Dataset](#).



- Select **Zoom Timeline to Range** in the context menu of the map layer. The timeline is refocused on current UTC time.
- Optionally, configure custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different timeframe.
- Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

## Visualize Live and Non-Moving Objects Dataset

You can visualize a spatiotemporal dataset having ongoing inserts of real-time data, but the locations of the data entities do not change.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See [Configure Spatiotemporal for Live and Non-Moving Objects Dataset](#) for more information.

- Click the **Visualizations** tab on the left pane in the Active Project page. This lists the various visualization options.
- Click and drag **Map** from the list to the visualization window on the right to create a map visualization. A default base map is displayed with no data visualization layers.
- Click the **Data** tab on the left pane in the Active Project page.

This lists all the **Datasets** that are loaded for the project.

4. Click and drag the desired spatiotemporal dataset from the list to the map view on the right.

Two map layers belonging to the dataset are created on the map.

5. Click the **Settings** icon in your map tool bar.
6. Switch **ON** the **Show timeline** toggle and click **OK**.

The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.

7. Click **⋮** against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**.
8. Select **Configure Animation** from the context menu of the map layer.

9. Switch **ON** **Animate layer based on automatic dataset refresh**.

The dataset animates with the Cesium clock events.

10. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

Also, note the following:

- Spatial Studio displays a default frequency value which is same as the **Data Change Rate** value configured on the Spatiotemporal dataset used for the visualization.
  - Only one dataset layer for the geometry animates (attributes change) as per the Cesium clock's current time (which points to the present UTC time value) and the multiplier value (default is 1x). Since the dataset is a streaming entity it will not have data ahead of time. Hence you must not change the default Cesium clock values. If you expect the data to be updated every x minutes, then configure **Time between auto refreshes** to x minutes, but do not change the Cesium timeline range or the multiplier value.
11. Select **Zoom Timeline to Range** in the context menu of the map layer to make the timeline reset to current clock time and a 1x multiplier.  
  
Upon reaching the set end time, the timeline will keep moving ahead and will not loop back.
  12. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

## Visualize Non-Live Moving Objects Dataset

You can visualize moving objects with historic timestamp values on a map in Spatial Studio.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See [Configure Spatiotemporal for Non-Live Moving Objects Dataset](#) for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

This lists the various visualization options.

2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

A default base map is displayed with no data visualization layers.

3. Click the **Data** tab on the left pane in the Active Project page.  
This lists all the **Datasets** that are loaded for the project.
4. Click and drag the desired spatiotemporal dataset from the list to the map view on the right.  
Two map layers belonging to the dataset are created on the map. The second layer representing the trails of the moving object is added automatically in Spatial Studio. See [Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset](#) for more information on the two map layers.
5. Click the **Settings** icon in your map tool bar.
6. Switch **ON** the **Show timeline** toggle and click **OK**.  
The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.
7. Click **⋮** against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**.  
The map layer gets added to the timeline and the timeline will range from minimum value to maximum value of the timestamp column. The current time will point to the min value of the timestamp column and the layer is now listening to the timeline events. However, the timeline is not operational at this step. Optionally, repeat this step to add multiple layers (of different spatiotemporal datasets) to the timeline.
8. Configure animation for the map layer by following the steps in [Configure Animation for Moving Objects Dataset](#).
9. Select **Zoom Timeline to Range** in the context menu of the map layer.  
The timeline is refocused to range from minimum value to maximum value of the timestamp column and current time will point to the minimum value of the timestamp column. This acts as a looping mechanism for a historic dataset.
10. Optionally, configure custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different timeframe.
11. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

## Visualize Non-Live and Non-Moving Objects Dataset

You can visualize a spatiotemporal dataset that simply contains different timestamp values in each row which are not grouped by any entity ids.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See [Configure Spatiotemporal for Non-Live and Non-Moving Objects Dataset](#) for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.  
This lists the various visualization options.
2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.  
A default base map is displayed with no data visualization layers.
3. Click the **Data** tab on the left pane in the Active Project page.  
This lists all the **Datasets** that are loaded for the project.

- Click and drag the desired spatiotemporal dataset from the list to the map view on the right.

A single map layer is created on the map.

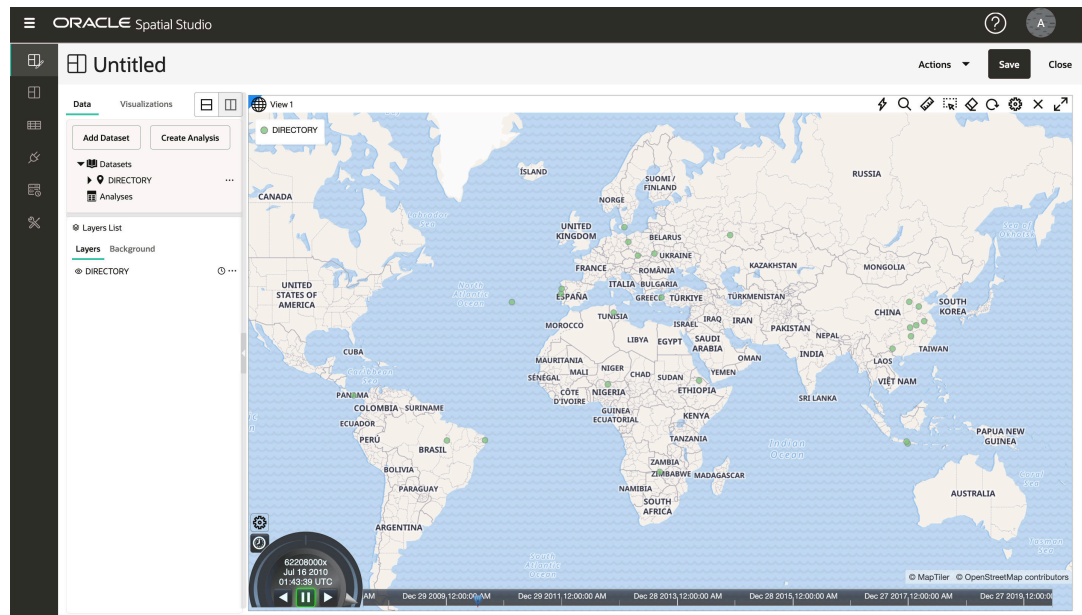
- Click the **Settings** icon in your map tool bar.
- Switch **ON** the **Show timeline** toggle and click **OK**.

The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.

- Click **...** against the primary layer in the **Data** tab of the **Layers** list and click **Add to Timeline**.

The map layer gets added to the timeline and the timeline will range from minimum value to maximum value of the timestamp column. The current time will point to the minimum value of the timestamp column and the layer is now listening to the timeline events. Also, the filtering configured for the spatiotemporal settings will automatically be applied and the map layer will be filtered as per the Cesium clock current time. For example, if the Cesium clock current time is Monday, May 22, 2023 5:13 PM and the configured time unit for filtering is `month`, then the map visualization will show all the geometries that have the timestamps between May 1, 2023 and May 31, 2023.

The multiplier of the timeline matches the filtering time unit selected. However, you can also change the time unit at which the dataset is currently being filtered (see [Configure Spatiotemporal for Non-Live and Non-Moving Objects Dataset](#)).



- Select **Zoom Timeline to Range** in the context menu of the map layer.
 

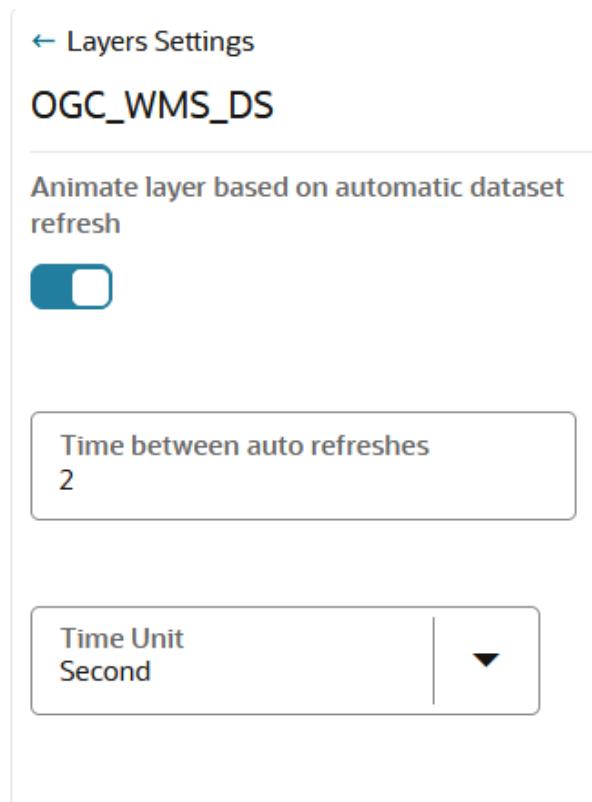
The timeline is refocused to range from minimum value to maximum value of the timestamp column and the current time will point to the minimum value of the timestamp column. This acts as a looping mechanism for a historic dataset.
- Optionally, select custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different time frame.
- Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

## Visualize Spatiotemporal Data in OGC WMS Datasets

You can visualize OGC WMS datasets that contain spatiotemporal data.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See [Configure Spatiotemporal for OGC WMS Datasets](#) for more information.

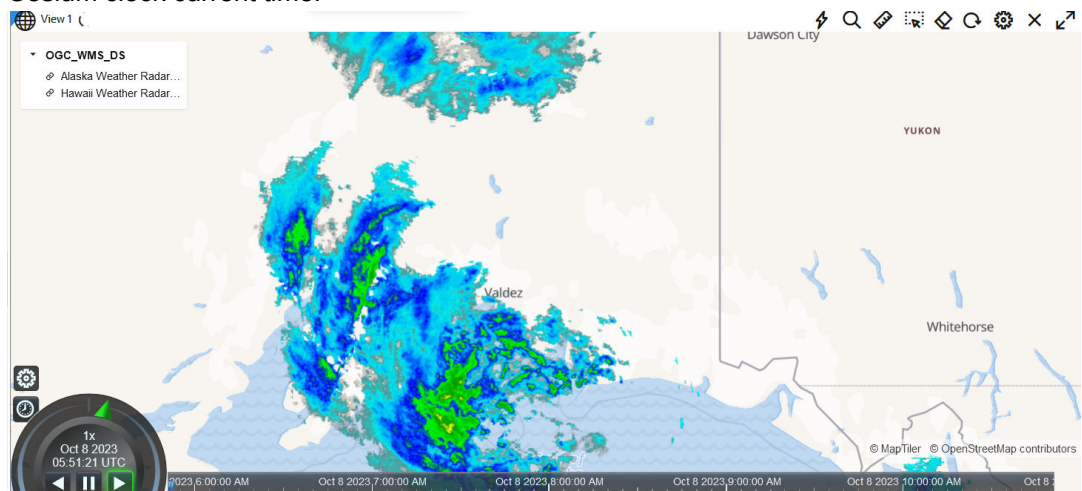
1. Click the **Visualizations** tab on the left pane in the Active Project page.  
This lists the various visualization options.
2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.  
A default base map is displayed with no data visualization layers.
3. Click the **Data** tab on the left pane in the Active Project page.  
This lists all the **Datasets** that are loaded for the project.
4. Click and drag the desired spatiotemporal dataset from the list to the map view on the right.  
A single map layer is created on the map.
5. Click the **Settings** icon in your map tool bar.
6. Switch **ON** the **Show timeline** toggle and click **OK**.  
The Cesium Timeline widget appears at the bottom of the map visualization canvas. However, the timeline is not operational at this step.
7. Click **⋮** against the map layer in the **Data** tab of the **Layers** list and select **Add to Timeline**.  
The map layer gets added to the timeline. Although the timeline is now listening to the timeline events, it is still not operational.
8. Select **Configure Animation** from the context menu of the map layer.  
The animation configuration dialog opens as shown:



9. Switch ON **Animate layer based on automatic dataset refresh**.

The dataset animates with the Cesium clock events.

The dataset will poll the WMS service to fetch the images as per the time value under the Cesium clock current time.



10. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

Also, note the following:

- Spatial Studio displays a default value of 2 seconds for WMS datasets. The effective refresh rates depend on how fast images are fetched from the respective WMS service. Empirically, for WMS data, any data change rate less than 2 seconds is not

sufficient to retrieve image and refresh the tiles. It can cause incomplete image loading before the new refresh, or the visualization may remain stuck in refresh state.

- The parameter ignores all the tick events from the timeline if the Cesium clock current time is less than `previousRefreshTime + x seconds` (or any other time unit). For example, if a dataset is supposed to refresh every 30 seconds, then configure this value in **Time between auto refreshes** so that even if the Cesium clock continues to throw tick events for all layers, this layer will ignore any such events.

11. Specify a **Time Unit**.
12. Optionally, select custom **Start Time**, **Stop Time**, **Multiplier**, and so on from the timeline settings. You can also use the Cesium timeline controls and make the current time pointer slide to a different time frame.

#### Note


**Zoom Timeline to Range** is disabled for an OGC WMS dataset. This is because each WMS dataset may comprise more than one image layers and it will be inaccurate to choose a time range for any one of these layers automatically. Therefore, use the Cesium timeline settings (see [Configure Cesium Timeline Settings](#)) to manually set the appropriate range of the timeline for the specific image layer that you wish to animate.

13. Optionally, select **Remove from Timeline** in the context menu of the map layer if you wish the map layer to stop listening to the Cesium timeline.

## Visualize GeoJSON URL Datasets with Spatiotemporal Data

You can visualize GeoJSON URL based datasets that contain spatiotemporal data.

The following instructions assume that you have enabled spatiotemporal for such a dataset and the dataset is already added to the project in the Active Project page. See [Configure Spatiotemporal for GeoJSON URL Datasets](#) for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.  
This lists the various visualization options.
2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.  
A default base map is displayed with no data visualization layers.
3. Click the **Data** tab on the left pane in the Active Project page.  
This lists all the **Datasets** that are loaded for the project.
4. Click and drag the desired spatiotemporal dataset from the list to the map view on the right.  
A single map layer is created on the map.
5. Click  against the map layer in the **Data** tab of the **Layers** list and select **Configure Animation**.

**Note**

GeoJSON URL based datasets are not dependent on the time values represented by the Cesium Timeline. They are just required to refresh periodically and therefore you need not enable the Cesium Timeline for such datasets.

6. Switch ON **Animate layer based on automatic dataset refresh**.
7. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

The GeoJSON URL map layer is set to refresh periodically based on this configured interval value.

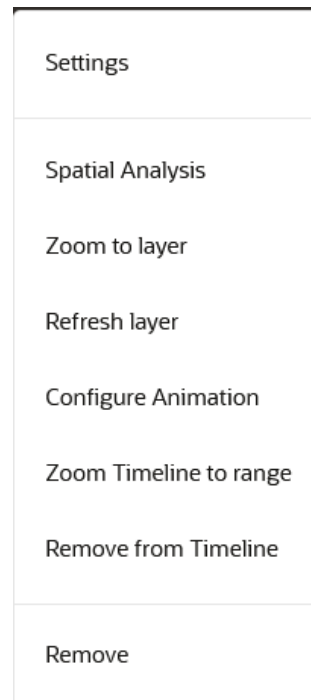
## Configure Animation for Moving Objects Dataset

You can animate a spatiotemporal map layer of a moving objects dataset based on Cesium map events.

The instructions assume that the spatiotemporal map layer is already added to the Cesium Timeline.

1. Click **⋮** against the primary layer in the **Data** tab of the **Layers** list.

The context menu of the map layer displays the following options:



2. Select **Configure Animation**.

The animation settings for the map layer opens.

3. Switch ON **Animate layer based on automatic dataset refresh**.

The dataset animates with the Cesium clock events.

4. Specify **Time between auto refreshes** to indicate the frequency of data refresh from the backend. This configuration also determines the smoothness and speed of the temporal animation.

Also, note the following:

- Spatial Studio displays a default frequency value which is same as the **Data Change Rate** value configured on the Spatiotemporal dataset used for the visualization.
  - All the map layers added to the timeline can individually have their own refresh or animation intervals.
  - The parameter ignores all the tick events from the timeline if the Cesium clock current time is less than `previousRefreshTime + x seconds` (or any other time unit). For example, if a dataset is supposed to refresh every 30 seconds, then configure this value in **Time between auto refreshes** so that even if the Cesium clock continues to throw tick events for all layers, this layer will ignore any such events.
5. Specify a **Time Unit**.
  6. Specify **How much data to load**, the trail length of your moving object. A trail length value of `N` indicates that Spatial Studio must fetch the recent `N` units (unit value as specified in the following step) of data of the moving object during every refresh.

✓ **Tip**

If the underlying database table or view contains millions of records, you can limit the map animation to display only the most recent `N` units of data as configured in **Trail Length**.

Note that Spatial Studio displays a default trail length value which is 15 times the **Data Change Rate** value configured on the Spatiotemporal dataset and is rounded to the nearest integer.

7. Specify a **Time Unit** for the trail length.

The animation settings are configured and you can view the animation of moving objects on the map.

📘 **Note**

You can choose a symbol and color for your moving object. However, ensure that the symbol you select adheres to the conditions explained in [Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset](#).

## Characteristics of Spatiotemporal Map Layers for Moving Objects Dataset

This section describes the distinct characteristics of the primary and secondary map layers when visualizing a spatiotemporal dataset containing moving objects.

- The trails map layer is considered the *secondary* layer to the main layer. If you delete the main layer from the map, then the trails map layer is automatically deleted as well.
- The main layer which shares the same name as the dataset is always a Point-type layer, that you can visualize using either as circle or using symbols or icons. When you use symbols, Spatial Studio will also automatically rotate the symbol based on the direction your object is moving.

Also note, the current release of Spatial Studio supports only those symbols that naturally point North (or point up) or those that do not represent an inherent direction or angle, such as any rounded symbols.

- The main layer will keep its animation even when you toggle the secondary layer invisible. However, if you toggle the main layer invisible, the trail layer will remain static as no new data is fetched from the backend.
- You cannot switch the main layer to Heatmap or Cluster type.
- You cannot use sticky Tooltip or popup as they cannot stick to the moving object when it moves to new locations.
- Spatial Studio drives the animation of moving objects and their trails by constantly refreshing the main layer's data from the backend. This implies that the base table is queried and the last N seconds of data is fetched by filtering the records based on the `TIMESTAMP` column.
- If you are working in a multi-user or multi-visualization environment or both, you must take care to avoid overloading the database with many animating layer's data refresh queries. For instance, ensure a layer is not refreshing its data too frequently, or fetching too many seconds of data on each refresh, or both.

## Visualize OGC WMS Maps as a Dataset

You can visualize an OGC (Open Geospatial Consortium) WMS (Web Map Service) dataset on a map.

This is in addition to creating a custom basemap that is based on external WMS maps, and switching to such a basemap in your map visualization. The main issue in using basemaps is that a single map visualization can only have one basemap. For instance, if you are using a basemap based on WMS images, then you can no longer display other background maps, such as OpenStreetMap. Therefore, the geographic context is lost as the WMS images typically do not contain detailed administrative boundaries, or other common features seen on a regular background map.

To overcome this limitation, Spatial Studio allows you to use a regular background map, while adding the WMS map images as a dataset layer on top. As the WMS images are just another dataset, which can be displayed as another layer on the map, you can easily reorder the layers, or toggle the visibility of the WMS images just like with any other map layer.

To visualize an OGC WMS dataset on a map, you must perform the following steps.

As a prerequisite ensure the following:

- The OGC WMS dataset is created using an OGC WMS connection and exists in Spatial Studio. See [Create an OGC WMS Dataset](#) for more information.
- The required OGC WMS dataset is added to the project in the Active Project page.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

This lists the various visualization options.

2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

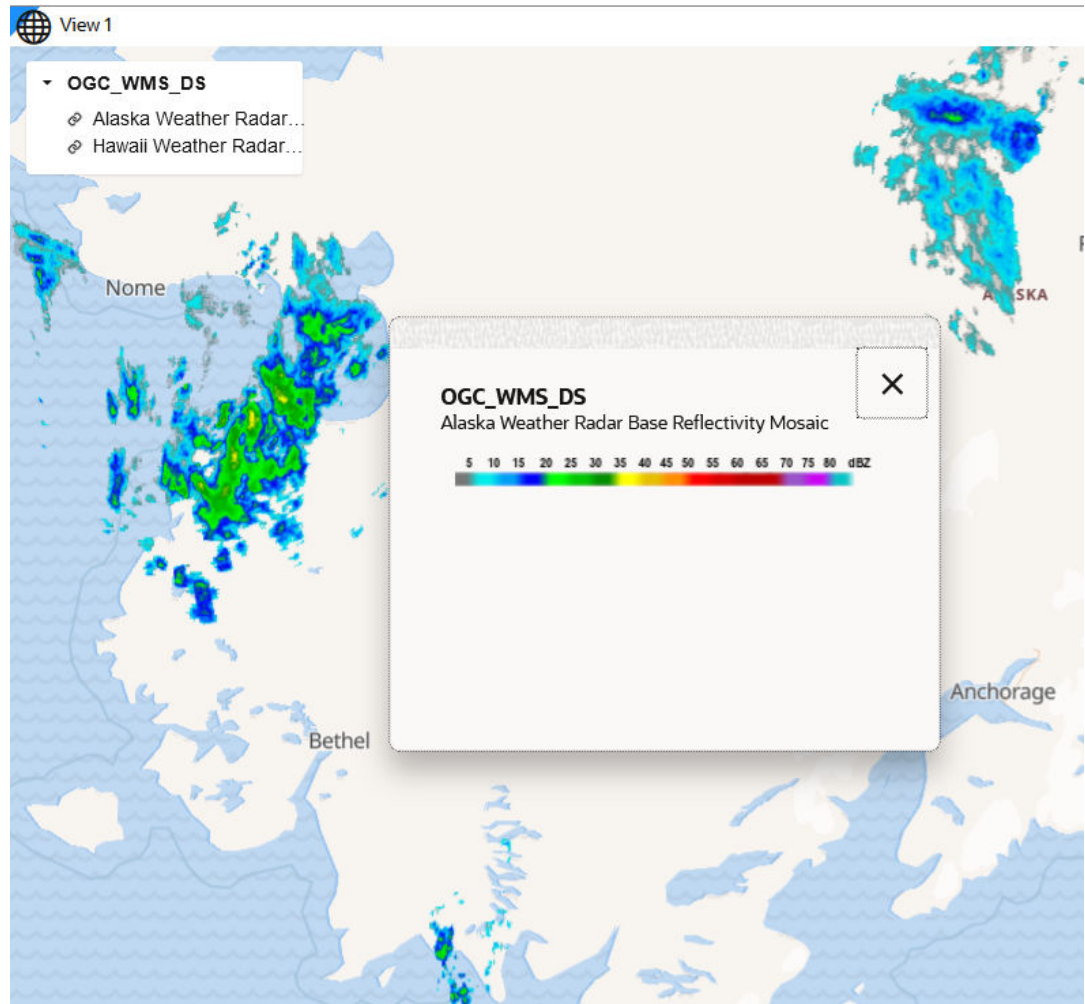
A default base map is displayed with no data visualization layers.

3. Click the **Data** tab on the left pane in the Active Project page.

This lists all the **Datasets** that are loaded for the project.

4. Drag and drop the desired **OGC WMS dataset** from the list to the map view on the right.

The OGC WMS data layer gets displayed on the map. The map will automatically zoom to the area covered by the WMS dataset if it is the very first dataset to be added to your map.



The preceding figure illustrates the weather pattern images (loaded from a WMS service) which are overlaid on top of the OpenStreetMap background.

✓ **Tip**

Click the **Image** link on the map legend to view the legend information generated by the WMS service for the OGC WMS map layer.

📘 **Note**

When you display a new WMS dataset for visualization, your browser will be sending the WMS image requests directly to the WMS server. You can always refresh the map layer to reflect the current data from the WMS server.

### Related Topics

- [Create an OGC WMS Dataset](#)  
Spatial Studio allows you to define datasets that are based on the `GetMap` responses from any external OGC (Open Geospatial Consortium) WMS (Web Map Service) services.

## Visualize Data With H3 Aggregations

Oracle Spatial Studio allows you to visualize point-type map data using hexagons with H3 (Hexagonal Hierarchical Spatial Index) aggregations.

Visualizing your map data as hexagons has several advantages:

- It helps you to identify patterns or clusters in a larger point dataset
- Easier interpretation of data, as in a hexagonal cell, all the points are equidistant from the hexagon center-point
- Hexagonal cells are color coded based on the number of datapoints they hold, which enables you to easily understand data patterns

To visualize your map data with H3 aggregations, you must perform the following steps.

The instructions assume that an H3 aggregation dataset is already added to the project in the Active Project page.

To prepare a dataset for H3 aggregation, see [Prepare an H3 Aggregation Dataset](#) for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

This lists the various visualization options.

2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

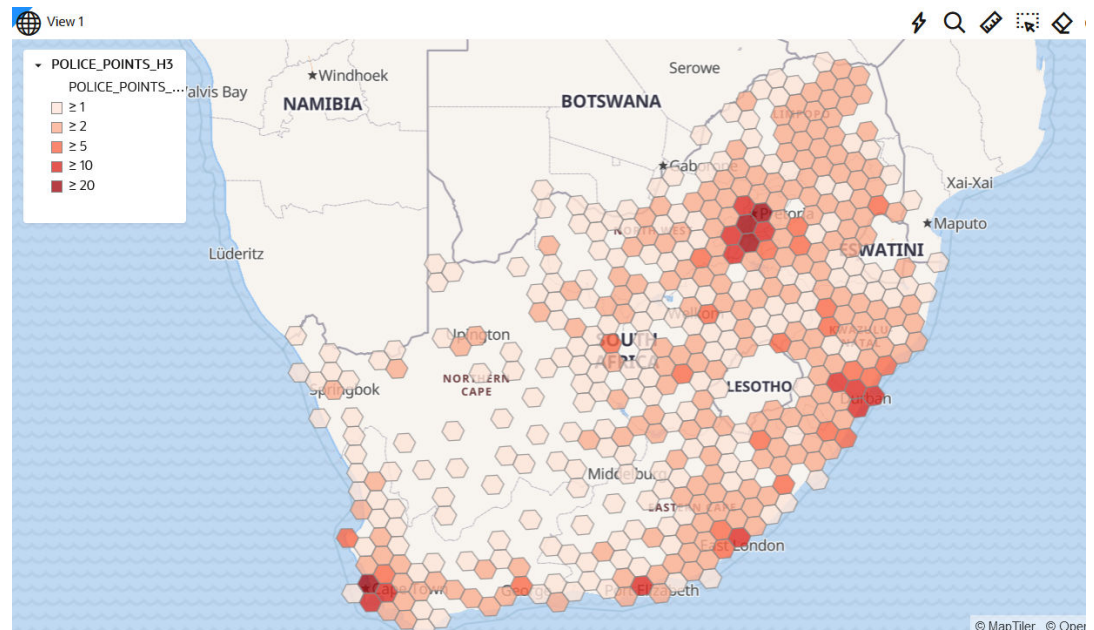
A default base map is displayed with no data visualization layers.

3. Click the **Data** tab on the left pane in the Active Project page.

This lists all the **Datasets** that are loaded for the project.

4. Click and drag the desired **H3 Aggregation dataset** from the list to the map view on the right.

A layer showing the hexagonal binning of the data points is displayed on the map as shown:



See [Apply Data-Driven Style to a Map with H3 Aggregations](#) for more information on applying styling for a H3 map layer.

## Visualize Custom Map Regions

Oracle Spatial Studio allows you to create custom map regions on map layers that support polygon type geometry.

You can create a new map region by selecting multiple polygon shapes and combining them with a new key-value. You can then append or insert this new map region with the new key-value into a target dataset containing all of your other custom map regions, or save it as a new dataset.

These newly created custom shapes are persisted on the underlying database table of the target dataset, and therefore can be used for data visualization or reporting just like any other dataset.

The following are the main characteristics for this feature support:

- The source dataset, that is the dataset whose polygon shapes you will be selecting and then combining into a custom map region, must always be based on an Oracle Database table. Datasets from Oracle views and Studio's Analyses are not currently supported.
- The new regions may or may not be contiguous.
- The target dataset, that is the dataset on which you want to store the newly created custom map regions, will store them in its geo-reference system.
- The target dataset can be a new dataset or an existing dataset in the current project. For a new dataset, you need to specify the connection, the table name, the dataset name, the key-column name of the table, and provide the key value for the new region.
- Only the key value and new geometry value are inserted into the newly created target table. For inserting the new region into an existing dataset, you may provide values for all of the dataset's attributes, or only the required ones.
- An existing targets dataset must meet the following requirements:
  - The geometry metadata information for the target dataset must be available in the SDO\_GEOM\_METADATA view.
  - A spatial index must exist on the geometry column. Note that if a spatial index is not created on the geometry column, then the target data layer cannot be dragged on to the map visualization canvas.
- For a new target dataset, once it is created and the first region is inserted, then the dataset can be manually added to the current active project and added as a layer to the map visualization. For subsequent processing, this new target dataset is treated as an existing target dataset.

## Create Custom Regions for Visualization

You can create custom polygon regions on the source dataset that contains polygon type geometries and apply them on a target dataset using the follow steps:

The instructions assume that the source and target datasets are already added to your Project in the ActiveProject page.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

This lists the various visualization options.

2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

A default base map is displayed with no data visualization layers.

3. Click the **Data** tab on the left pane in the Active Project page.

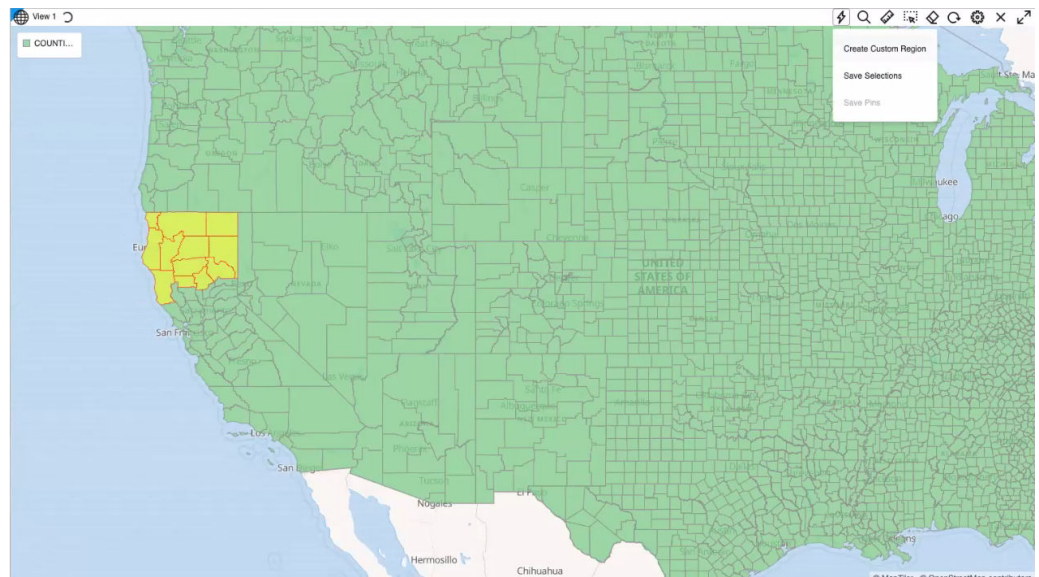
This lists all the **Datasets** that are loaded for the project.

4. Click and drag the desired **source dataset** from the list to the map view on the right.

A map layer with polygon shapes is created.

5. Create the required custom regions by performing the following steps as many times as required:

- a. Select the regions for aggregation using the polygon selection tool in the map tool bar.



✓ **Tip**

Alternatively, you can also select multiple polygons by using the keyboard shortcut **Ctrl + Click** on a Windows system.

- b. Click , **Actions** icon on the map tool bar and select **Create Custom Region**.

Combining shape dialog opens as shown:

**Combining shape**

Combine a set of shapes and append results to existing dataset

Combine shapes in \*  
COUNTIES.GEOM

Target dataset \*  
Create new

Include only selected items

Connection \*  
NEDATA

Table name \*  
SALES\_TERR

Dataset name \*  
SALES\_TERR

Key column name \*  
SALES\_REGION\_NAME

Key value \*  
Northern CA

**i** Only polygon datasets are allowed as source or target. Target dataset must have a key column defined.

OK Cancel

- c. Select the source dataset from the **Combine shapes in** drop-down list.
- d. Select one of the following desired options for **Target dataset**:
  - **Create new**: To create a new target dataset:
    - i. Enter **Connection**, **Table name**, and **Dataset name** details for the new target dataset.
    - ii. Enter the **Key column name** and the **Key value** that uniquely identifies the custom map region.
  - **Append to existing**: To append the custom polygon shapes to an existing target dataset:
    - i. Select an existing target dataset from the **Append result to dataset** drop-down list.
    - ii. Click **Enter new shape attributes** and enter a unique key value for the **Key column name** of the target dataset.

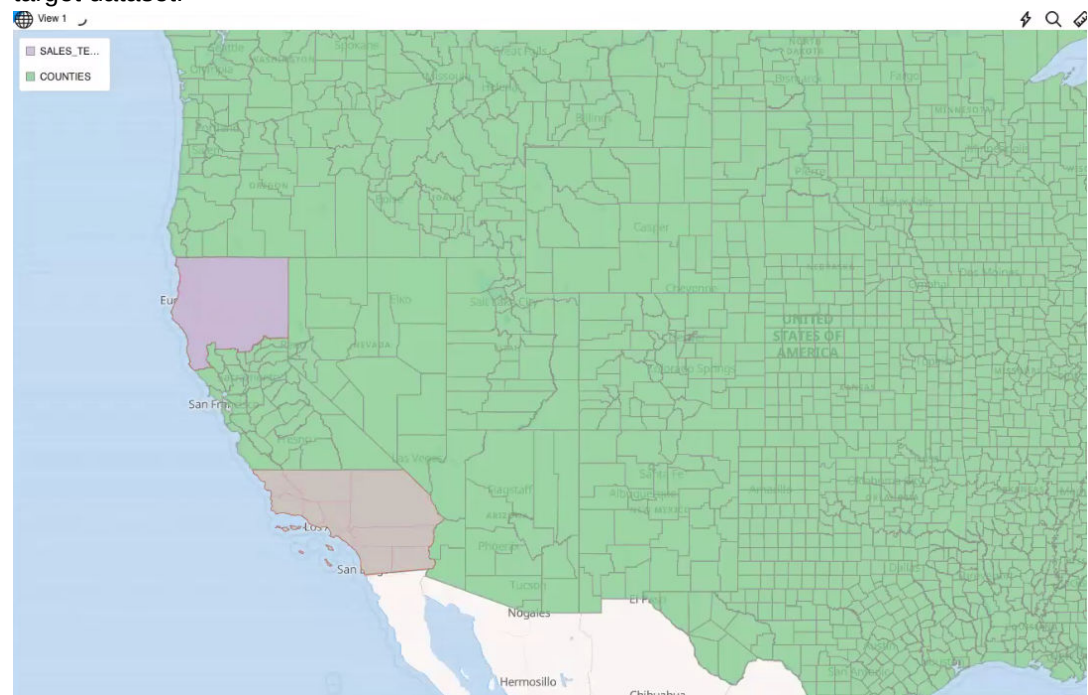
- e. Optionally, switch on or off the **Include only selected items** toggle button:

**⚠ Caution**

The whole source dataset may be aggregated into one region if **Include only selected items** is switched off. In this case the process may run for a long time depending on the number of features in the source dataset. Therefore, use this option only if required.

- f. Click **OK** to create the custom map region.
6. Drag and drop the **target dataset** to the map view on the right to view the newly created custom regions.

The following figure shows the newly defined custom regions that were inserted into the target dataset.



## Create a Target Dataset

There are two ways to create a target dataset:

- **By Spatial Studio:** Refer to the [Create new](#) target dataset option in the earlier section. Note that you must specify the key column name for the target dataset as the key values are stored in the key column names for the corresponding geometries (custom map regions).
- **By manual process:** Perform the following steps to create a dataset manually:
  1. Connect to an Oracle database schema using SQL Developer or any other tools.
  2. Create a spatial table as shown:

```
CREATE TABLE affected_regions (region_id NUMBER PRIMARY KEY, geom
SDO_GEOMETRY);
```

3. Insert the spatial table into USER\_SDO\_GEOM\_METADATA view. For example:

```
INSERT INTO USER_SDO_GEOM_METADATA VALUES (  
  'affected_regions', -- TABLE_NAME  
  'geom', -- COLUMN_NAME  
  SDO_DIM_ARRAY -- DIMINFO attribute for storing dimension bounds, 0.5 m as  
  tolerance  
  (SDO_DIM_ELEMENT ('LONGITUDE', -180, 180, 0.5 ),  
   SDO_DIM_ELEMENT ( 'LATITUDE', -90, 90, 0.5 )),  
  4326 -- SRID value for specifying a geodetic coordinate system  
  );  
COMMIT;
```

4. Create a spatial index on the SDO\_GEOMETRY column.

```
CREATE INDEX affected_regions_sidx ON affected_regions(geom) INDEXTYPE IS  
MDSYS.SPATIAL_INDEX_V2;
```

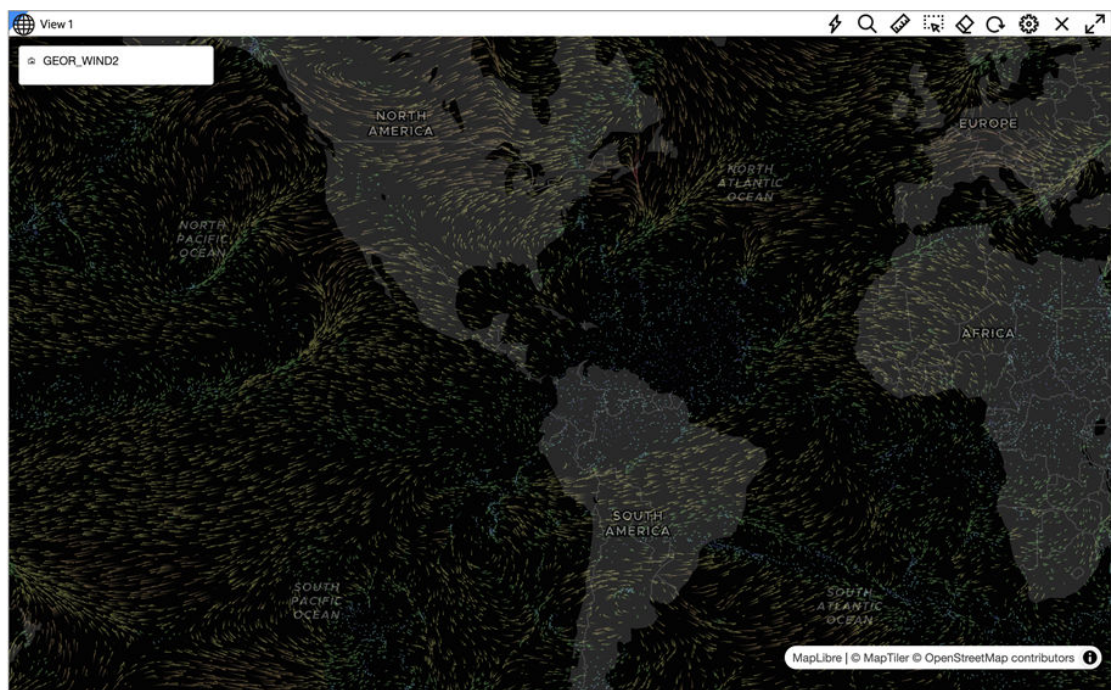
5. Create a dataset in Spatial Studio from the database schema used in the preceding steps.

The required target dataset is created. You may use this data layer on to which you can apply the newly created custom map regions.

## About Wind Animation

You can create and visualize wind animations that depict the direction of flow between various locations.

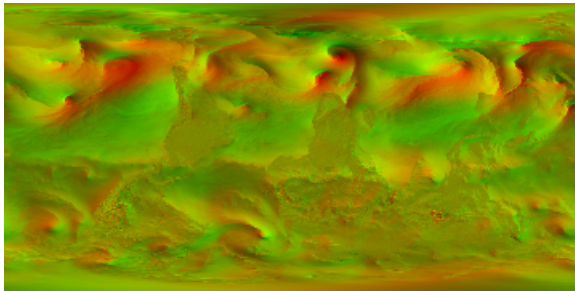
Although commonly referred to as wind animation, this visualization applies for any movement-based visualization. For instance, it can be used to render wind speeds, depict tectonic plate movements, or other vector-based simulations. The following figure shows a sample wind animation in Spatial Studio:



These visualizations rely on wind velocities along the  $x$  ( $u$ ) and  $y$  ( $v$ ) axes as input. These velocities are encoded within an image, where the red (R) and green (G) channels represent the  $x$  and  $y$  velocities, respectively. The values are scaled and mapped to an integer range of 0–255, with the R channel holding the  $u$  velocities and the G channel holding the  $v$  velocities.

The base image thus serves as a grid of  $u$  and  $v$  velocities at each integral longitude and latitude point within the specified bounding box (bbox). With this setup, the visualization generates random particles on the map, which are then animated according to the wind velocities, creating dynamic flowing visuals.

The following shows a sample base image that can be used to create a wind animation:



The base image for the wind animation can be generated from a NOAA dataset or from any other supported data providers (see [Generate a Base Wind Image From a NOAA Dataset](#) for an example). You can then load this image as GeoRaster to Oracle Database and create a wind animation dataset for visualization.

## Generate a Base Wind Image From a NOAA Dataset

This section provides the steps for generating a base wind image using a NOAA provider.

You can generate a base image for creating a wind animation dataset from the NOAA GFS Dataset website or programmatically through scripts.

1. Open the URL NOAA GFS Dataset in your browser.
2. Select a **Subdirectory** for any specified data and time and proceed to the **atmos** option to work with atmospheric data.
3. Set the file type to `gfs.t06z.pgrb2.1p00.f000`.
4. Select the layer type as **10m above the ground**.
5. Select the **UGRD** (U-component of wind, eastward velocity) variable, specify the bounding box (bbox) you wish to analyze, and then click **Start Download**.
6. Repeat the previous step for **VGRD** (V-component of wind, northward velocity).  
Note that the velocity grids are downloaded as GRIB files.
7. Parse to extract the grid values from these files using GRIB tools (for example, `wgrib2`).
8. Create the base image by combining the grid values for UGRD and VGRD.

Note the following for creating the base image:

- The **R (Red)** channel represents UGRD (x-axis velocities).
- The **G (Green)** channel represents VGRD (y-axis velocities).

- The velocity values must be scaled to fit within the 0-255 range, where `umin`, `umax`, `vmin`, and `vmax` represent the minimum and maximum values for the `u` (x-axis) and `v` (y-axis) velocities. These minimum and maximum values are crucial for encoding and decoding the velocity values from the base image, as they will be scaled to fit the 0-255 range for visualization purposes.

### Note

It is important that you note the data range values as these will be required to create the wind animation dataset for the first time in Spatial Studio.

Alternatively, you can generate the base wind image programmatically through code as shown in the following example scripts. The following scripts describe the steps for downloading, parsing grid values, and finally writing them into an image format for use in visualization.

#### download.sh

```
#!/bin/bash

GFS_DATE="20240719"
GFS_TIME="00"; # 00, 06, 12, 18
RES="1p00" # 0p25, 0p50 or 1p00
BBOX="leftlon=0&rightlon=360&toplat=90&bottomlat=-90"
LEVEL="lev_10_m_above_ground=on"
GFS_URL="https://nomads.ncep.noaa.gov/cgi-bin/filter_gfs_${RES}.pl?
dir=%2Fgfs.${GFS_DATE}%2F${GFS_TIME}
%2Fatmos&file=gfs.t06z.pgrb2.1p00.f000&${LEVEL}=on&subregion=${BBOX}"
curl "${GFS_URL}&var_UGRD=on" -o utmp.grib
curl "${GFS_URL}&var_VGRD=on" -o vtmp.grib

grib_set -r -s packingType=grid_simple utmp.grib utmp_out.grib
grib_set -r -s packingType=grid_simple vtmp.grib vtmp_out.grib

printf "{\"u\":`grib_dump -j utmp_out.grib`,`v\":`grib_dump -j
vtmp_out.grib`}" > tmp.json

rm utmp.grib vtmp.grib utmp_out.grib vtmp_out.grib

DIR=`dirname $0`
node ${DIR}/prepare.js ${1}/${GFS_DATE}/${GFS_TIME}
```

#### prepare.js

```
const PNG = require('pngjs').PNG;
const fs = require('fs');

const data = JSON.parse(fs.readFileSync('tmp.json'));
const name = process.argv[2];
const umessage = data.u.messages[0];
const vmessage = data.v.messages[0];

const unpack = (message) =>
  message.reduce((acc, { key, value }) => ({ ...acc, [key]: value })),
```

```

    });
    const u = unpack(umessage);
    const v = unpack(vmessage);

    const width = u.Ni;
    const height = u.Nj;

    console.log(`Width: ${width}, Height: ${height}`);
    console.log(`u: min=${u.minimum}, max=${u.maximum}`);
    console.log(`v: min=${v.minimum}, max=${v.maximum}`);
    console.log(`u values length: ${u.values.length}, v values length: ${v.values.length}`);

    const png = new PNG({
      colorType: 2,
      filterType: 4,
      width: width,
      height: height
    });

    for (let y = 0; y < height; y++) {
      for (let x = 0; x < width; x++) {
        const i = (y * width + x) * 4;
        const k = y * width + x;

        if (k < 0 || k >= u.values.length || k >= v.values.length) {
          console.error(`Index out of bounds at (x: ${x}, y: ${y}) ->
k: ${k}`);
          continue;
        }

        const uValue = u.values[k];
        const vValue = v.values[k];

        if (isNaN(uValue) || isNaN(vValue)) {
          console.error(`Invalid value at (x: ${x}, y: ${y}) -> u: ${uValue}, v: ${vValue}`);
          continue;
        }

        png.data[i + 0] = Math.floor(255 * (uValue - u.minimum) /
(u.maximum - u.minimum));
        png.data[i + 1] = Math.floor(255 * (vValue - v.minimum) /
(v.maximum - v.minimum));
        png.data[i + 2] = 0;
        png.data[i + 3] = 255;
      }
    }

    png.pack().pipe(fs.createWriteStream(`/Users/user1/Downloads/build/${name}.png`));

    fs.writeFileSync(`/Users/user1/Downloads/build/${name}.json`,
JSON.stringify({
  source: 'http://nomads.ncep.noaa.gov',
  date: formatDate(u.dataDate + '', u.dateTime),

```

```

width: width,
height: height,
uMin: u.minimum,
uMax: u.maximum,
vMin: v.minimum,
vMax: v.maximum
}, null, 2) + '\n');

function formatDate(dateStr, timeStr) {
  const year = dateStr.slice(0, 4);
  const month = dateStr.slice(4, 6);
  const day = dateStr.slice(6, 8);
  const hour = String(timeStr).padStart(4, '0');
  return `${year}-${month}-${day}T${hour.slice(0, 2)}:00:00Z`;
}

```

## Visualize a Wind Animation Dataset

You can create a wind animation visualization in Spatial Studio.

The following instructions assume that you have a wind animation enabled GeoRaster dataset and the dataset is already added to the project in the Active Project page. See [Create a Wind Animation Dataset](#) and [Enable Wind Animation For an Existing GeoRaster Dataset](#) for more information.

1. Click the **Visualizations** tab on the left pane in the Active Project page.

This lists the various visualization options.

2. Click and drag **Map** from the list to the visualization window on the right to create a map visualization.

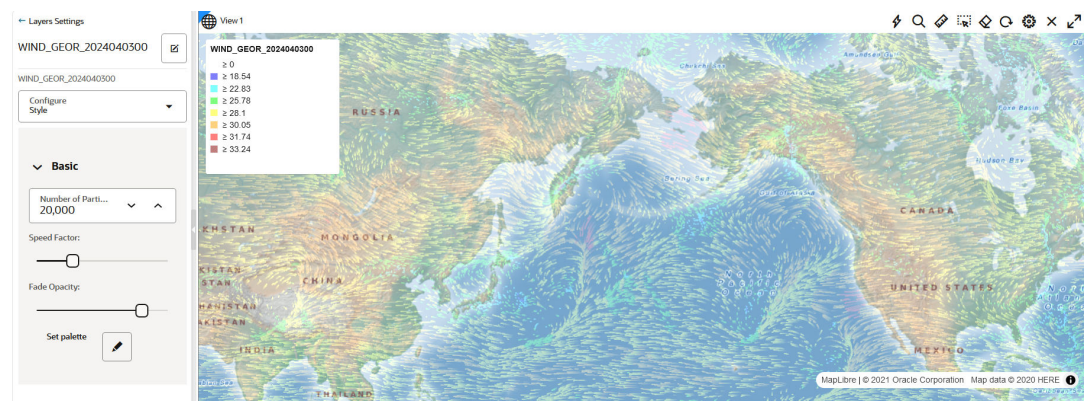
A default base map is displayed with no data visualization layers.

3. Click the **Data** tab on the left pane in the Active Project page.

This lists all the **Datasets** that are loaded for the project.


4. Click and drag the desired wind animation dataset from the list to the map view on the right.

The wind animation visualization gets displayed as shown:




Legend using a color scheme is supported for wind animations. However, pitch and rotation actions are not supported. If the view is rotated or pitched, then the wind animation

will be disabled, and a warning will be displayed. The wind animation will automatically be reenabled once the pitch/rotate is returned to the default (0).

5. Optionally, click  against the wind animation dataset layer in the **Data** tab of the **Layers** list and configure the following properties.
  - **Number of Particles:** Controls how many particles are randomly drawn in the current viewport. These particles will be animated based on the wind velocities.
  - **Speed Factor:** A multiplier between zero and one that adjusts the on-screen movement in relation to the actual wind speed.
  - **Fade Opacity:** Manages the length of particle trails and when they should fade out, affecting the smoothness of the animation.
  - **Set palette:** Sets the color scheme for different ranges of wind velocity.

## Configure a Map Visualization

Learn how to configure the settings for your map visualization.

You can configure the map visualization settings, by clicking  , the **Settings** icon in the map tool bar.

The Visualization Settings dialog opens with the default configuration values as shown as shown:

### Visualization Settings

Viz label  
World Map

Wraparound east-west

Show legend

Legend Position  
Top left

Navigation Bar  
None

Show minimap

Show scale

Unit of map scale  
Imperial

Show tile boundaries

Show timeline

Basemap Language  
English International

OK Cancel

Spatial Studio supports the configuration of the following values:

- **Viz label:** You can define the label for your map visualization.
- **Wraparound east-west:** By default, the map is continuous, that is, the map displayed for visualization is east-west wrap around. You can choose to disable this option if you prefer to display the map in a non-repeating mode.
- **Show legend:** The legend displays the map layers that are used in the visualization.
- **Legend Position:** This determines where the legend gets displayed on the map.
- **Navigation Bar:** This displays zoom and compass controls on the map.

- **Show minimap:** You can enable this option if you want to view an overview of the main map as an inset within the main map.
- **Show scale:** You can enable this option if you want to configure a specific scale for the map.
- **Unit of map scale:** Supported scale types are:
  - Imperial
  - Metric
  - Nautical
- **Show tile boundaries:** You can switch ON this toggle to view the vector tile boundaries on the map. The current map zoom level and tile column and row number are displayed for each visible tile. This is mostly used as an information tool for debugging map rendering issues.
- **Show timeline:** By enabling this slider, you can display the Timeline on the map.
- **Basemap Language:** This option appears only if you are using one of the three built-in MapTiler vector basemaps as a map background. You can then set the language for your basemap.

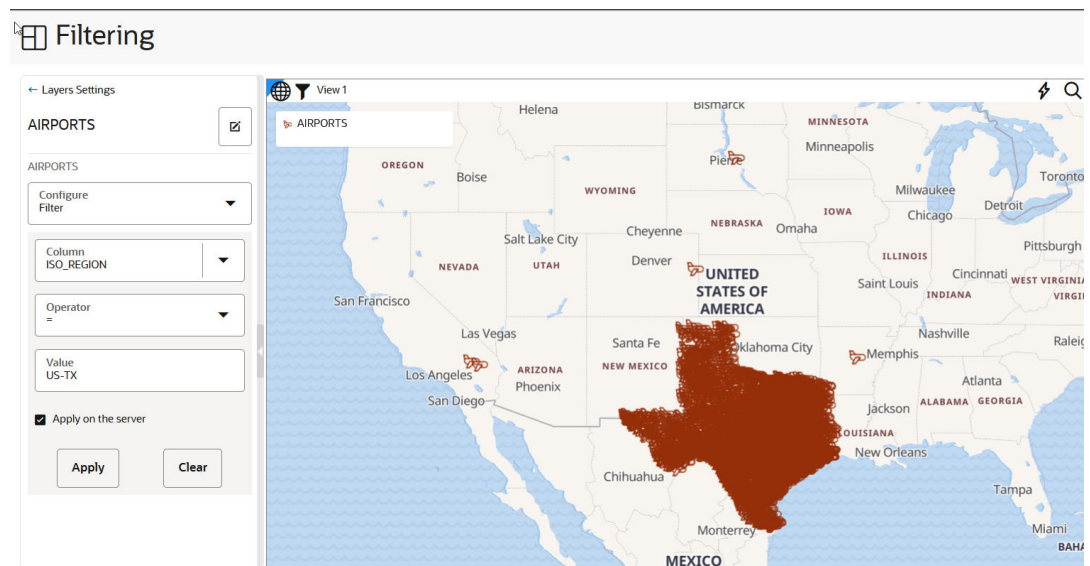
## Filter Data on a Map Layer

You can filter on an attribute column of a dataset to determine the data points that must be displayed on a map visualization.

The following steps enable you to add a data filter on a map layer.

The instructions assume that a map layer is displayed on your Active Project page.

1. Click **⋮** against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Select **Filter** from the **Configure** drop-down list as shown.



4. Select the **Column** name against which you want to filter data.

5. Select the **Operator** and enter the data **Value**.
6. Optionally, select **Apply on the server** checkbox if you wish to filter the data at the server side.

If **Apply on the server** option is not checked, then the filter is applied instantly on the client and only on the data that is currently displayed on the map. It is important to note that if the source table contains large amount of data, then Spatial Studio may not always bring all the data to the visualization client. Therefore, the client-side filter may not be able to find an item that should be there but is not displayed (due to server performing automatically data sampling when generating vector tiles).

However, server side filter always queries the source table with the filter condition and brings the filtered result to the client for display.

7. Click **Apply**.

The data points on the map layer are filtered as per the column filter.

## Add Interactions to a Map Visualization

You can enhance your map interaction by configuring tooltips and info windows for the map layers used in the map visualization.


Spatial Studio supports the following interactive features:

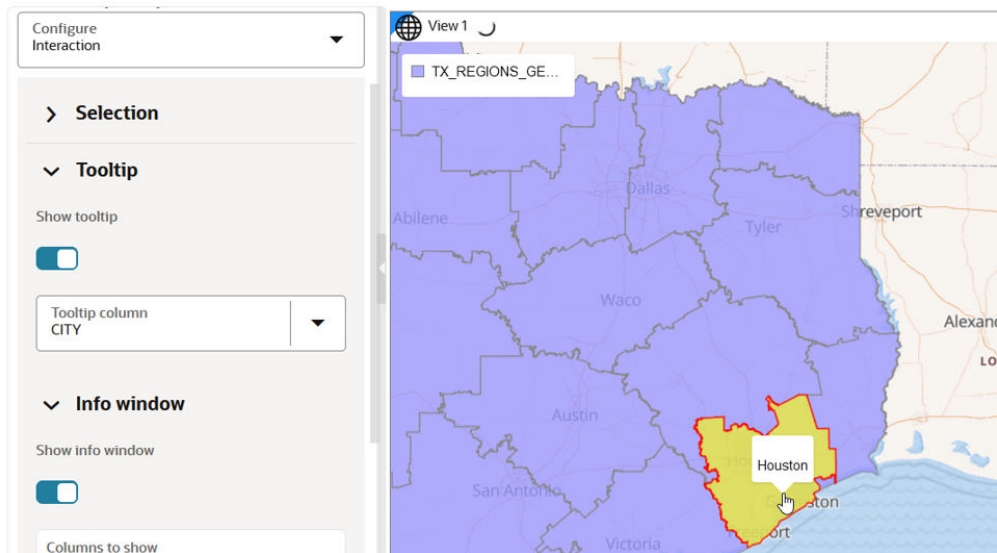
- **Tooltip:** A tooltip is shown when you hover over a location on your map and displays the specified attribute information.
- **Info Window** An info window (popup window) displays the configured information for one or more map layers at a given location or shape on your map.

## Configure and View a Tooltip

Perform the following steps to configure a tooltip.

The instructions assume that you have a map layer displayed on your Active Project page.

1. Click  against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Select the **Interaction** option from the **Configure** drop-down list.
4. Enable **Show tooltip** under **Tooltip**.
5. Select a **Tooltip column**.
6. Hover over a specific data point or shape on your map to view the tooltip information.

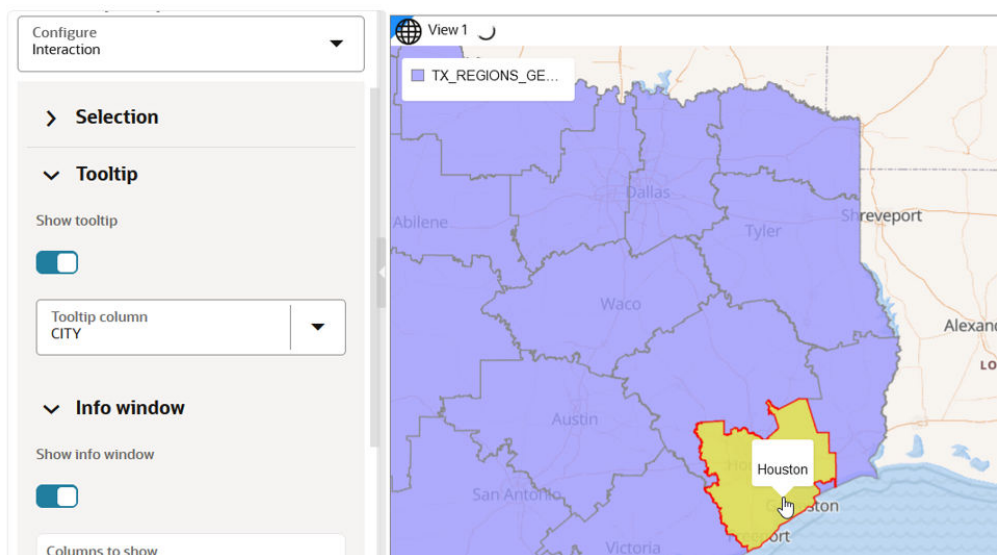


## Configure and View a Tooltip

Perform the following steps to configure a tooltip.

The instructions assume that you have a map layer displayed on your Active Project page.

1. Click **⋮** against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Select the **Interaction** option from the **Configure** drop-down list.
4. Enable **Show tooltip** under **Tooltip**.
5. Select a **Tooltip column**.
6. Hover over a specific data point or shape on your map to view the tooltip information.



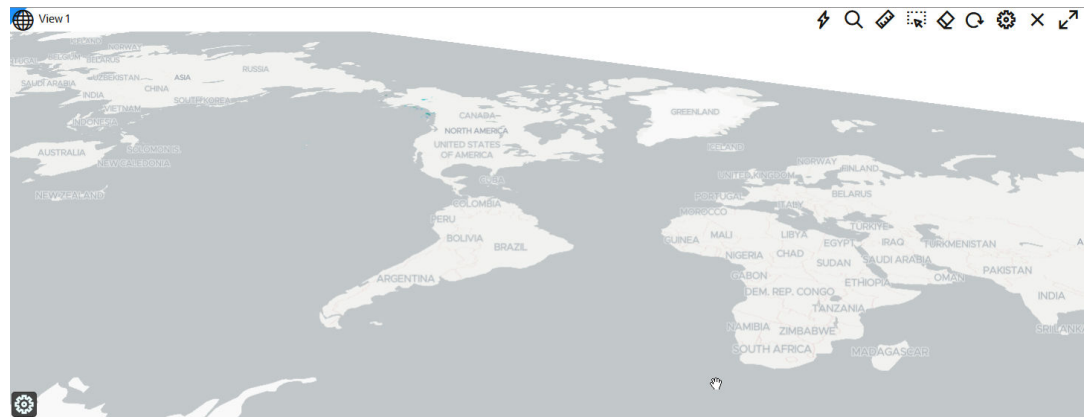
## Changing the Pitch and Bearing of a Map

You can set the pitch and bearing of a map by tilting or rotating your map in the map visualization panel.

1. Navigate to the **Active Project** page where the desired project is displayed.
2. Click and drag the right mouse button if you wish to tilt the map.
3. Click and rotate the right mouse button if you wish to rotate the map.

The following example shows a tilted and rotated map:


**Figure 8-1 Tilting and Rotating of a Map**



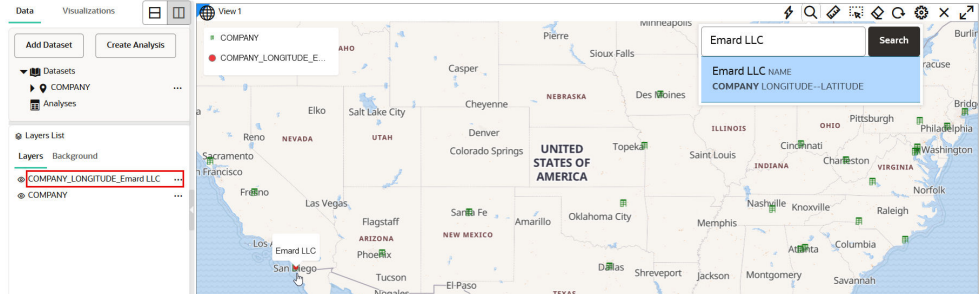
4. Optionally, click **Save** to save the project with the new pitch and bearing settings.

## Search Locations and Features on a Map

Using the **Search** option, you can quickly find locations and features on a map.

1. Click  in the map tool bar to search on the map.
2. Select one of the following option to perform the search.
  - **Search by Locations**
    - a. Click **Address or Longitude, Latitude** in the search drop-down list.
    - b. Enter **Address or place name**, or alternatively, enter **Longitude** and **Latitude** to search.  
Note that as you enter the address (or place name), suggestions more relevant to your search are displayed first.
    - c. Select the required suggestion from the list if you entered **Address or place name** in the preceding step.  
Spatial Studio drops a pin and zooms to the location of the search result.
  - **Search by Feature ID**  
A feature is a geometry object (point, line, or polygon type) on the map.
    - a. Click **Feature** in the search drop-down list.
    - b. Enter the complete ID of the feature in the search input box.  
Note the following:
      - The feature ID is identified by the key property column value of the specific feature in its dataset.
      - The search key is not case sensitive.
      - You must enter the complete feature key to find the feature on the map.

- c. Click **Search**.  
If the feature is found, Spatial Studio displays the feature ID and the dataset name in the selection box.
- d. Select the feature in the selection box.  
Spatial Studio performs a search on the source data table and displays the search results on a separate map layer as shown:



# 9

## Style a Map Layer

Spatial Studio allows you to explore different styling options for your map layers, in order to enhance visualization and analysis.

The styling options provided to you may vary depending on the type of data you are mapping.

### Topics:

- [Apply a Render Style For a Point Layer](#)
- [Apply Style for a GeoRaster Layer](#)
- [Apply Data-Driven Style to a Map with H3 Aggregations](#)
- [Apply Predefined Colors to a Map Layer](#)
- [Apply Predefined Symbols to a Map Layer](#)
- [Apply Predefined Colors to Symbols](#)
- [Apply Custom Map Symbols to a Map Layer](#)
- [Apply an Animated Map Symbol to a Map Layer](#)
- [Apply Style to a Map Layer Using a GeoJSON URL Dataset](#)
- [Set Selection Tolerance on a Map Layer](#)
- [Add a Pin on a Map](#)
- [Apply Map Backgrounds](#)
- [Use the Redline Map Tool](#)

## Apply a Render Style For a Point Layer

You can render a point map layer using one of the following render style options:

- Circle (default)
- Symbol
- Heatmap
- Cluster

The following steps enable you to apply your preferred render style option.

The instructions assume that you have point map layer displayed on your Active Project page.

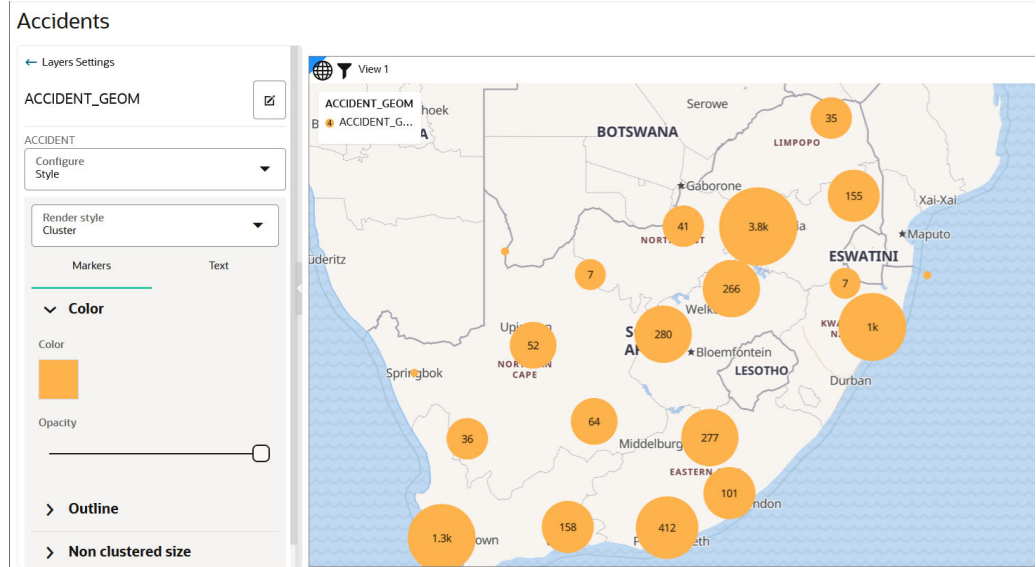
1. Click **⋮** against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Configure **Style** and select a **Render Style** option from the drop-down list.

By default, a point map layer always uses Circle to represent the data points.

**Note**

Each render style has its own settings.

- If you select **Cluster** as the render style option, the data points on your map are shown clustered depending on the cluster circle size.

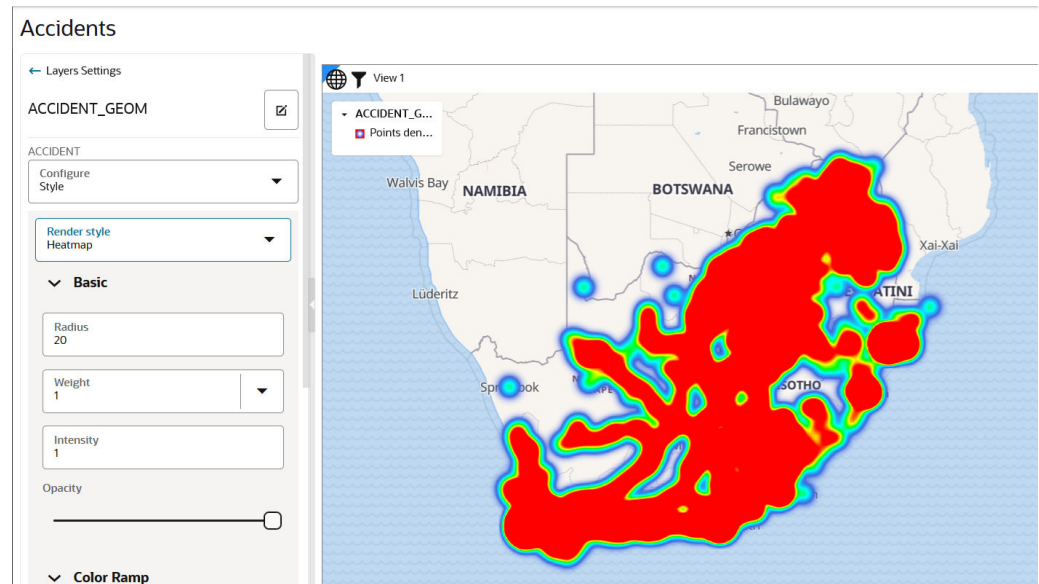


Optionally, you can change the color and the style of the text labels representing the number of points in each cluster.

- If you select **Heatmap** as the render style option, the data points on your map are rendered with continuous colors based on the concentration of points as shown:

**Note**

Hot colors represent concentration of points, and cool colors represent sparsity of points.



Also, you can further customize the Heatmap visualization by changing the **Radius** or **Weight** (or both) in the **Basic** settings panel shown in the preceding figure. The following describes more about these parameters:

- **Radius:** This value defines (in pixel) how far each data point contributes to (influences) the heat of its surrounding area. Its contribution drops to zero for any area beyond this radius with the data point at the center.
- **Weight:** This value defines how much weight a data point contributes to the heat. The default value is set to 1 which means all data points contribute equally to the heat. If you select a numeric column (with zero or positive values) in the **Weight** drop down list, then that value determines the weight contributed by a data point to the heat calculation. For instance, if a data point's weight column has a value of 5, then it is contributing to the heat as if there are five data points at that location (each with the default weight of 1). However, if the weight column contains a negative value, then note that the result is not predictable.
- **Intensity:** This value should always be 1.

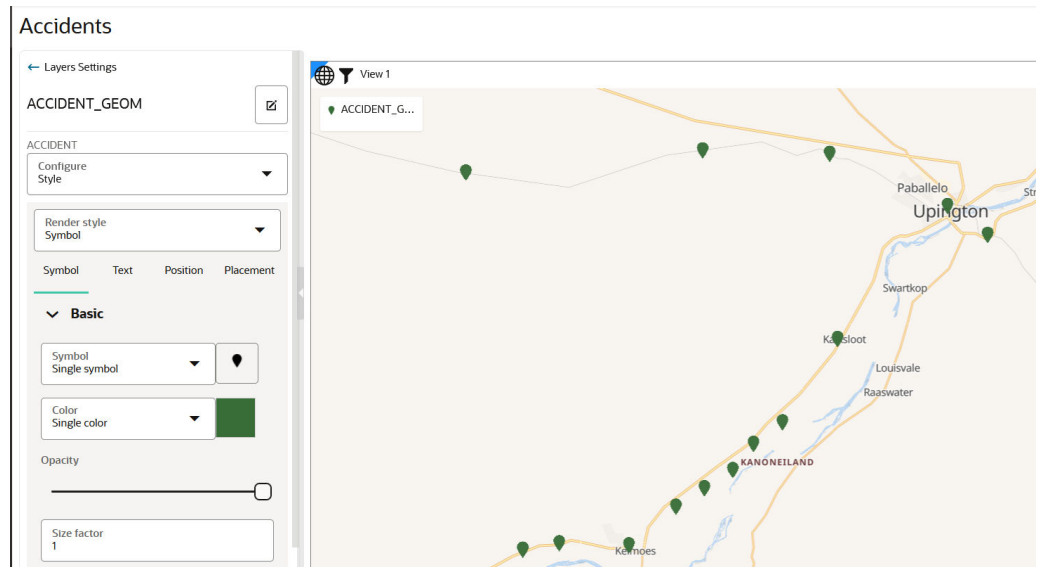
✓ **Tip**

It is recommended that you reduce the default value of the **Radius** parameter to observe a more localized view of point concentrations.

- If you select **Symbol** as the render style option, the data points on your map are rendered with your chosen symbol as shown:

✓ **Tip**

You can optionally select a color for your symbol.



You can customize the symbol used to represent the data points by clicking the image button next to the **Symbol** drop-down list. Spatial Studio provides several built-in sets of symbols and also supports custom map symbols (icons).

#### See Also


- [Apply Predefined Symbols to a Map Layer](#)
- [Apply Custom Map Symbols to a Map Layer](#)

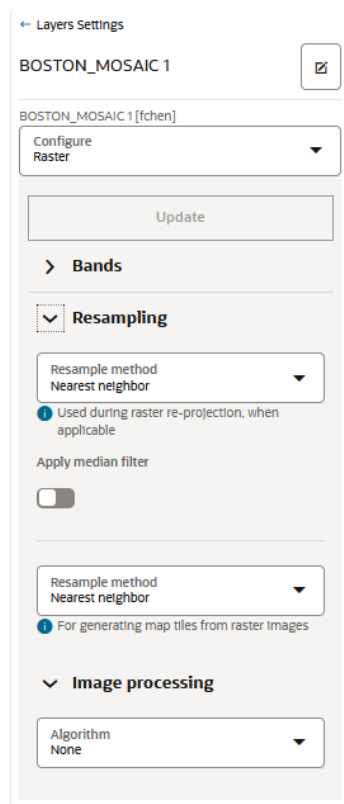
The map layer gets rendered with the appropriate style.

## Apply Style for a GeoRaster Layer

You can style a GeoRaster map layer using the following steps.

The instructions assume that you have a GeoRaster map layer displayed on your Active Project page.

1. Click  against the **dataset** in the **Data** tab of the **Layers** list.
2. Select **Settings** in the context menu.  
The **Layer Settings** panel opens.
3. Optionally, modify any of the following options in the **Style**:
  - **Opacity**
  - **Maximum Brightness**
  - **Minimum Brightness**
  - **Saturation**
  - **Contrast**
  - **Hue Rotate**
  - **Fade Duration**
4. Optionally, modify any of the following rendering options in the **Raster** tab:



- **Bands:** Spatial Studio, by default supports the following bands:

- Red
- Blue
- Green
- Alpha

For GeoRaster images that have more than three layers, you can choose which three layers you want to visualize.

- **Resampling:** The following two types of resampling processes are supported:
  - **Image Reprojection:** This represents the interpolation method to be used when transforming an image from one SRS (Spatial Reference System) to another. This applies only if the SRS of the source image in the database table is different from Spatial Studio's base map projection.
  - **Map Image Tile Generation:** This represents the image interpolation value that determines how each image cell's value on a view port is interpolated using the original image pixels. During an image tile generation, resampling occurs (although the provided images are in the same SRS) as the spatial resolution of the two images may be different.
 

The following interpolation algorithm options are supported:

    - \* **NEAREST NEIGHBOR:** This option has no interpolation by taking the nearest image pixel's value directly.
    - \* **BI-LINEAR:** This option will consider 4 neighboring pixels to determine the image cell's value.
    - \* **CUBIC:** This option uses cubic convolution function to estimate image cell's value. Since a 4x4 neighboring pixels participate in the interpolation, it results in a smoother image.

- **Image Processing:** represents the subprogram to be used to enhance the visual quality of the images.  
You can choose the *Terrain RGB* algorithm and enable the **Use as terrain** toggle to render GeoRaster images with GeoRaster Digital Elevation Model (DEM) data as 3D terrains on the map.

The GeoRaster map layer is rendered with the updated settings.

## Apply Data-Driven Style to a Map with H3 Aggregations

You can apply different resolutions to your H3 map layer to enhance your visualization.

In case of an H3 aggregation dataset, the hexagonal cells and the distribution of points in these hexagons automatically change at each resolution level, as you zoom in and out of the map. This implies that the color bins for one level might not be the same as for another level.

Spatial Studio provides an option to automatically calculate color bins as you alter your resolutions. You can also turn this option off if you want to test against a set of specific thresholds.

The following steps enable you to apply a data-driven styling option for your H3 map layer.

The instructions assume that you have a H3 map layer displayed on your Active Project page.

1. Click **☰** against the map layer in the **Layers** tab of the **Layers List** list.
2. Select **Settings** in the context menu.
3. Configure **Style**.
4. Select **Based on Data** for the **Color** value under **Fill**.  
The **Style details** panel is displayed.
5. Select the **Column** to control styling.
6. Switch on or off the **Automatically adjust bin values** toggle button.
  - If turned on, the bin values will automatically update as you zoom in or out on the map.
  - If turned off, **Create value bins** option appears.
7. Assign colors to the bins based on data values.


The following figure shows the Style details panel options:


← Style details






POLICE\_POINTS\_H3

Column  
POLICE\_POINTS\_H3\_COUNT

Automatically adjust bin values

Create value bins 

Set palette 

Value	Output	
≥ 1		×
≥ 2		×
≥ 5		×
≥ 10		×
≥ 20		×

The color bins on the H3 map layer gets rendered appropriately for different resolutions as shown in the preceding figure.


## Apply Predefined Colors to a Map Layer

Using a column with predefined color codes or values, you can create accurate and consistent choropleth map layers.

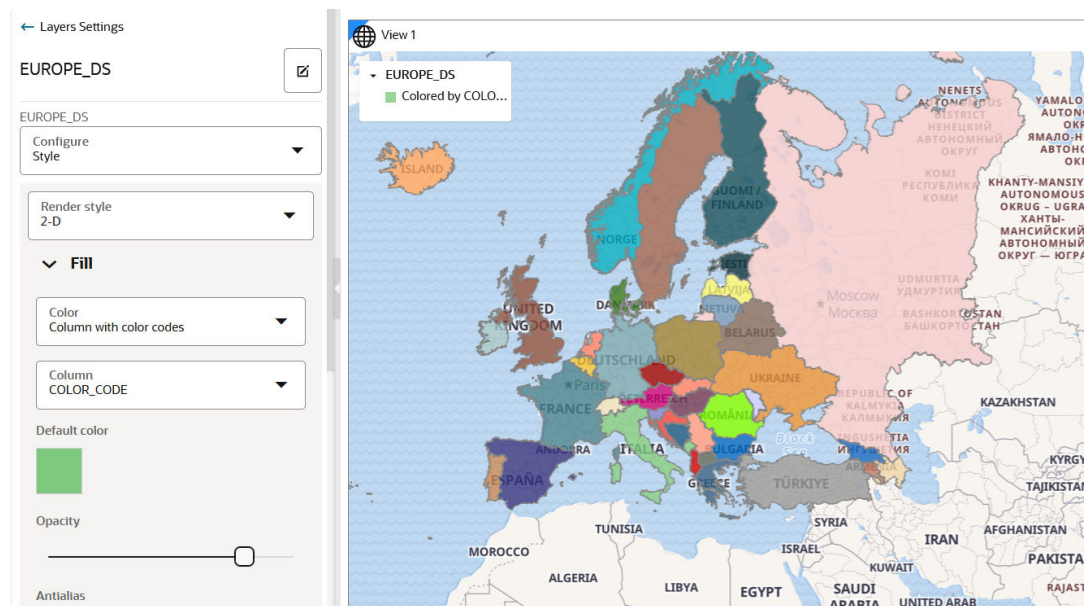
You can store a color-coded value in a column of your dataset and then use this column property to color code your map.

The following steps enable you to color code your map layer.

The instructions assume that the map layer displayed on your Active Project page uses a dataset having a column property that contains color-coded values.

1. Click  against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Configure **Style** by selecting **Column with color codes** for the **Color** value under **Fill**.
4. Select the **Column** that contains the color value.

The following figure shows the styling of the map layer using the color variable in the dataset:



The color code gets applied to the map layer.

## Apply Predefined Symbols to a Map Layer

Using a column with predefined symbol values, you can apply data-driven symbol styling to your map layer.

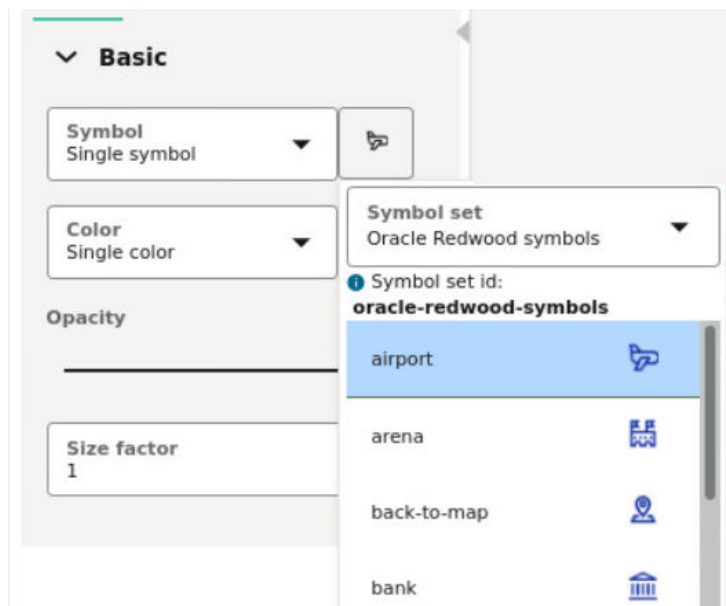
However, the symbol must belong to one of the supported symbol sets. Symbols in Spatial Studio are grouped into three sets and each set is identified by a *Symbol set id* as described in the following table:

**Table 9-1 Symbol Set**

Symbol Set	Symbol set id
Spatial Studio default	studio
Oracle Redwood symbols	oracle-redwood-symbols
Airfields	airfields

You can store a symbol name and the symbol set to which it belongs in a column of your dataset and then use this column property to assign symbols to your map.

For example, assume you want to use the `airport` icon as shown in the following figure:



You must then use `oracle-redwood-symbols/airport` as the symbol name in your dataset column. In this case:

- `oracle-redwood-symbols`: is the symbol set id
- `airport`: is the name for the icon to be used on the map layer

The following steps enable you to apply data driven symbol styling for your map layer.

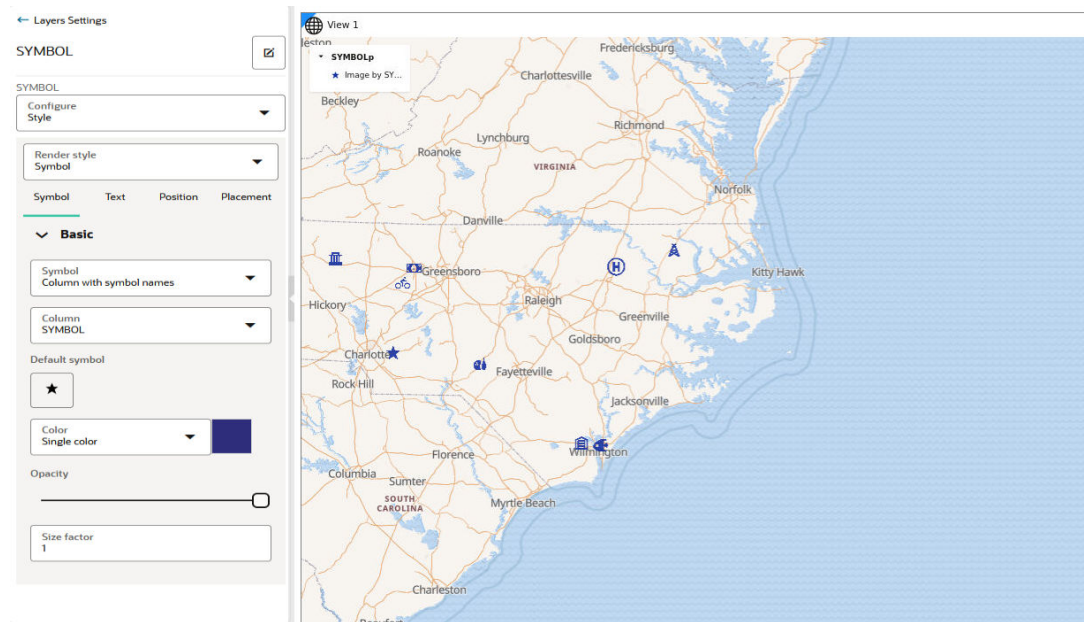
The instructions assume that the map layer displayed on your Active Project page uses a dataset having a column property that contains symbol names following the convention as explained earlier in this section.

1. Click **⋮** against the map layer in the **Layers** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Configure **Style** and select **Symbol** as the **Render Style**.
4. Select **Column with symbol names** from the **Symbol** drop-down list in the **Basic** section of the **Symbol** tab.
5. Select the **Column** that contains the symbol name value.

The following figure shows the styling of the map layer using the symbol name variables in the dataset:

**Note**

If incorrect symbol names are present in the dataset column, then for those data points, the **Default symbol** is displayed on the map layer.



The symbols gets applied to the map layer.

## Apply Predefined Colors to Symbols

You can color the symbols on a map layer by using an attribute column of the dataset that contains predefined color codes.

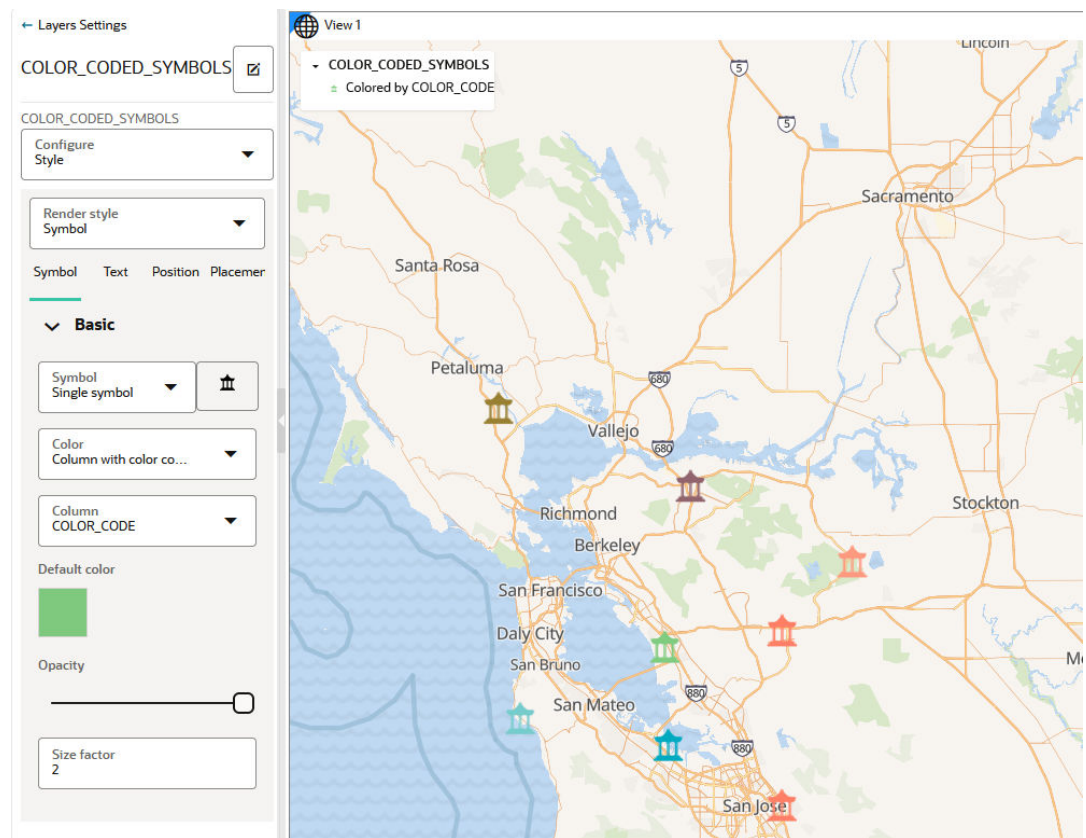
The following steps enable you to color code the symbols on a map layer.

The instructions assume that the map layer displayed on your Active Project page uses a dataset having a column property that contains color-coded values.

1. Click **\*\*\*** against the map layer in the **Layers** tab of the **Layers List**.
2. Select **Settings** in the context menu.
3. Configure **Style** by selecting **Column with color codes** for the **Color** value in the **Basic** panel.
4. Select the **Column** that contains the color value.

Note that the color values in the column must be in #RGB notation with the # character included.

The color code gets applied to the symbols on the map layer. The following figure shows the color-coded symbols on the map layer using the color variable in the dataset:



## Apply Custom Map Symbols to a Map Layer

You can apply custom map symbols for styling your map layer.

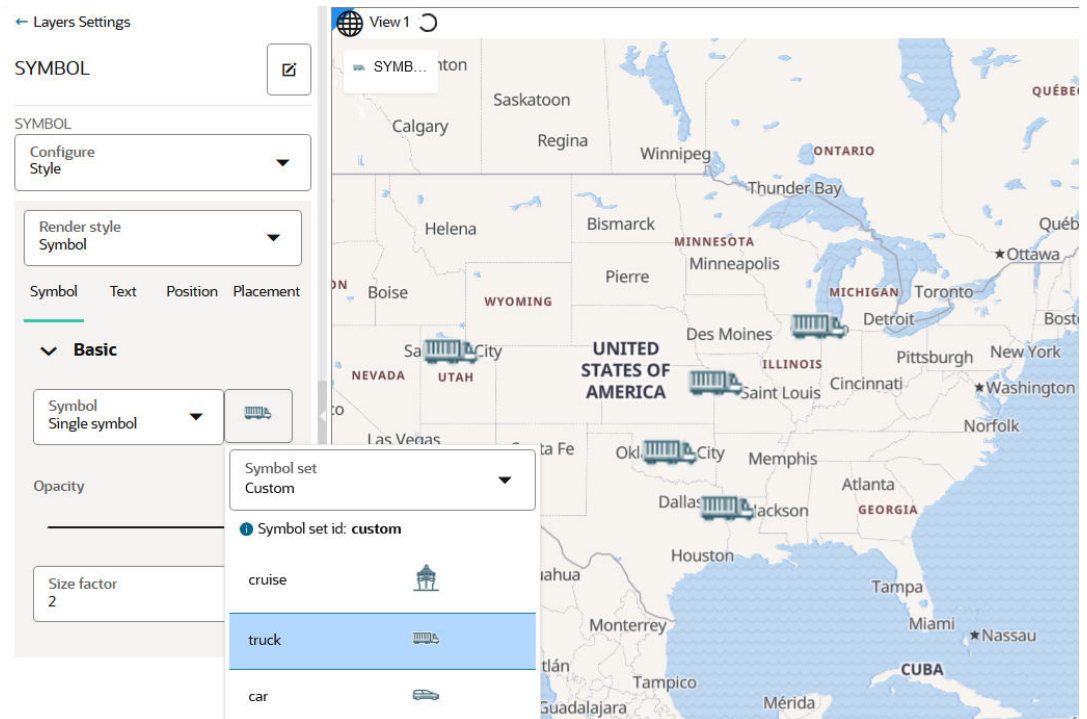
However, note that if a point dataset is being styled by custom symbols, then it can no longer use any of the built-in symbols. Essentially, you cannot mix both custom and built-in symbols on a map layer in the map visualization.

Perform the following steps to style your map layer using custom map symbols.

The instructions assume that a map layer is displayed on the Active Project page and the custom map symbols are already added in Spatial Studio. See [Upload a Map Symbol](#) for more information.

1. Click **⋮** against the map layer in the **Layers** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Configure **Style** and select **Symbol** as the **Render Style**.
4. Click the image button next to the **Symbol** drop-down list.  
The **Symbol set** drop-down appears.
5. Select *Custom* under **Custom symbols** in the **Symbol set** drop-down list.  
The uploaded custom symbols list appears.
6. Select the required custom symbol.

The symbol gets applied to the map layer as shown in the following figure:



## Apply an Animated Map Symbol to a Map Layer

You can apply a circular animating (pulsing) symbol for styling point-type map layers.

Perform the following steps to apply an animating symbol to a map layer.

The instructions assume that a point map layer is already displayed on the map. The new animating symbol is found in the Symbol render style or symbol picker.

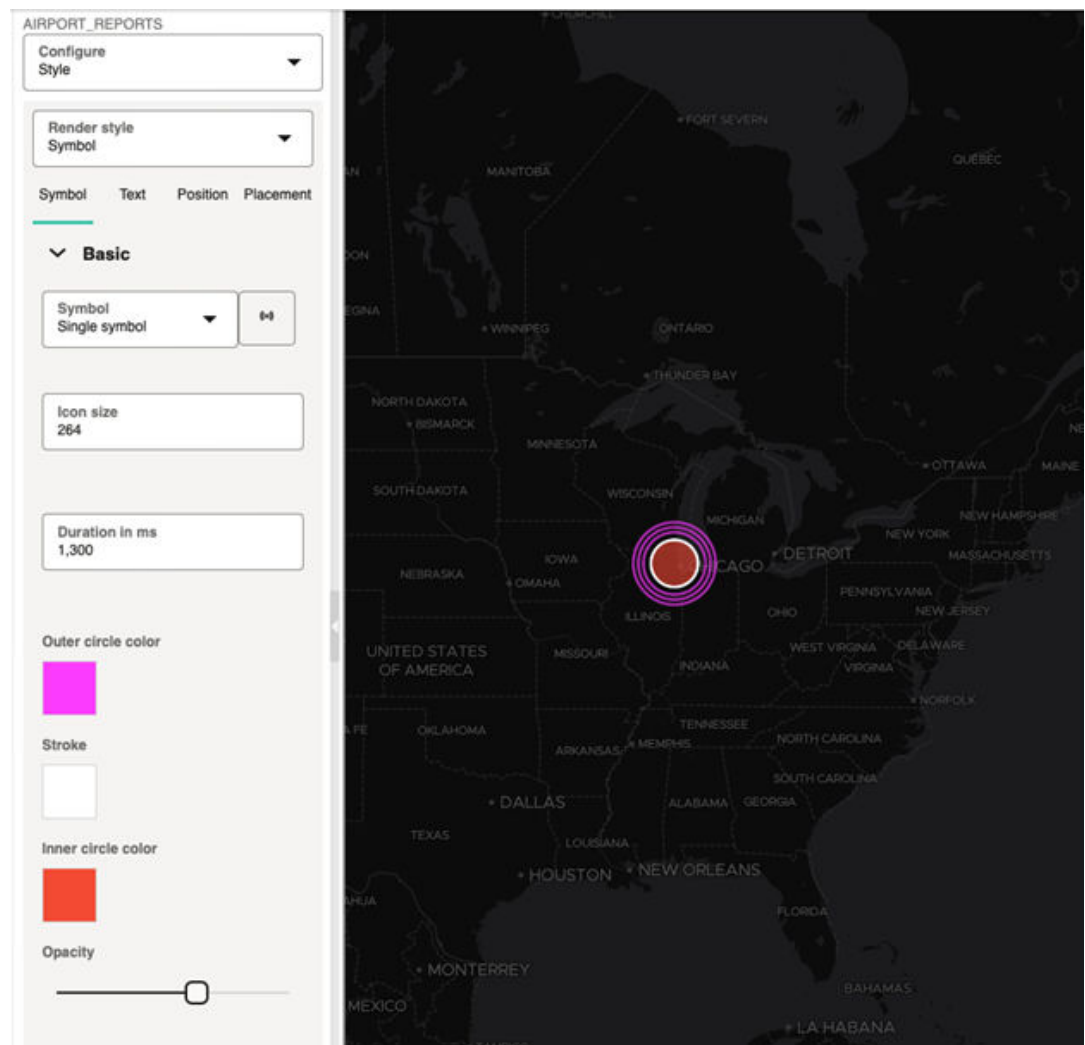
1. Click **⋮** against the map layer in the **Layers** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Configure **Style** and select **Symbol** as the **Render Style**.
4. Click the image button next to the **Symbol** drop-down list.

The **Symbol set** drop-down appears.

5. Select the *pulsing-dot* symbol under the **Animations** section in the **Symbol set** drop-down list.
6. Optionally, customize the animating symbol.

This includes the overall **Icon size**, **Inner circle color**, **Outer circle color**, **Stroke**, and **Opacity** of the inner circle. Also, you can customize the animation speed by configuring the **Duration in ms** field.

The following figure shows custom styling of an animated symbol on a map visualization.



## Apply Style to a Map Layer Using a GeoJSON URL Dataset

Spatial Studio supports data-driven styling for your GeoJSON URL dataset map layer. You can access the dataset columns that are sourced from the source URL and apply the desired styling for the map layer.

### See Also

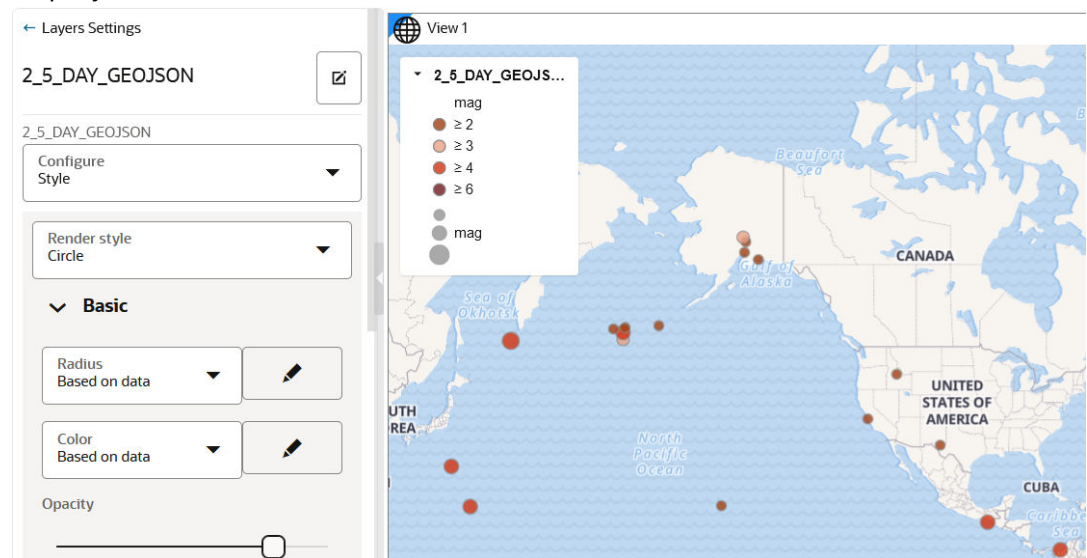
[Create a GeoJSON URL Dataset](#)

The instructions assume that you have added a GeoJSON URL dataset on your Active Project page.

1. Click **⋮** against the map layer in the **Layers** tab of the **Layers List** list.
2. Select **Settings** in the context menu.
3. Configure **Style**.
4. Apply the radius or color styling based on data columns.

- **Styling based on data**
  - a. Select **Based on Data** in the **Radius** or **Color** drop down list.
  - b. Click the **Edit bind** icon.
  - c. Select the **Column** to control styling.
  - d. Optionally, adjust the bin and the output values.
- **Applying predefined colors**
  - a. Select **Column with color codes** in the **Color** drop down list.
  - b. Select the **Column**.

The following figure shows the radius and color styling applied to a GeoJSON URL dataset map layer:



## Set Selection Tolerance on a Map Layer

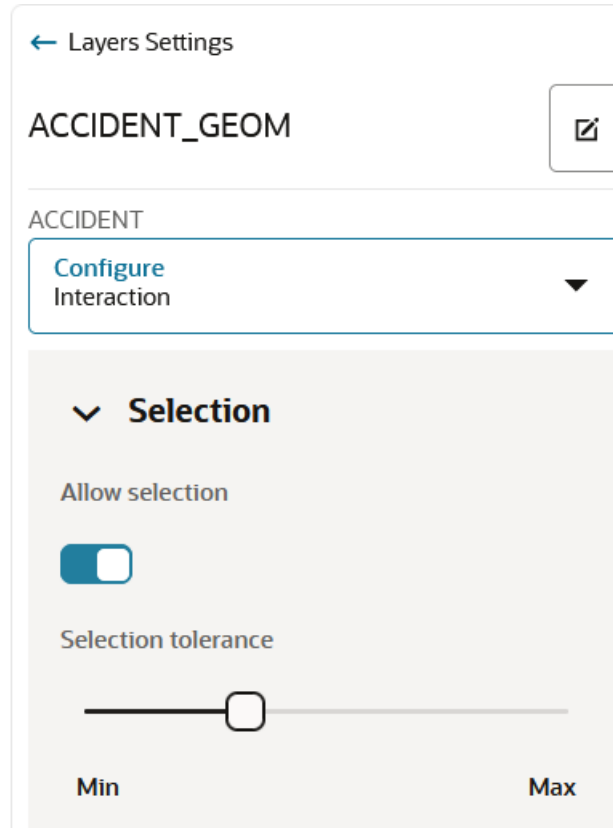
Spatial Studio allows you to increase or decrease the selection tolerance on a map layer, so that selecting small and linear geometry features is easier.

The following steps enable you to adjust and set the selection tolerance on a map.

The instructions assume that a project is open on the Active Project page.

1. Click **⋮** against the **dataset** in the **Data** tab of the **Layers** list.
2. Select **Settings** in the context menu and configure **Interaction**.
3. Switch on the **Allow selection** toggle button.
4. Adjust the **Selection tolerance** slider as required.

The following figure shows the **Selection** section for setting the tolerance:



The custom selection tolerance gets applied to the map layer.

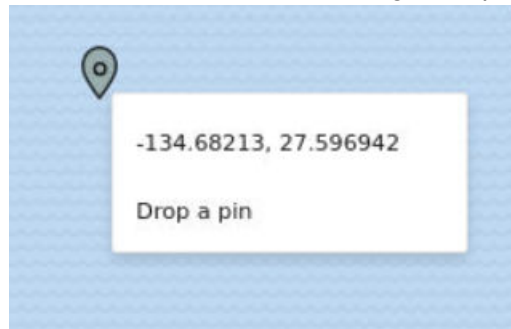
## Add a Pin on a Map

The following steps enable you to inspect the current mouse pointer's latitude and longitude coordinates and pin a location on the map layer.

The instructions assume that you have a project opened on your Active Project page and the map layer is displayed for visualization.

1. Right-click on any area on the map layer.

The coordinates for the location gets displayed as shown:



2. Click **Drop a pin** to add a location marker.

The pin gets displayed on the map. Additionally, you can also copy the coordinates by clicking on the marker and then clicking the **Longitude, Latitude: click to copy** icon.

## Apply Map Backgrounds

Spatial Studio provides ready-to-use map backgrounds to enhance your visualization.

You can select one of the following map backgrounds for your project visualization:

- MapTiler Vector Basemaps
- Oracle Raster Basemaps
- Blank Basemaps
- User-defined Basemaps

As an administrator, you can also register custom basemaps and use them in map visualizations. They may be raster or vector tiles that are typically hosted on third party servers, or they be created using a WMS OGC web service. See [Add a Custom Basemap](#) for more information.

The labels on the the basemap are displayed in English along with the local language of the region. However, you can change the language for the basemap labels. See [Configure a Map Visualization](#) for more information.



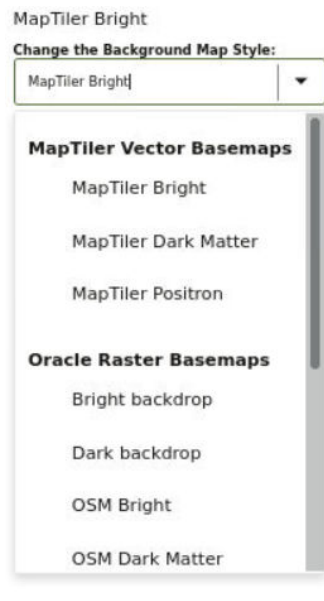
The following section describes how to apply a specific map background for your project:

### Change Map Backgrounds

The following steps enable you to apply different map backgrounds in your project visualization.

The instructions assume that you have a project opened on your Active Project page.

1. Click **\*\*\*** in the **Background** tab of the **Layers** list.
2. Select **Settings** in the context menu.
3. Click the **Change the Background Map Style** drop-down and select your required background map as shown.



All custom basemaps appear under **User-defined Basemaps** in the drop-down list. The selected map background gets applied to your project visualization.

## Use the Redline Map Tool

Spatial Studio provides the Redline map tool for drawing and annotating different geometry shapes on your map.

In addition, you can edit, delete, or share these redline drawing sets by exporting it to a GeoJSON file.

Perform the following steps to get started with the Redline map tool. The instructions assume that you have a project opened on your Active Project page and the map layer is displayed for visualization.

1. Click the **Actions** icon on the map tool bar and select **Redline**.

Alternatively, right-click on the map layer and select **Show redline toolbar**. The Redline map tool bar appears as shown:

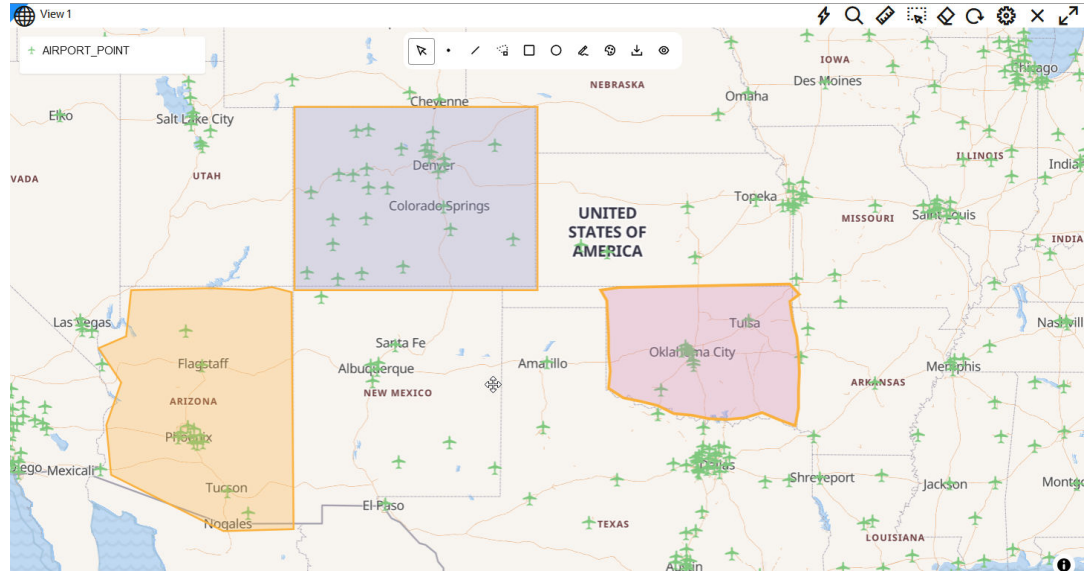


The tool bar provides the following options for defining or managing Redline objects on the map:

- **Select Feature (default):** To select a Redline object for update or delete.
- **Draw Point:** To define a Redline point.
- **Draw Line:** To define a Redline line.
- **Draw Polygon:** To define a Redline polygon.
- **Draw Rectangle:** To define a Redline rectangle.
- **Draw Circle:** To define a Redline circle.
- **Draw Freehand:** To draw a Redline freehand.
- **Click to choose a color:** To choose the default color for the Redline objects.

- **Export Features:** To export the Redline objects to a GeoJSON file. You can later upload the file to create a **Dataset** which can be used in Map Visualizations. See [Create a Dataset by Uploading a File](#) to upload a GeoJSON file.
  - **Toggle Visibility:** To hide or unhide the marked Redline objects.
2. Click the desired drawing option and draw the corresponding shape on the map.

For example, the following figure shows three Redline objects added to a map layer:



Repeat this step to add as many Redline objects as required.

✓ **Tip**

You can duplicate and move a Redline object on the map.

3. Optionally, perform any of the following actions on a defined Redline object.
- **Modify the Shape of the Redline Object**
    - Click **Select Feature** on the Redline map toolbar.
    - Click the required Redline object.  
The existing vertices of the object are shown highlighted in red.
    - Click along the object boundary to add new vertices (points) and adjust its shape as required.
    - Optionally, move the entire object to the desired location on the map.
  - **Edit Feature Properties**
    - Click **Select Feature** on the Redline map toolbar.
    - Right-click and select **Edit Feature Properties** on the required Redline object.
    - Add a **Description** to annotate the object.  
This description will be displayed as a tooltip when you mouse over a Redline object.
    - Optionally, modify the **Fill** and **Outline** width.
  - **Duplicate Feature**
    - Click **Select Feature** on the Redline map toolbar.

- b. Right-click and select **Duplicate Feature** on the required Redline object.
  - c. Move the duplicated object to the desired area on the map.
- **Delete Feature**
  - a. Click **Select Feature** on the Redline map toolbar.
  - b. Right-click and select **Delete Feature** on the required Redline object to be deleted.

Also, note that the following keyboard shortcuts are supported when working with Redline objects:

- Click `esc` to deselect the currently selected feature.
  - Click `del` to delete the currently selected feature.
  - Click `ctrl + r` and drag to rotate the currently selected feature.
  - Click `ctrl + s` and drag to scale or resize the currently selected feature.
4. Optionally, export all the marked Redline objects to a GeoJSON file.
    - a. Click **Export Features** on the Redline map toolbar.
    - b. Click **Download as GeoJson** and save the `.geojson` file to your system.

Also, note the following details regarding the exported GeoJSON file:

- Each Redline object is automatically assigned a unique ID (UUID), which will be a exported.
  - Any description entered for a Redline object is exported.
  - Any styling information, such as custom colors and outline width are NOT exported.
5. Click **Save** to save your project with the Redline drawings.

The drawings will be persisted as a part of the project. Note that when you reopen an existing project with Redline drawings, the shapes are initially not editable. You must select the Redline tool again to "rehydrate" the tool with the drawings.

6. Close the Redline map tool by clicking the **Actions** icon on the map tool bar and selecting **Redline**.

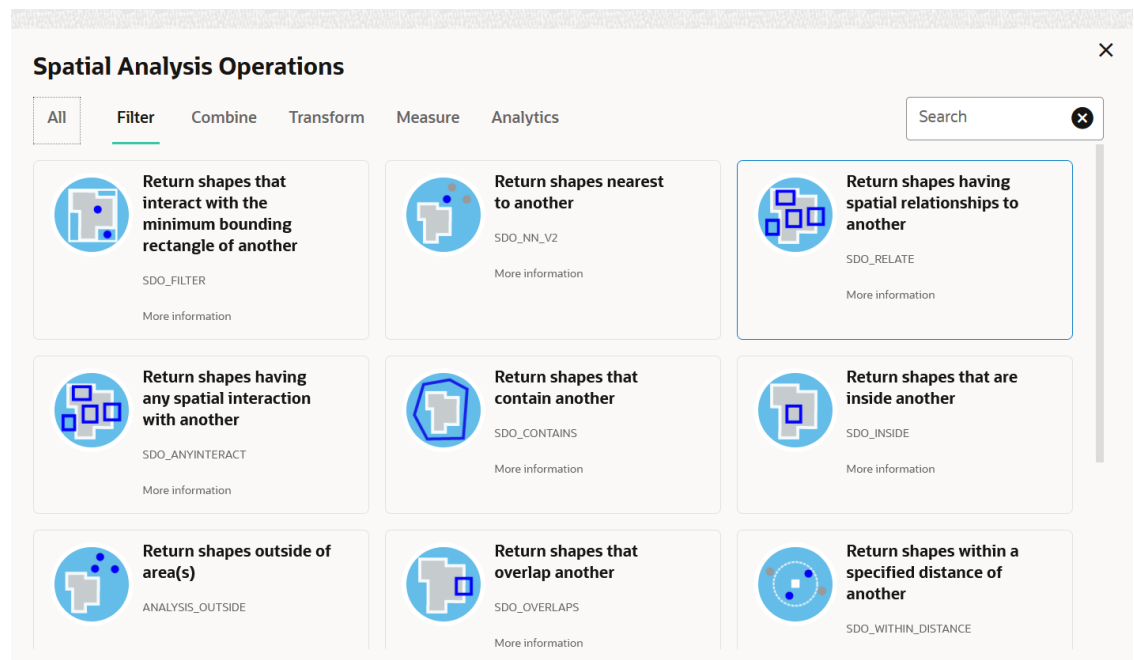
# 10

## Run Spatial Analyses

You can perform various spatial analyses (such as filtering by proximity, nearest neighbor analysis and so on) and visualize the results in Spatial Studio.

These spatial analyses are grouped under the following categories in Spatial Studio:

- Filter
- Combine
- Transform
- Measure
- Analytics



The following topics explore a few spatial analysis operations:

### Topics

- [Create Lines to Connect Latitude/Longitude Pairs](#)
- [Create an Isochrone Map for Analysis](#)
- [Determine the N-Nearest Geometries](#)
- [Determine Geometries Within a Specified Distance](#)
- [Determine the Geometries Filtered By Non-Spatial Attributes](#)
- [Determine the Size of Geometries](#)
- [Densify Geometry Analysis](#)
- [Find the Shortest and Quickest Route](#)

- [Summarize By Region Analysis](#)

## Create Lines to Connect Latitude/Longitude Pairs

The **Create lines from start/end points** transform operation creates a line connecting two pairs of latitude and longitude coordinates on a map layer.

To perform this transformation analysis, ensure that a dataset comprising two pairs of latitude and longitude coordinates (one represents the starting points and the other, ending points) in each row is added in the Active Project page. The **Create lines from start/end points** analysis takes the column names of these two pairs of latitude and longitude coordinates as input and generates the line geometry connecting the starting and ending points.

Perform the following steps to run the **Create lines from start/end points** spatial analysis.

1. Click **☰** against the map layer whose coordinates needs to be filtered in the **Layers** tab.
2. Select **Spatial Analysis**.

The **Spatial Analysis Operations** slider opens.

3. Click the **Transform** tab and select **Create lines from start/end points**.

**Create lines from start/end points** slider opens as shown:

### Create lines from start/end points

Create lines connecting start coordinate to end coordinate

Results dataset  
LATLON LINES

Start longitude column  
LON\_LAT\_2.START\_LON

Start latitude column  
LON\_LAT\_2.START\_LAT

End longitude column  
LON\_LAT\_2.DEST\_LON

End latitude column  
LON\_LAT\_2.DEST\_LAT

Display as linestrings representing arcs on the Earth's surface

Distance between vertices in resulting linestring (in meters)  
50,000

**Run** Run in background Cancel

4. Optionally, modify the resulting datasets name in **Results dataset**.
5. Select the **Start longitude column**.
6. Select the **Start latitude column**.
7. Select the **End longitude column**.
8. Select the **End latitude column**.

- Optionally, switch **ON** the **Display as linestrings representing arcs on the Earth's surface** toggle.

This factor takes into consideration that the earth is spherical and accordingly projects the connecting line between the two sets of coordinates on the map layer. It is very useful for large distances between two coordinates and it is recommended that you use this option.

- Optionally, modify the **Distance between vertices in resulting linestring (in meters)** (only if you have included the **Display as linestrings representing arcs on the Earth's surface** option in the preceding step).

- Click **Run**.

The Analysis results are listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.

- Drag and drop the following layers on the map - starting points, ending points, and finally the **GEOMETRY** (that connects the starting and ending points) analysis on the map view.

The following figure shows an example of the **Create lines from start/end points** spatial analysis:

### Flight\_Paths



## Create an Isochrone Map for Analysis

You can create isochrone (driving-time) polygons, which show the areas that can be reached within a specified distance or time, for a set of input locations.

Perform the following steps to run the **Driving reach** spatial analysis.

- Click **...** against the map layer, which contains the input locations, in the **Layers** tab.
- Select **Spatial Analysis**.

The **Spatial Analysis Operations** slider opens.

- Click the **Analytics** tab and select **Driving reach**.

**Calculate drive time/distance polygons** slider opens as shown:

### Calculate drive time/distance polygons

Returns polygons representing areas reachable within a drive time or drive distance.

Results dataset  
DRIVING TIME POLYGON

Calculate polygon from  
AIRPORT\_POINT.GEOM

Reach  
2

Unit  
HOUR

**Store results:**

Geometry column name  
RESULT

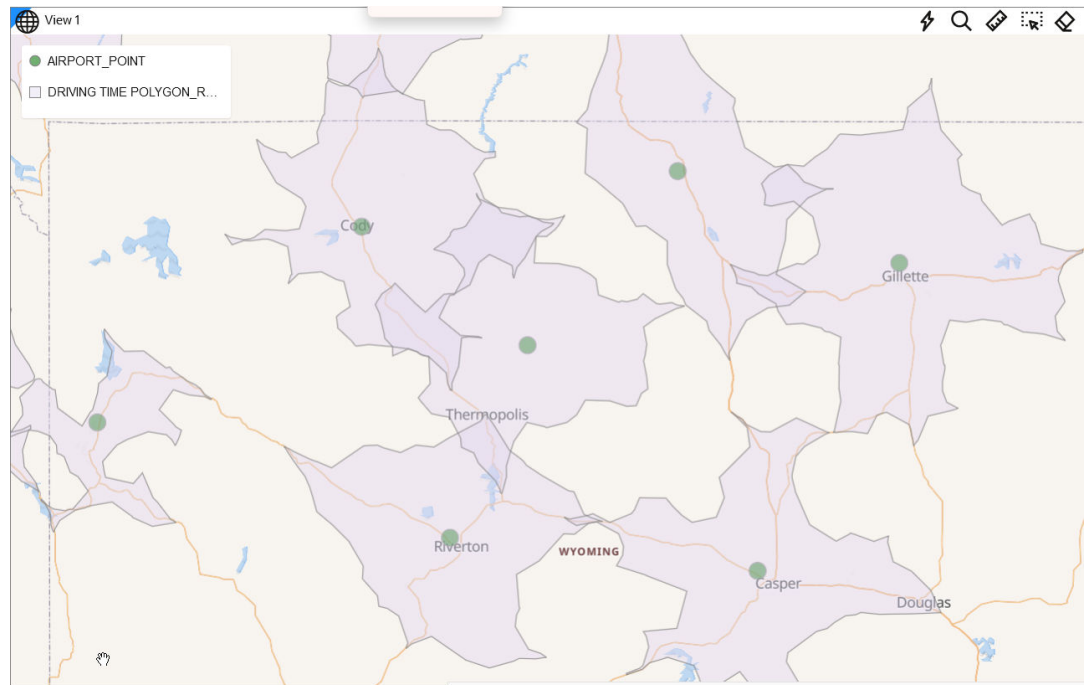
Run Cancel

4. Optionally, modify the resulting dataset name in **Results dataset**.
5. Specify the input geometries from the **Calculate polygon from** drop-down.  
You can choose one of the following options:
  - **Point geometries:** Select the specific input geometry column of the dataset.
  - **Input coordinates:** Enter manually the **Longitude** and **Latitude** coordinates.
  - **Pins on the map:** This option appears if you have one or more pins created on the map.
6. Specify the **Reach** distance or time as required.
7. Select the **Unit** for the specified **Reach**.
8. Optionally, modify the **Geometry column name** in which the resulting polygon geometries will be stored.
9. Click **Run**.

The job to run the analysis gets initiated. Once the job completes, the Analysis result dataset gets listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.

10. Drag and drop the geometry column from the **Results dataset** on the map view.

The following figure shows an example of **Driving reach** spatial analysis. The polygons shows the areas that are within two hour reach from the input locations (shown in green).



## Determine the N-Nearest Geometries

Using the `SDO_NN_V2` filter, you can determine the N-nearest geometries to a geometry.

To find the N-nearest geometries, you must perform the following steps.

The instructions assume that you have the layer to be filtered and the map layer to be used as a filter displayed on your Active Project page.

1. Click **☰** against the map layer, whose coordinates needs to be filtered, in the **Layers** tab.
2. Select **Spatial Analysis**.  
The **Spatial Analysis Operations** slider opens.
3. Click on the **Filter** tab and select **Return shapes nearest to another**.  
**Nearest neighbors** slider opens as shown:

### Nearest neighbors ✕

Determines the nearest neighbor geometries to a geometry.

---

Analysis name  
MEXICO\_CITIES SDO\_NN

Layer to be filtered  
MEXICO\_CITIES [admin].LOCATION

⚠ Spatial validation is needed for accurate analysis results.

Include only selected items in the layer above

Layer to be used as the filter

Required

Include only selected items in the layer above

Number of results  
1

**Run**   Run in background   Cancel

4. Enter **Analysis name**.
5. Select the **Layer to be filtered**.

i **Note**

Ensure that you have run spatial validations on the map layer to be filtered and the map layer to be used as the filter in order to obtain accurate analysis results.

6. Enter **Number of results**.
7. Click **Run**.  
The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.
8. Drag and drop the analysis result on the map view.  
This creates a new map layer highlighting the N-nearest neighbor geometries for a geometry.

## Determine Geometries Within a Specified Distance

Using the `SDO_WITHIN_DISTANCE` filter, you can filter coordinates that are within a specific distance from a point on the map layer.

To filter points based on this proximity filter, you must perform the following steps.

The instructions assume that you have the layer to be filtered and the map layer to be used as a filter displayed on your Active Project page.

1. Click **☰** against the map layer whose coordinates needs to be filtered in the **Layers** tab.
2. Select **Spatial Analysis**.  
The **Spatial Analysis Operations** slider opens.
3. Click on the **Filter** tab and select **Return shapes within a specific distance of another**.  
**Within distance** slider opens as shown:

**Within distance** ✕

Uses the spatial index to identify the set of spatial objects that are within some specified distance of a given object, such as an area of interest or point of interest.

[More information](#)

Analysis name  
ACCIDENTS WITHIN DISTANCE

Layer to be filtered  
ACCIDENTS.GEOM

Include only selected items in the layer above

Layer to be used as the filter  
POLICE\_POINTS.GEOM

Include only selected items in the layer above

distance  
200

unit  
Meter

> Advanced

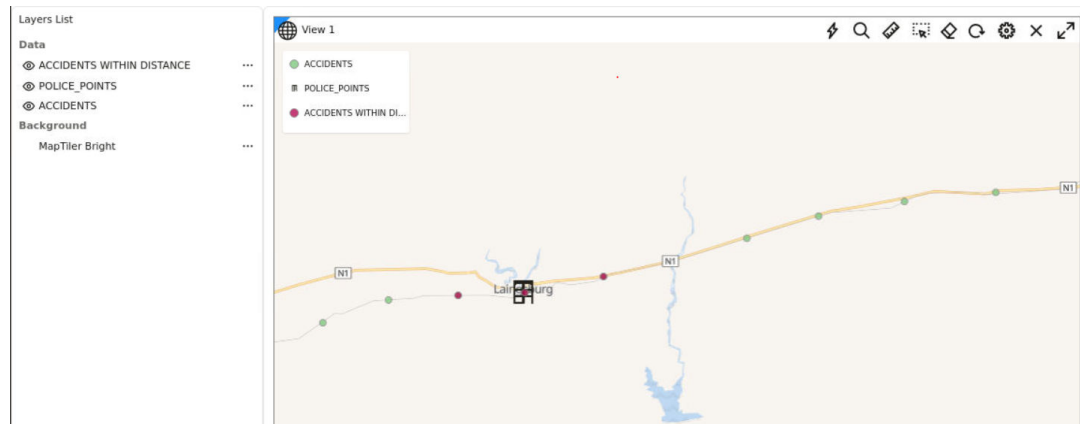
Run Run in background Cancel

4. Enter **Analysis name**.
5. Select the **Layer to be filtered**.
6. Select the **Layer to be used as the filter**.
7. Enter **distance** and **unit**.
8. Click **Run**.

The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.

9. Drag and drop the analysis result on the map view.

This creates a new map layer highlighting the filtered coordinates within a specific distance from a point as shown:



## Determine the Geometries Filtered By Non-Spatial Attributes

You can perform non-spatial filter analysis using a compound query.

To run a compound query with non-spatial attributes, you must perform the following steps.

The instructions assume that you have the layer to be filtered displayed on your Active Project page.

1. Click **...** against the map layer, whose coordinates needs to be filtered, in the **Layers** tab.
2. Select **Spatial Analysis**.

The **Spatial Analysis Operations** slider opens.

3. Click the **Filter** tab and select **Return elements filtered by non-spatial rules**.

The **Attribute Filter** slider opens as shown:

**Attribute filter** ✕

Analysis name  
AIRPORT\_POINT FILTERED

Dataset to be filtered  
AIRPORT\_POINT

**Criteria (2)** Collapse All Group Ungroup

▼ **Criteria 1** AREA\_ID Equals 1002377 🗑️

Column  
AREA\_ID

Operator to filter by.  
Equals

Value  
1002377

And Or

▼ **Criteria 2** AREA\_ID Equals 1003655 🗑️

Column  
AREA\_ID

Operator to filter by.  
Equals

Value  
1003655

+ Add criteria

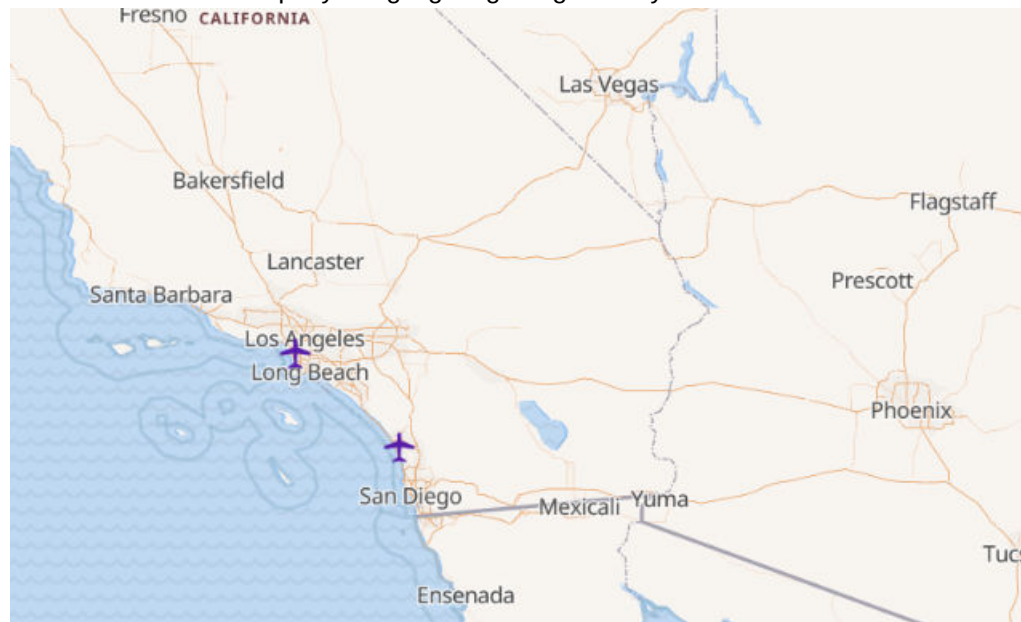
Run Run in background Cancel

4. Optionally, change the default **Analysis name**.
5. Optionally, change the **Dataset to be filtered** only if you want to apply the filter criteria against a different dataset. In such a case, Spatial Studio removes any existing criteria associated with the default dataset.
6. Select the **Column** name.
7. Select the **Operator to filter by** from the drop-down list.
8. Enter the **Value** to be filtered.
9. Optionally, click **Add Criteria** to repeat from step-6 to step-8 to add as many criteria as required. Also, click the **And** or **Or** operator to form the compound query.
10. Click **Run**.

The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane in the Active Project page.

11. Drag and drop the analysis result on the map view.

This creates a new map layer highlighting the geometry for the filtered attributes.



## Determine the Size of Geometries

You can run a spatial analysis to measure the size of the geometries on your map layer.

The analysis operation returns the size of the geometries in bytes. These values are stored in a new dataset column. Perform the following steps to measure the size of the geometries.

The instructions assume that you have a dataset with point geometries displayed on your Active Project page.

1. Click **☰** against the map layer whose coordinates needs to be filtered in the **Layers** tab.
2. Select **Spatial Analysis**.  
The **Spatial Analysis Operations** slider opens.
3. Click on the **Measure** tab and select **Calculate geometry storage size in bytes**.

A slider opens as shown:

### Calculate geometry storage size in bytes

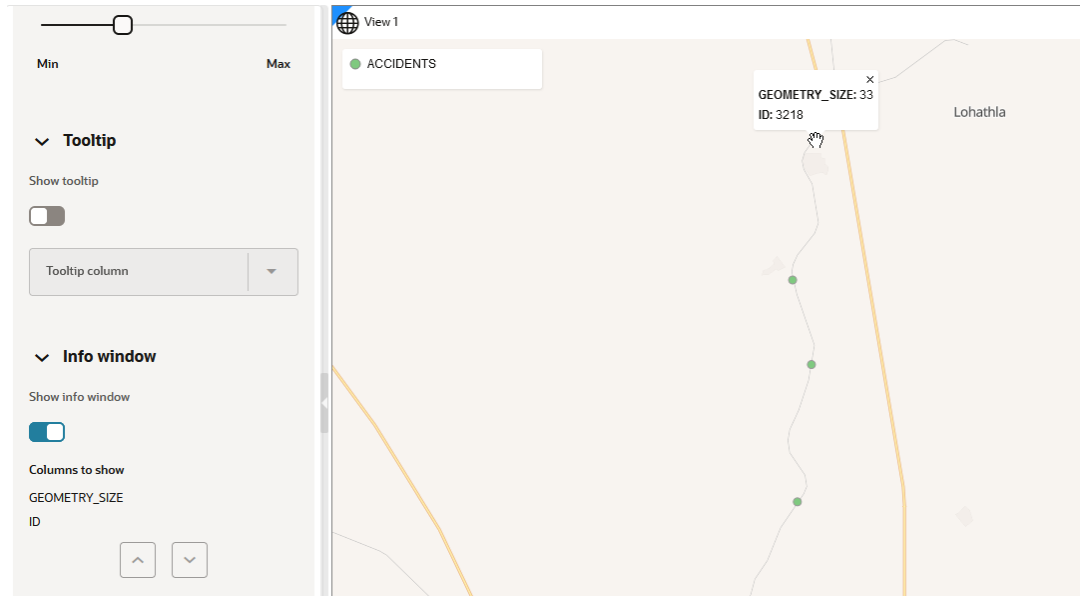
Creates a new column displaying the size in bytes of each geometry in the selected column.

Result Column Name GEOMETRY_SIZE
Geometry Column ACCIDENTS.GEOM

4. Optionally, modify the **Result Column Name**.

5. Select the **Geometry Column** from the drop-down list to compute the geometry size.
6. Click **Run**.

The Analysis result is added as a new column to the dataset in the Active Project page. You can then interact with the map to view the size value through tool tip or info windows. For example:



## Densify Geometry Analysis

The **Densify Geometry** transform operation densifies the input geometry by adding more points based on an interval value.

This analysis is useful when visualizing large distances between two coordinates. To perform this analysis, ensure that a dataset comprising the input geometries (lines or polygons) is added in the Active Project page.

Perform the following steps to run the **Densify Geometry** spatial analysis.

1. Click **☰** against the map layer whose coordinates needs to be filtered in the **Layers** tab.
2. Select **Spatial Analysis**.  
The **Spatial Analysis Operations** slider opens.
3. Click the **Transform** tab and select **Densify Geometry**.  
**Densify Geometry** slider opens as shown:

## Densify geometry

Results dataset DENSIFIED
Layer to be transformed LATLON LINES_2.GEOMETRY ▼
Interval for densification (meters) 5,000



4. Optionally, modify the **Results dataset** name.
5. Select the **Layer to be transformed**.
6. Optionally, modify the **Interval for densification**.

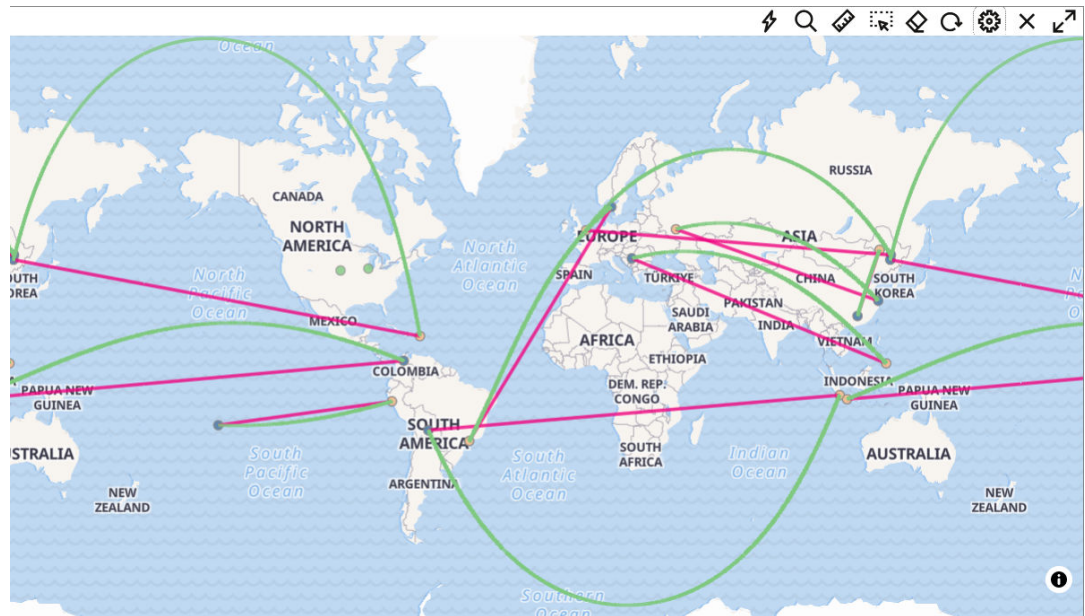
If the interval is set to too small a value, then the densified geometry may contain a very large number of vertices. This can cause an adverse effect on storage and performance when visualizing or further analyzing them.

7. Click **Run**.

The Analysis results are listed under **Analyses** in the **Data** elements panel on the left pane of the Active Project page.

8. Drag and drop the densified geometry column from the result dataset.

The following figure shows an example of the **Densify Geometry** spatial analysis. Considering that the earth is spherical, the densified geometry (in green) is projected as a curve.



## Find the Shortest and Quickest Route

Using the **Driving route** spatial analysis operation, you can find and store the shortest or fastest driving route between two points.

The route analysis supports the following modes:

- **Pairwise Routing:** In this mode, each input dataset contains both the starting and ending point geometries for the route.
- **One-to-many Routing:** In this mode, the route is determined between the starting point geometries in the dataset to a single end point. This end point can be defined by one of the following methods:
  - **Map Pins:** You can previously pin a location on the map by directly adding a pin ([Add a Pin on a Map](#)) or by using the search option ([Search Locations and Features on a Map](#)).
  - **Input coordinates:** You can manually provide the longitude and latitude coordinates when configuring the route analysis.

Also, note the following:

- The route analysis can be performed only on datasets with point geometries.
- You can choose to include one or more of the following parameters in the resulting output:
  - Route Geometry
  - Distance
  - Time
- The results of the analysis (route geometry, distance and (or) time) are stored directly into the input dataset.
- The analysis can be used multiple times on the same dataset by specifying different column names for storing the results.

Perform the following steps to run the **Driving route** spatial analysis.

The instructions assume that you have a dataset with point geometries displayed on your Active Project page and the destination pin is already placed on the map.

1. Click **☰** against the map layer containing the starting point geometries for the route.
2. Select **Spatial Analysis**.

The **Spatial Analysis Operations** slider opens.

3. Click the **Analytics** tab and select **Driving route**.

**Calculate driving route** slider opens as shown:

### Calculate driving route ✕

Returns the route, time and (or) distance between from a set of points to a specific destination.

---

For each item in  
MEXICO\_CITIES.LOCATION ▼

Calculate Route to  
View 1 pin 1: -103.37645393935804, 20.7044732104 ▼

**Store results:**

Time column  
DRIVE\_TIME Unit  
MINUTE ▼

Distance column  
DRIVE\_DISTANCE Unit  
MILE ▼

Route column  
ROUTE\_GEOM

Route preference  
Shortest time ▼

Run
Cancel

4. Select the input dataset in the **For each item in** drop-down.

Note that this drop-down will only list datasets with point geometries that are added to the project.

5. Select the destination end point in the **Calculate Route to** drop-down.

Note that this drop-down allows you to choose the end point against the following headers:

- **Point geometry columns:** Lists other point geometry columns in the input dataset. This is primarily used for pairwise routing (from the start to the end points of each feature in the same dataset).
- **Map Pins:** Lists the map pins that are already added on the map. See [Add a Pin on a Map](#) and [Search Locations and Features on a Map](#) for more information on dropping a location pin on the map.
- **Input coordinates:** Manually enter the longitude and latitude coordinates.

Using either map pins or input coordinates results in the routes being calculated from each starting point geometry in the input dataset to a single end point.

- Select one or more of the following checkbox options and specify the corresponding column name to store the results of the analysis.

- **Time column**
- **Distance column**
- **Route column**

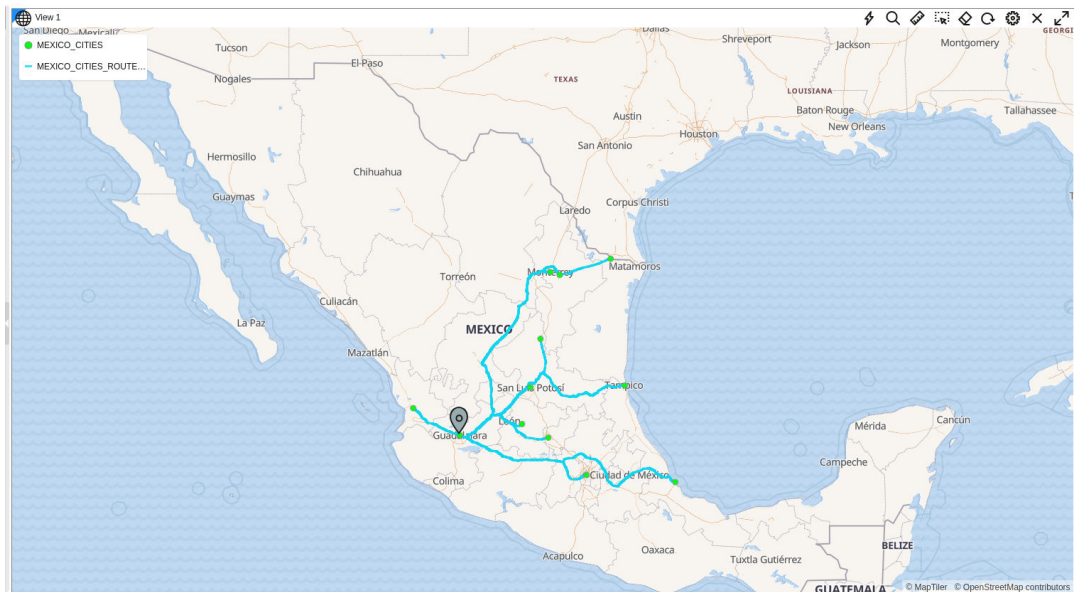
Note that at least one of the preceding columns must be included in the results.

Optionally, select the **Unit** for Time and Distance columns.

- Select the **Route preference**.
- Click **Run** to run the analysis.

On completion, the input dataset gets updated with the extra columns chosen to store the results.

The following figure shows the results of the shortest route analysis (from each input point to the destination pin) on map visualization.



## Summarize By Region Analysis

Spatial Studio supports descriptive analysis where you can obtain the summary of data points (such as count, average, sum, minimum, and maximum) on a region based dataset.

To perform summarize by region analysis, you can perform the following steps.

The instructions assume that you have a point map layer displayed over a region map layer on your Active Project page.

- Click **☰** against the map layer, whose coordinates needs to be filtered, in the **Layers** tab.
- Select **Spatial Analysis**.

The **Spatial Analysis Operations** slider opens.

- Click the **Analytics** tab and select **Summarize By Region**.

The **Summarize by region** slider opens as shown:

### Summarize by region ✕

Enrich a dataset of regions with a summary of the points inside.

4. Optionally, change the default name for the new analysis **Results dataset**.
5. Select the region based map dataset from the **For each item in** drop-down list.
6. Select the point map layer from the **Summarize items in** drop-down list.
7. Select the **Summary** option.
8. Optionally, change the **Summary column name**.
9. Click **Run**.

The Analysis result is listed under **Analyses** in the **Data** elements panel on the left pane in the Active Project page.

10. Drag and drop the analysis result on a table or map visualization.

You can view the summary results as shown:

ID	GEOID	NAME	MIN	
<input type="checkbox"/>	18	31	Nebraska	1352.58
<input type="checkbox"/>	19	42	Pennsylvania	1272.58
<input type="checkbox"/>	20	53	Washington	1077.94
<input type="checkbox"/>	21	22	Louisiana	2785.51
<input type="checkbox"/>	22	13	Georgia	1921.03
<input type="checkbox"/>	25	01	Alabama	1341.42
<input type="checkbox"/>	24	49	Utah	5114.15
<input type="checkbox"/>	25	39	Ohio	1114.14
<input checked="" type="checkbox"/>	26	48	Texas	1043.01
<input type="checkbox"/>	27	08	Colorado	1274.21
<input type="checkbox"/>	28	45	South Carolina	1043.58
<input type="checkbox"/>	29	40	Oklahoma	3302.59
<input type="checkbox"/>	30	47	Tennessee	1035.43