Monitoring Water Quality for Aquaculture using NASA Remote Sensing Observations

Amita Mehta (GESRAT II, NASA Goddard Space Flight Center (GSFC)), William Wainwright (SSAI, NASA GSFC), Kelly Luis (NASA Jet Propulsion Laboratory (JPL)), & Rachel Jiang (JPL)

Coordinators: Erin Urquhart (NASA), Kelly Luis (JPL), Melanie Follette-Cook (NASA GSFC)

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Workshop Agenda

Part 1: Presentations [9:30 to 11:00 AM]

- Introduction to NASA Water Resources Program
- Introduction to Earth Observations for Monitoring Water Quality
  - Fundamentals of Remote Sensing
  - Satellite missions
  - Data products
- **Demonstration**: Data access, analysis, and visualization web tools: Worldview
- Overview of Satellite-based Tool for Rapid Evaluation of Aquatic EnvironMents (STREAM)
- **Demonstration**: Data access, analysis, and visualization web tools: STREAM

Break [11:00 to 11:15 AM]

Part 2: Hands-on Exercises [11:15 AM to 12:15 PM]

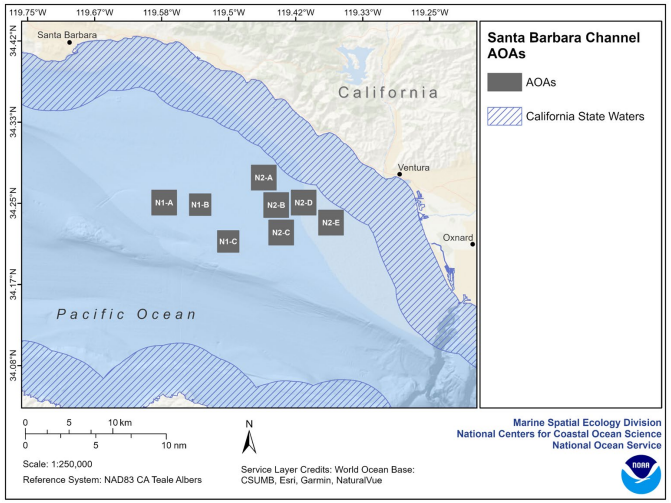
- **Monitoring coastal and inland WQ parameters for facilitating aquaculture applications using Worldview and STREAM**

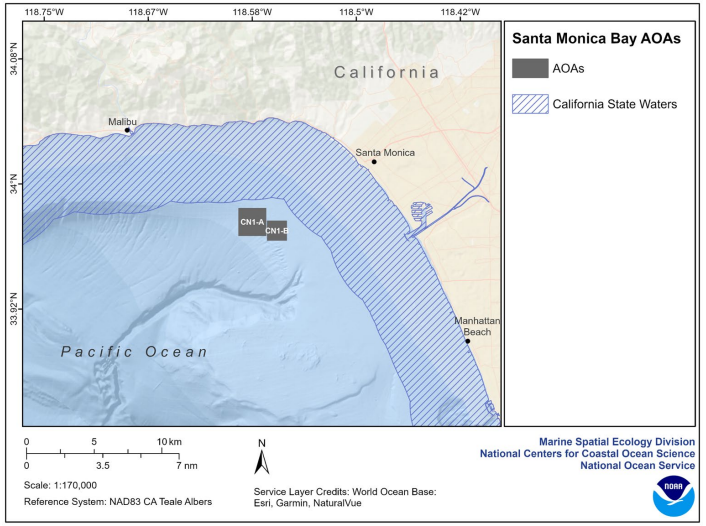
Summary and Survey [12:15 to 12:30 PM]

Exercise 1:
Examine Chlorophyll-a Concentration Data using Worldview

Introduction

- This exercise focuses on the southern California coast, one of the Aquaculture Opportunity Areas (AOA) identified by NOAA.
- One of the criteria for water quality used to determine an AOA is Chlorophyll-a (Chl-a) concentration.
- Oceanic conditions are also considered (e.g. SST, currents, bathymetry, ocean surface height).
- SST, bathymetry and ocean surface height can be obtained from NASA satellites, and ocean currents can be obtained from ocean model.
- **In this exercise, we will focus on visual inspection of Chl-a data in the coast of southern California. There was a toxic algal bloom in March 2025.**



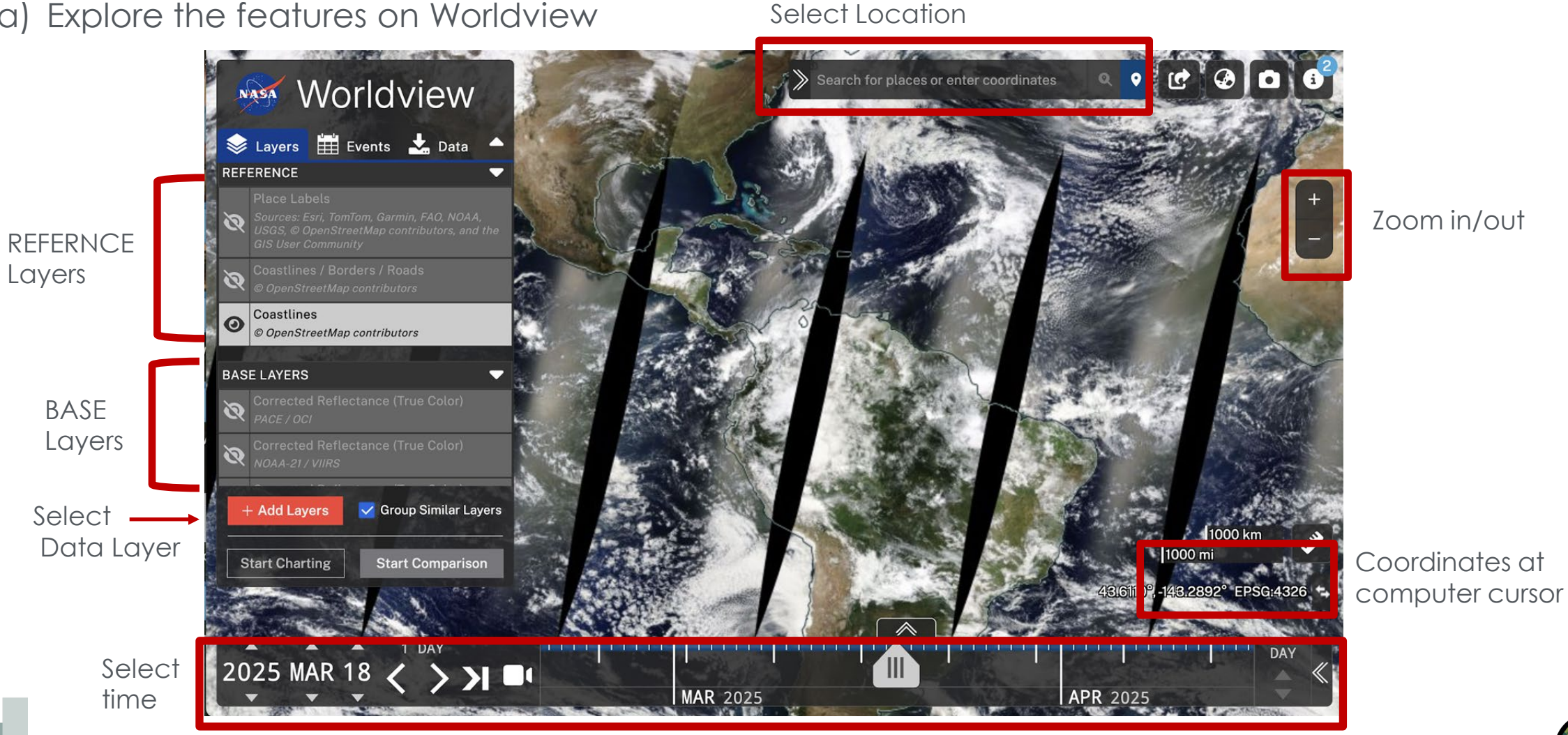


Reference: Morris et al. 2021

Open and Explore Worldview

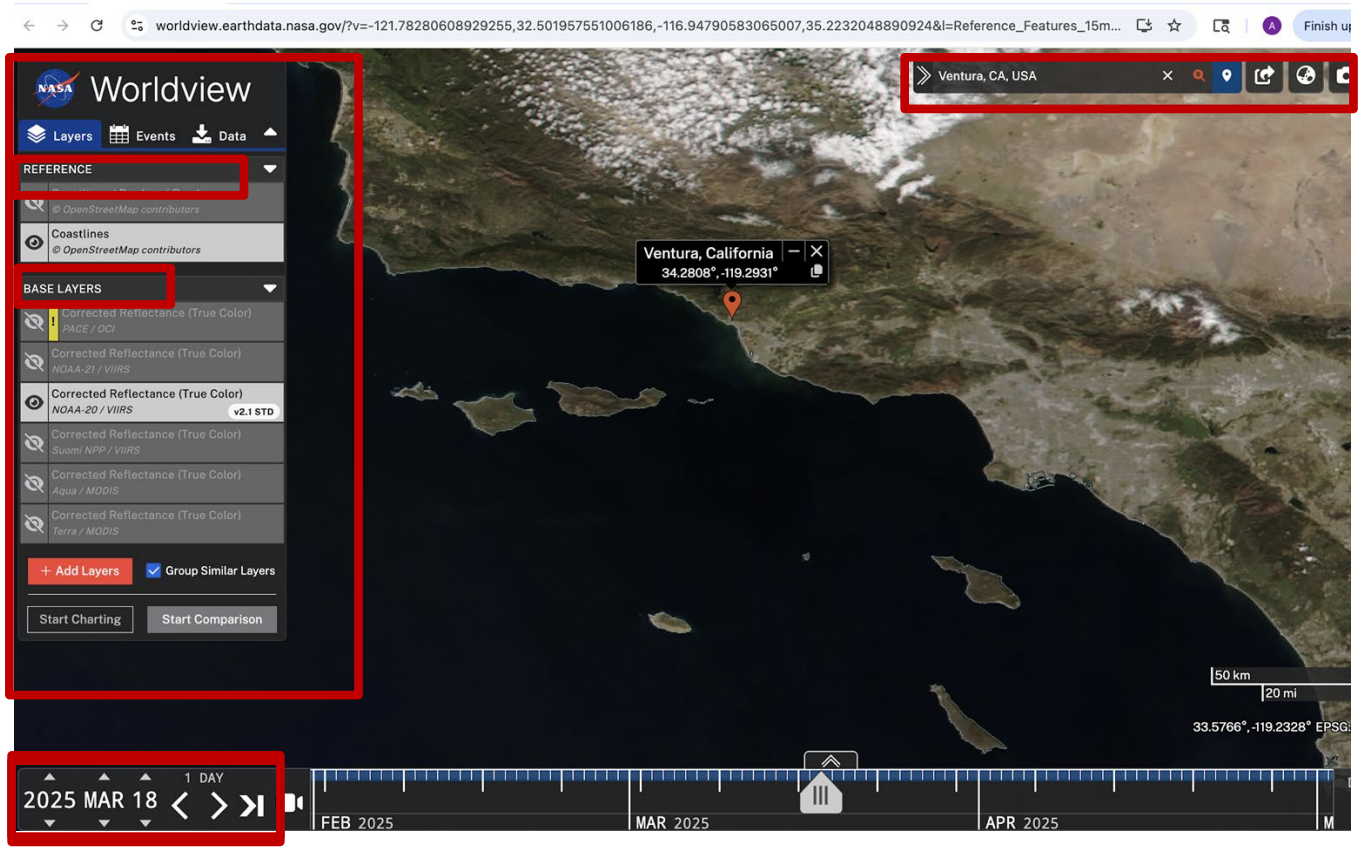
1. Open Worldview

   a) Explore the features on Worldview



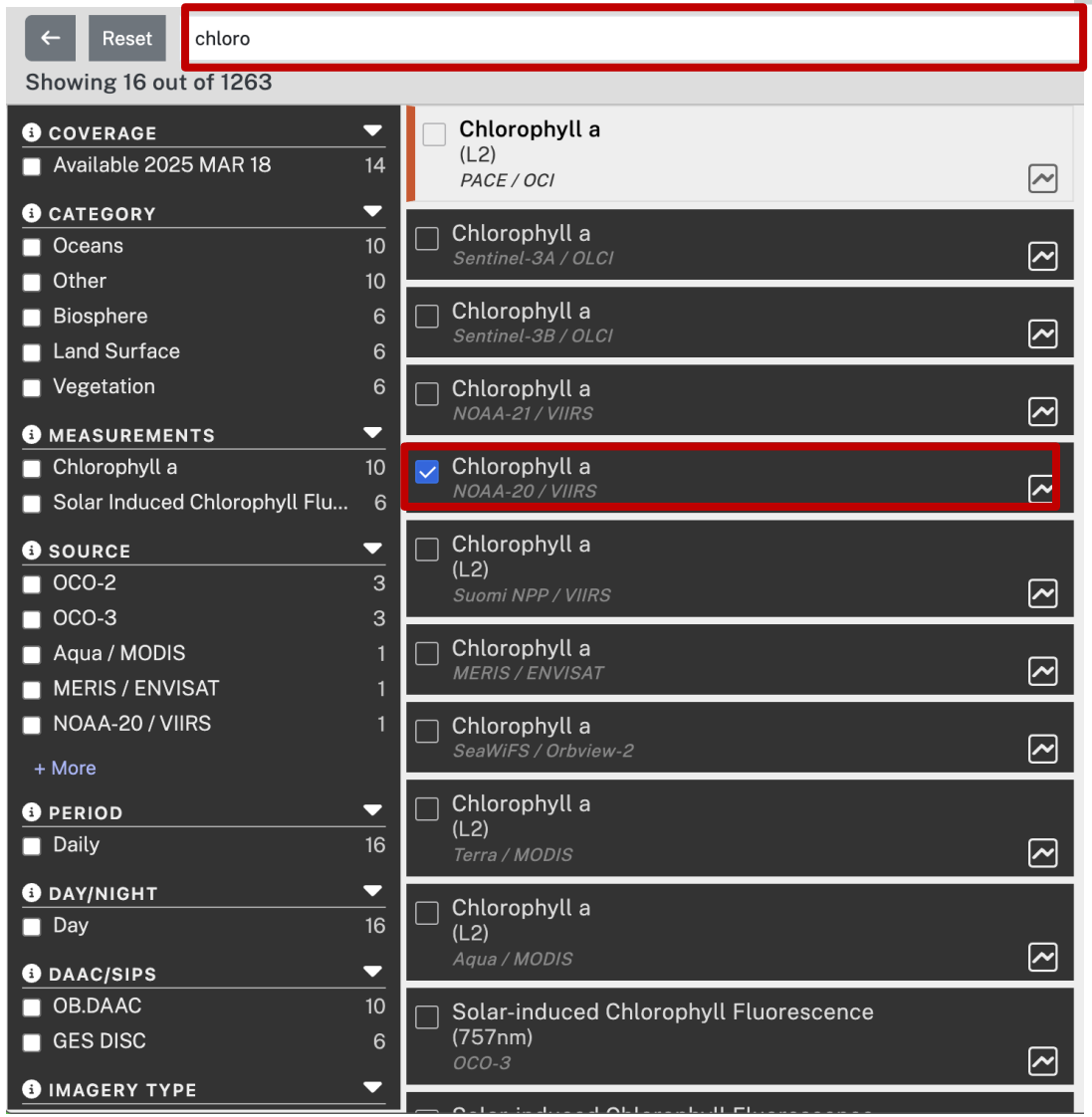
Add Reference and Base Layers

1. Open Worldview
2. From the left panel:
   - Click on the eye symbol to activate **REFERNCE** > **Place Labels** to help you navigate & orient yourself.
   - Similarly, activate **Base Layers > Corrected Reflectance (True Color) NOAA-20/VIIRS.**
3. Click on the timeline arrows at the bottom left to select the date March 18, 2025.
4. In **Search for places or enter coordinates** window > enter Ventura > select **Ventura, CA, USA.** The map will zoom on this area.



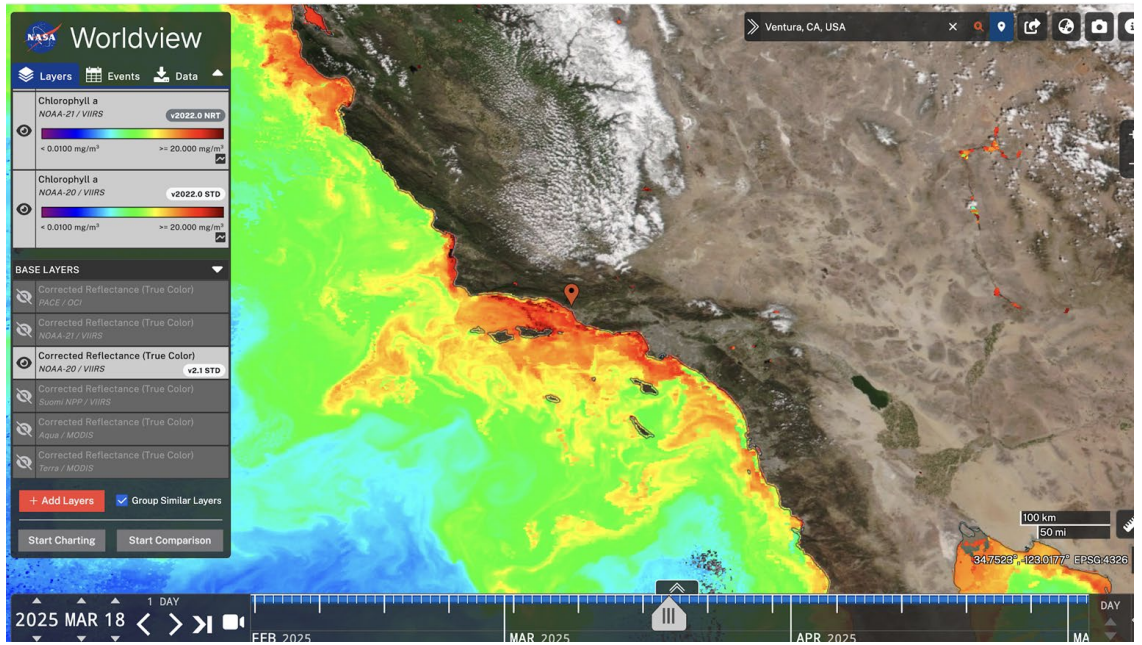
Add Data Layers

5. In the left panel click on **+ Add Layers.** This will open a layer selection window.
6. In the **search** window at the top, type Chlorophyll. A number of data options will appear in the layer window.
7. Select **Chlorophyll a NOAA 20/VIIRS**.
8. Close the search window by clicking **X** next to the Search window.



Examine Chlorophyll-a Data

9. First, examine the layer NOAA 20/VIIRS. Then, from the timeline at the bottom, use the arrow to change day to examine data from March 18 to March 25.
10. Examine how the Chlorophyll values change (hover over map area to see the value range on the color bar).
    - You may go back to + Add Layers and activate additional Chlorophyll-a layer from other satellites. You may select one or more additional **Chlorophyll a** layers from **PACE/OCI, Sentinel 3A/OLCI and 3B/OLCI, NOAA 21/VIIRS, Suomi NPP/VIIRS, Terra/MODIS, Aqua/MODIS.**
11. Examine each layer separately using the righthand eye icon to hide all but one layer. Repeat step 10 for each layer.

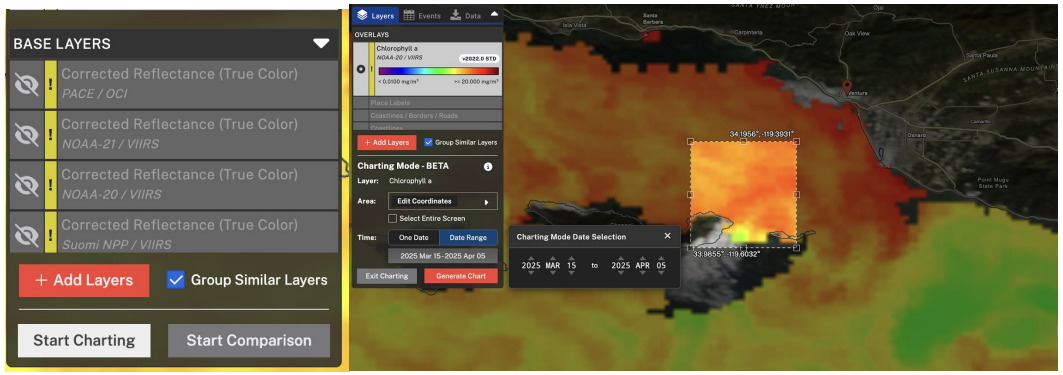


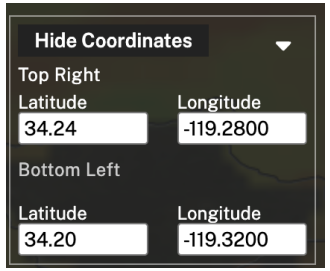
Questions

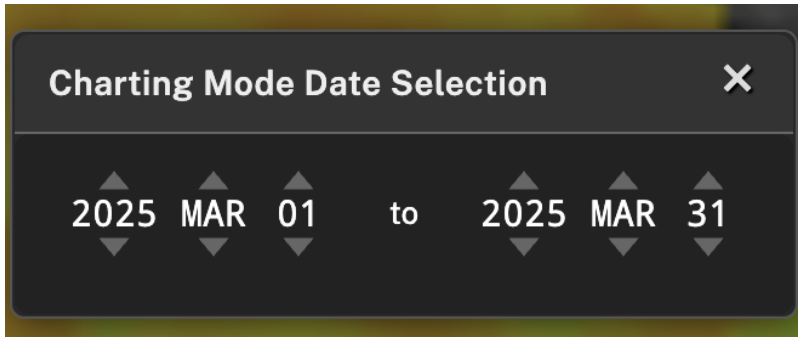
- Which units are used for Chl-a data? (see color bar)
- Go to the date March 23, 2025. Hover your cursor at any point off the coast near Ventura.
  - **Note:** The latitude-longitude coordinates in the bottom right on the map window and corresponding data range from the color bar.
  - Examine how the Chl-a values vary.
- Examine the Chl-a map on March 25, 2025 and comment on the Chl-a values.
- Why do some areas appear grey, and have no data?

Examine Chlorophyll-a Time Series

12. In the layer panel, click on **Start Charting** below the **+ Add Layer** window.
13. A window **Charting Mode – Beta** will open along with a box selecting an area on the map.
    - In **Area: Edit Coordinates** window you can add specific coordinates, or drag the box to cover the area of interest
    - Click on **Edit Coordinates** and enter these coordinates:
    - In **Time:** window select **Date Range** > Click on the date window to get **Charting Mode Date Selection** window.
    - Using the arrows, select the date range from 1 to 31 March 2025.
    - Click on **Generate Chart** to get a time series of Chl-a averaged over the selected area.







Questions

- Hover over the time series curve to see dates and Chlorophyll-a values:
- Which date has maximum Chlorophyll-a value? How much?
- Why are the Chlorophyll-a values zero for some days?