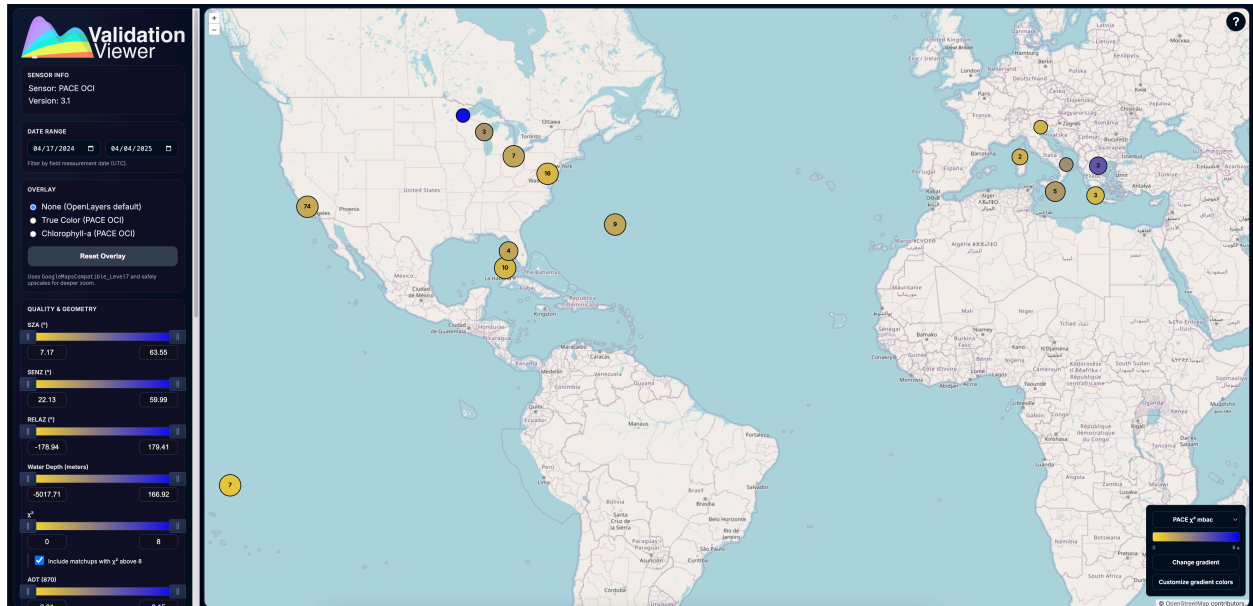# Validation Viewer User Guide

General Information

The PACE Validation Viewer application is a tool for dynamically visualizing satellite–in-situ matchup pairs. Our current release focuses on remote sensing reflectance, Rrs (sr^{-1}), data from the PACE OCI Apparent Optical Properties (AOPs) product suite.

Matchups are displayed geographically on an interactive map, allowing users to explore matchup sites worldwide. All matchups follow the standard SeaBASS criteria described in Bailey and Werdell (2006). The tool offers a broad set of auxiliary parameters and matchup quality metrics that can be used to filter, stratify, and tailor matchup queries to specific scientific or validation goals.

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Getting Started

This is the default view of the Validation Viewer. A **marker**, which represents one matchup, is presented with a circle without a number. A numbered circle is defined as a **cluster**, which represents the number of matchups within the clustered area.

The control panel on the left allows users to filter through data depending on what information they are looking for and let them control which map overlay to use on the map interface.

The legend on the bottom right displays a color bar outlining how the markers will be colored based on the statistic assigned in the legend.

Gradient Legend
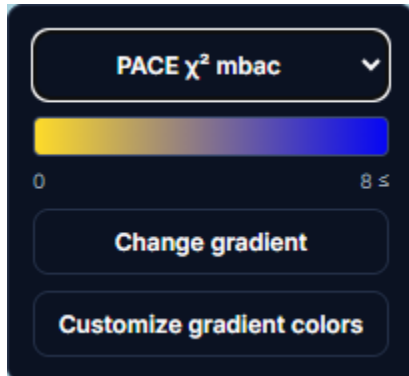
This legend corresponds the color of the markers and clusters to the value of the specified statistic shown above the color bar gradient. This statistic, called the **gradient field,** can either be *PACE χ^2 mbac* or *PACE QWIP*.

- An individual marker's color is based on its value against the gradient field currently selected.
  - For example, if the gradient field is *PACE χ^2 mbac*, a marker's color is based on its χ^2 value. Likewise, if the gradient field is *PACE QWIP*, a marker's color is based on its *PACE QWIP* score.
- A cluster's color is the average color of all the individual markers it represents.
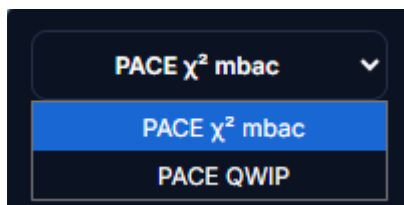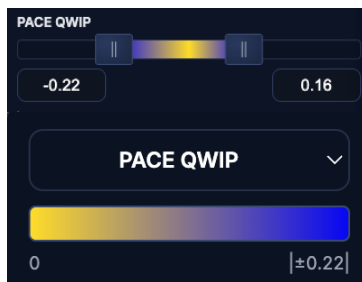

The gradient field can be changed by clicking on the name of the gradient field to reveal a dropdown list of gradient fields to select from.
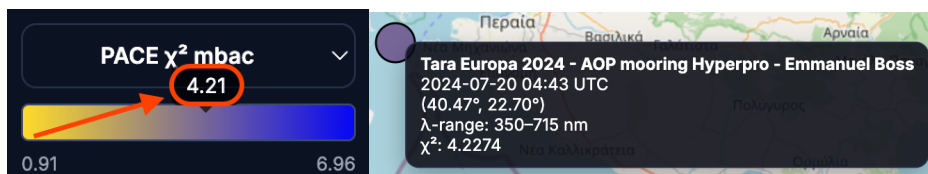
The value that a color on the gradient represents can be viewed when hovering the mouse over any point on the gradient

PACE QWIP gradient

For the PACE QWIP gradient, <u>if the lower bound is set to a negative number and the upper bound is set to a positive number,</u> the markers will be colored based on its PACE QWIP's score's proximity from 0 (i.e. its absolute value). The minimum color will always represent 0, while the maximum color will represent the absolute value of the larger of the two extrema.
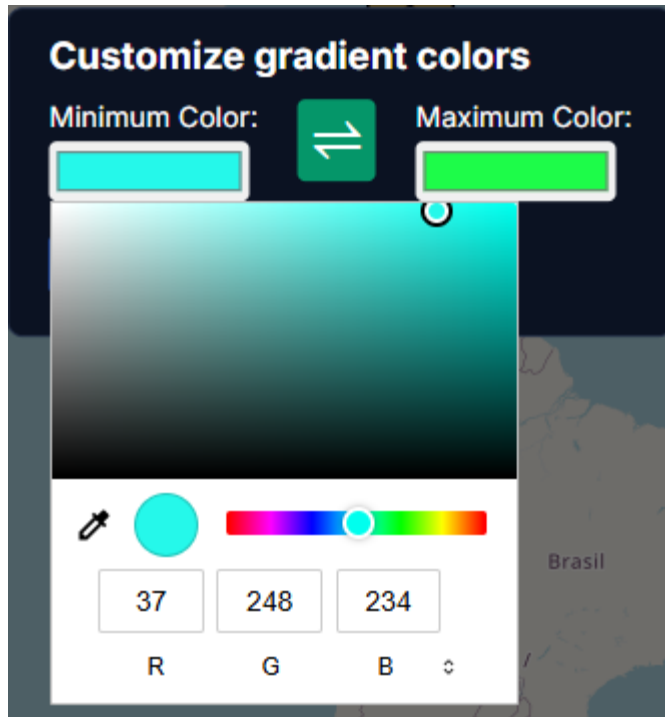
Changing the gradient color

There are two ways to change the colors of the gradient:
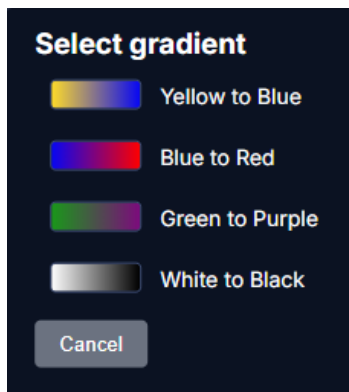
The first way is by clicking on the button labeled "Change gradient" and clicking on one of the four gradient options. These gradients were created with different types of colorblindness in mind. The default gradient is Yellow to Blue.
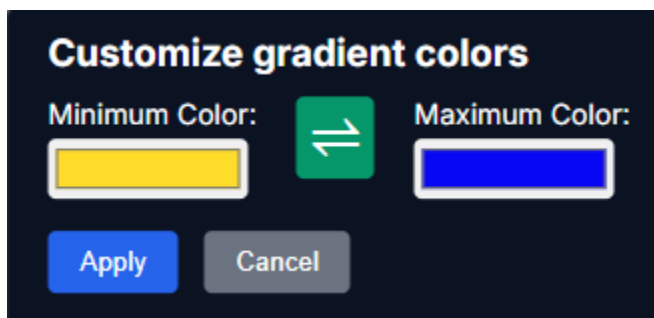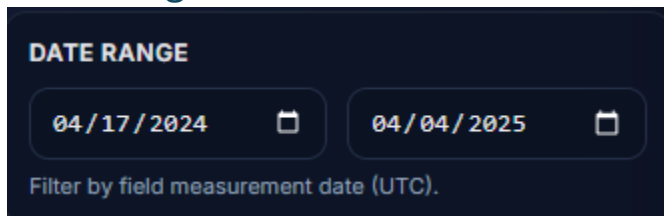

The second way is by clicking on the button labeled "Customized gradient colors" and customizing the colors that represent the lower and upper bounds of the gradient field values. The green button in the middle swaps the minimum and maximum colors. Selecting the "Apply" button will recolor the markers using the new gradient scheme.

For the "Customize gradient colors" option, clicking on either extremum's color will pull up a color selection input window. **The input window will be different per browser.** Once the desired colors are set, they will be applied to the graph when "Apply" is clicked.
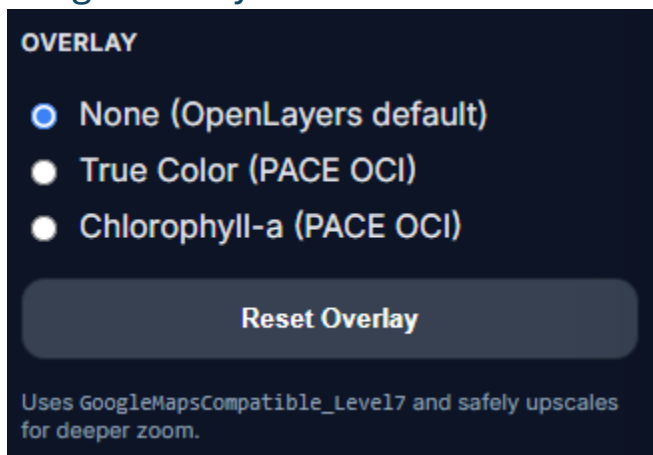
Filters and Control Menu

Date Range

The **Date Range** filter can be used to capture matchups within a specific temporal range. The first date tab is used to specify the *Start Date, while* the second date tab is used to specify the *End Date*. You can manually input numbers for the date or select the calendar icon to navigate to a specific date. You will need to select the "Apply Filters" in the bottom of the control panel on the left to apply the date range filter on the markers.

Image Overlay

The **Image Overlay** tab can be used to display a GIBS image layer over the map captured by the PACE OCI instrument. Users have the option to select between *True Color* and *Chlorophyll-a* image projections. *True Color* captures images how they would appear to the human eye by using a subset of the light wavelengths it can detect. *Chlorophyll-a* layer provides the near-surface concentration of chlorophyll a in milligrams of chlorophyll pigment per cubic meter (mg/m3) in the ocean. The default overlay is set to "None".
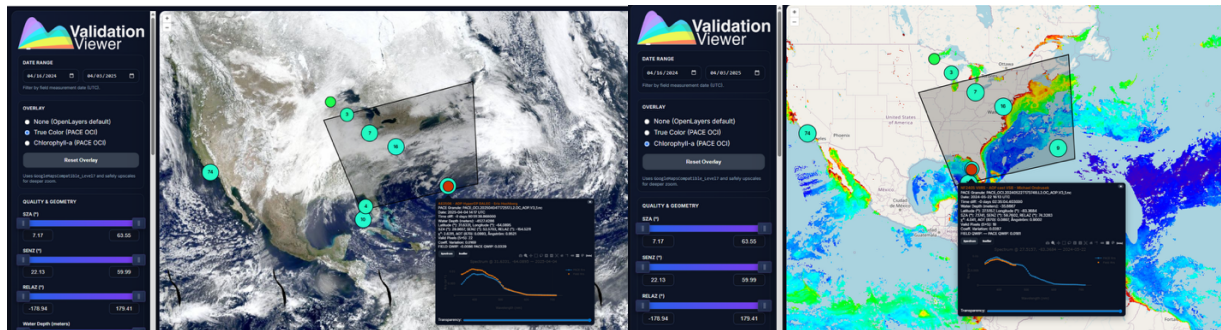
Whenever a marker is selected, the map will display that marker's overlay, if it exists. On the left is an example of the True Color overlay, and on the right is an example of the Chlorophyll-a overlay.

- If an overlay exists, it will stay on screen after the marker has been deselected. Use "Reset Overlay" to revert to the default overlay without selecting another marker.
- If an overlay does not exist, a notification will appear in the top-right corner that reads "This layer could not be found."

Quality & Geometry Metrics

To filter by values of certain fields, use the **Quality & Geometry** sliders, which will capture the matchups whose values of those fields are in the specified ranges. You will need to select the "Apply Filters" in the bottom of the control panel on the left to apply the quality and geometry metric filters on the markers.

- For a given field's slider, the lower and upper bounds can be set by either using the two endpoints or by typing in the desired bounds in the boxes with numbers.

- The default values for the sliders of χ^2, *PACE QWIP*, and *FIELD QWIP* are based on their usual range of values. These sliders have checkboxes labeled "Include matchups with [field name] below/above [lower/upper bound]", which can be disabled to exclude matchups with a given field's value outside the stated bound when its corresponding bound is set to max

- The default values for the rest of the sliders are based on the lowest and highest values of each field from all the matchups' data put together.

- The color gradient of the sliders is the same as the color gradient used to color the markers. For FIELD and PACE QWIP sliders, whenever the lower bound is set to a negative number and the upper bound is set to a positive number, the color representing the minimum is centered around 0.
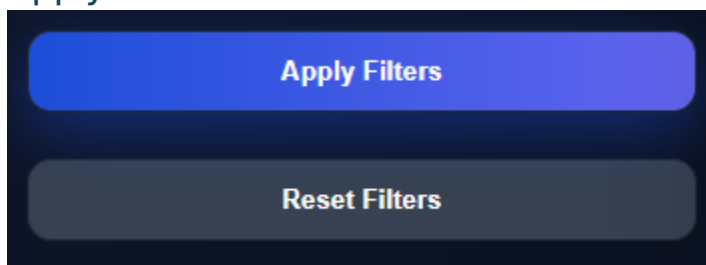
Data Types
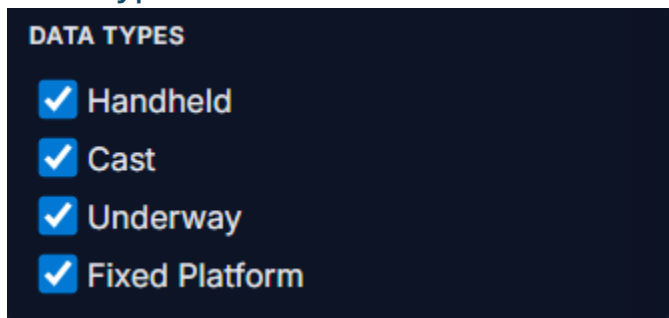
The **Data Types** filters list will capture all matchups whose data type matches at least one of the data types whose checkbox is enabled. You will need to select the "Apply Filters" in the bottom of the control panel on the left to apply the data type filters on the markers.

- Every matchup has a data type specified by the **Data Types** box. The data types are *Handheld*, *Cast*, *Underway*, and *Fixed Platform*. As such, <u>no matchups will appear if no data type is selected</u>.

Apply and Reset Filters

Once the desired filters are set for the **Date Range**, **Quality and Geometry Metrics**, and **Data Types** sections, click on **Apply Filters**.

- This button will keep track of the current filters in place and will be greyed out while the filters in the panel match the filters that are currently applied.
- If markers get filtered out in a cluster, the cluster number will decrease and the cluster color will change to reflect the missing markers.
- Individual markers will keep their same color unless the filter for the selected gradient statistic is modified.

To reset filters back to their default values, click on **Reset Filters**.

- Please note that the active gradient statistic will not revert to the default *PACE χ^2 mbac*.
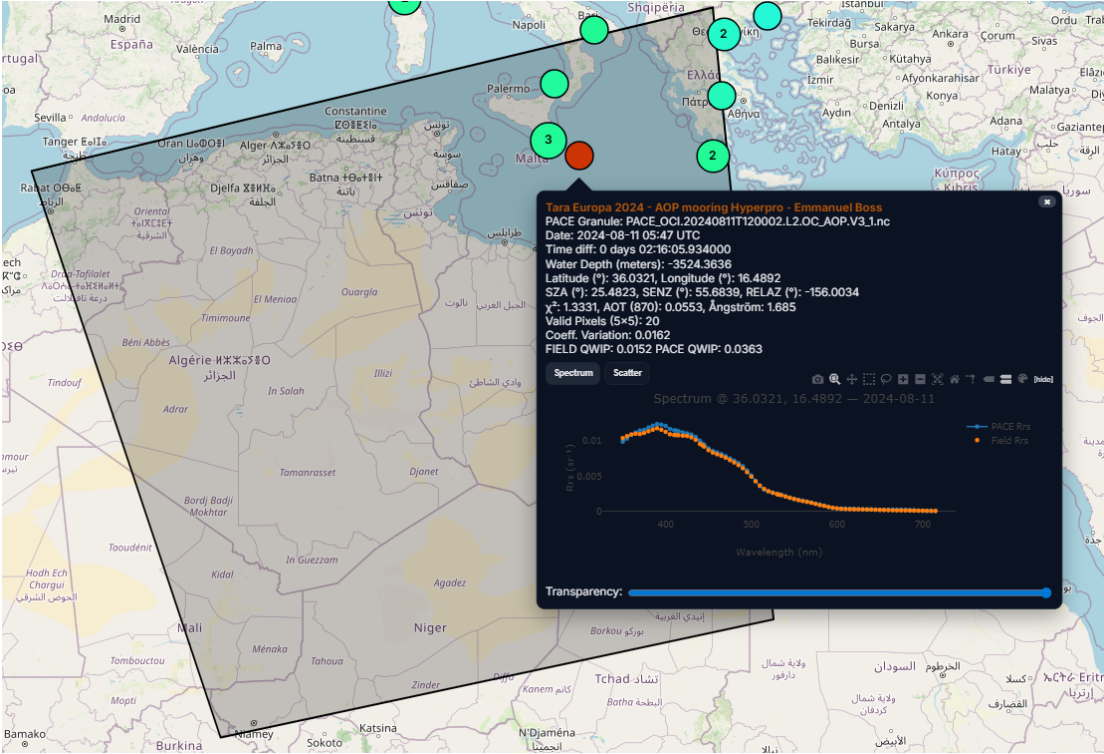- The gradient itself will also remain the same color range.

Markers and clusters
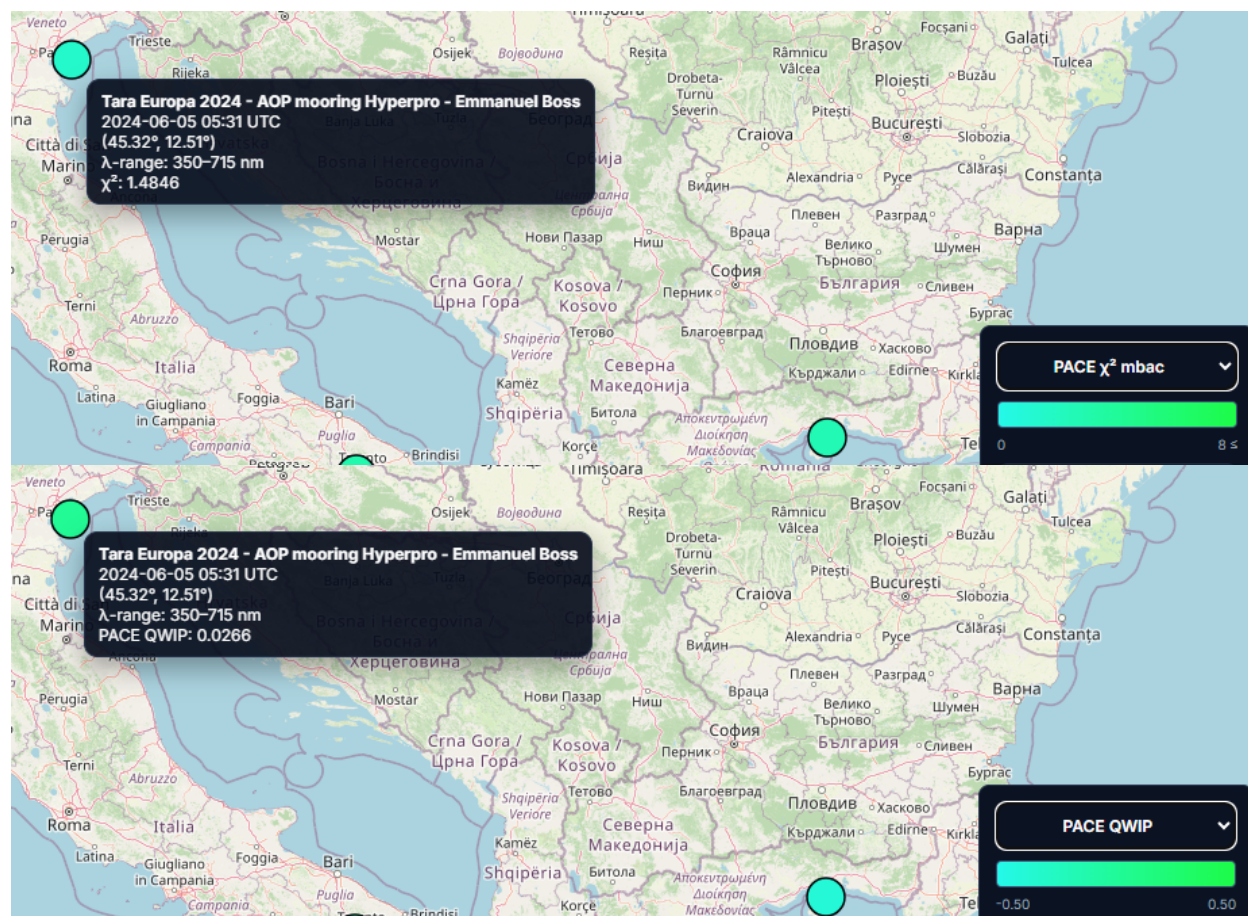
Hovering over a marker will display its name, date and time (in UTC), coordinates, wavelength, and either its *PACE χ^2 mbac* or *PACE QWIP* value, depending on the gradient stat selected.

By clicking on a marker, a popup displaying that marker's information and a translucent black polygon representing the area the granule covers will appear. Users can view both a *Spectrum* and *Scatter* graph associated with the marker. To deselect the marker and remove its popup window and region polygon, click the × in the top right corner.
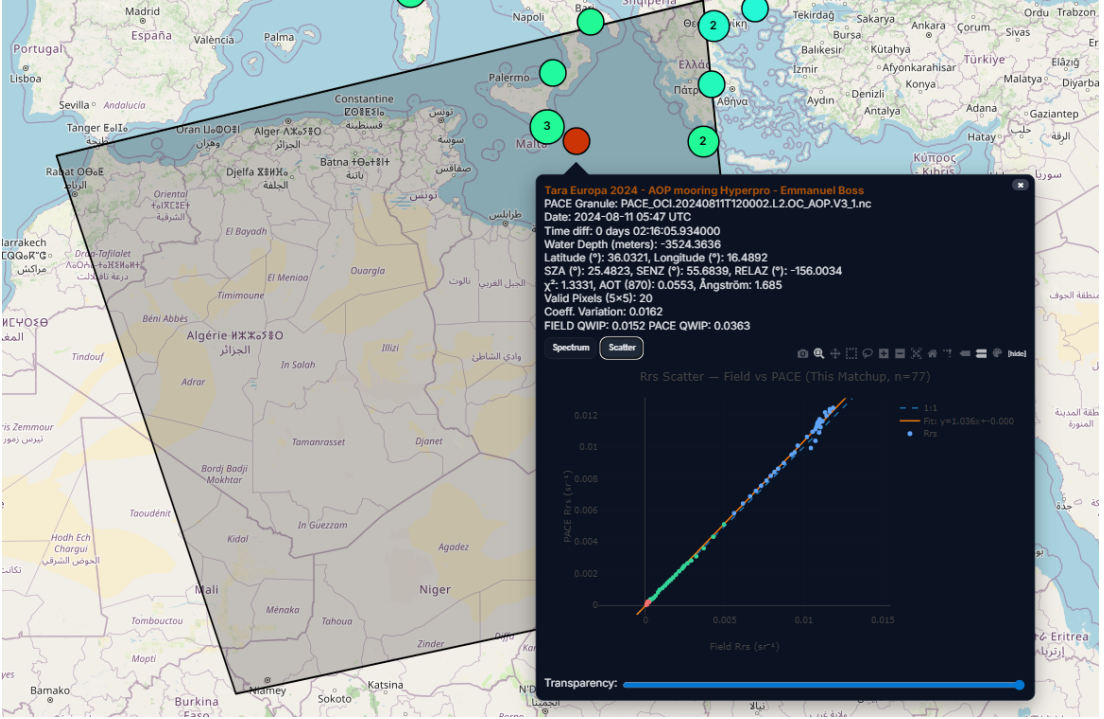- The transparency slider controls the transparency of the popup menu.
- The **[hide]** button will hide the graph from displaying on the interface.

See below for images for what a popup and its graphs look like.

Spectrum Marker Graph:

Scatter Marker Graph:

When a cluster is clicked, a menu appears and provides the list of markers that comprise that cluster. Each marker in the list has the same information shown as if it were being hovered over as a marker (name, UTC date and time, coordinates, wavelength, and gradient stat value). Click on one of the markers in the list to select it and make its region and popup window display.

All-Matchups Rrs Scatter
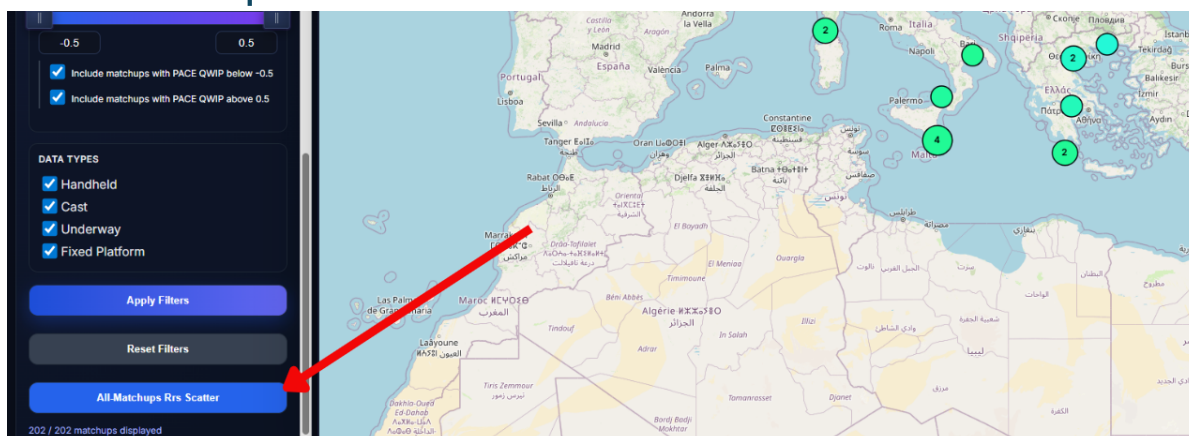
To open the All-Matchups Rrs Scatter graph, select the "All-Matchups Rrs Scatter" button in the filters and control menu on the left. This will open a popup menu that captures the data for all the matchups in the tool and display the results in a scatter plot graph by wavelength, including a 1:1 and best fit lines against the data.

- To specify the wavelength to plot the data against, drag and drop the wavelength slider to the specific value or manually type in the wavelength (between 350-715nm) in the input box on the right of the wavelength slider. Changes in the wavelength will be reflected on the graph with the matchup data.
- By clicking on the same vertical axis that a point lies on, a popup will open of the matchup's *Spectrum* plot.
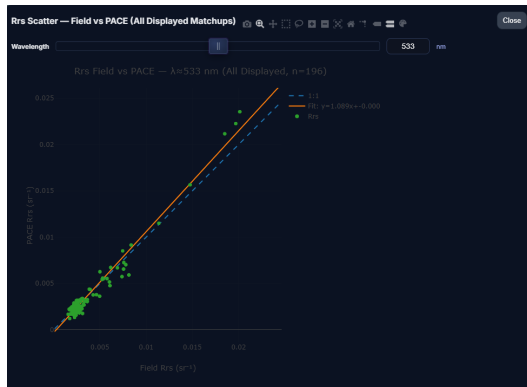
Rrs Scatter Plot: **Rrs Scatter Plot (1:1 and Fit Line off):**

Additionally, you can click on the click on the line and dot legend icons (or its text) next to the graph to toggles on/off that graph's element from displaying. The above example displays only the Rrs plot points on the graph for the matchup data, while the 1:1 and best fit lines have been toggled off from the popup window.

Graph options

By using this sidebar, the user can perform the following for all graphs:

- ⬜ Download the plot as it appears
- ⬜ Zoom in on a rectangular selection
- ⬜ Pan around the graph
- ⬜ Box around a set of points to highlight
- ⬜ Freeform select a set of points of highlight
- ⬜ ⬜ Zoom in and out of the graph
- ⬜ Autoscale the graph (scatter graphs)
  - o Has the same effect as resetting zoom and orientation for spectrum graphs
- ⬜ Reset graph's zoom and orientation
- ⬜ Toggle dotted lines over the point the mouse is hovering over that shows where on the x and y axes it is
- ⬜ Display the information of the point the mouse is hovering over
- ⬜ Display the information of all the points on the x-axis value the mouse is hovering over (active by default)
- ⬜ Recolor graph and graph elements

To reset highlighting, double-click while in box or freeform highlight mode.