

Introduction to Tuva Labs

Using the Damariscotta Buoys

What is Tuva?

Tuva Labs (tuvalabs.com) is a website that lets you manipulate data and create graphs online.

The goal of Tuva is, in their own words:

We're on a mission to make open data useful for teaching and learning by offering teachers, students, and parents a platform to analyze, visualize, and interpret real data around issues relevant to their communities and their interests.

Source: <https://tuvalabs.com/about/>

If you make a username/id, you can import your own data sets into Tuva. Tuva does also have some curated data sets you can use.

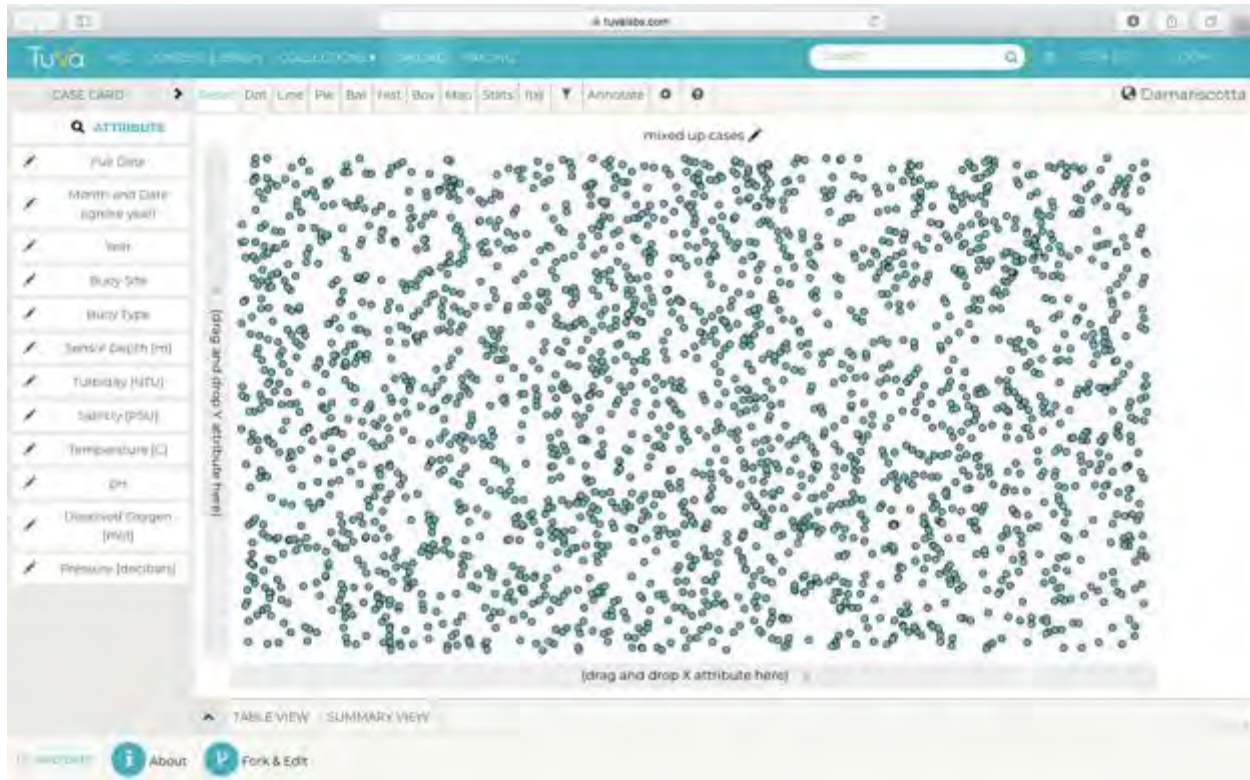
However, while the site is free to use, the free data sets are limited if you do not have a subscription. If you want a paid subscription, we recommend getting one through your school (or organization), since the subscriptions can be quite pricey.

Open a Tuva dataset

You do not need to make a username/id to use Tuva for this kit. You can use all of this buoy data for free.

Click on the following link to open up the Damariscotta Buoy Data in Tuva Labs:
<https://tuvalabs.com/renzibeth/datasets/10ecf99b43e54609a4797e6490559a34/>

You should see something like this:



This file contains data from three buoys in the Damariscotta bay and estuary from 2015 to 2017.

Note: the Tuva website may lag a little because there are so many data points in this file. This is why the buoy data has been separated into three different Tuva files - if the data from all nine buoys were all in one file, your internet would lag quite a bit no matter how good your connection.

What are Attributes?

On the left side you will see a list of water quality characteristics:



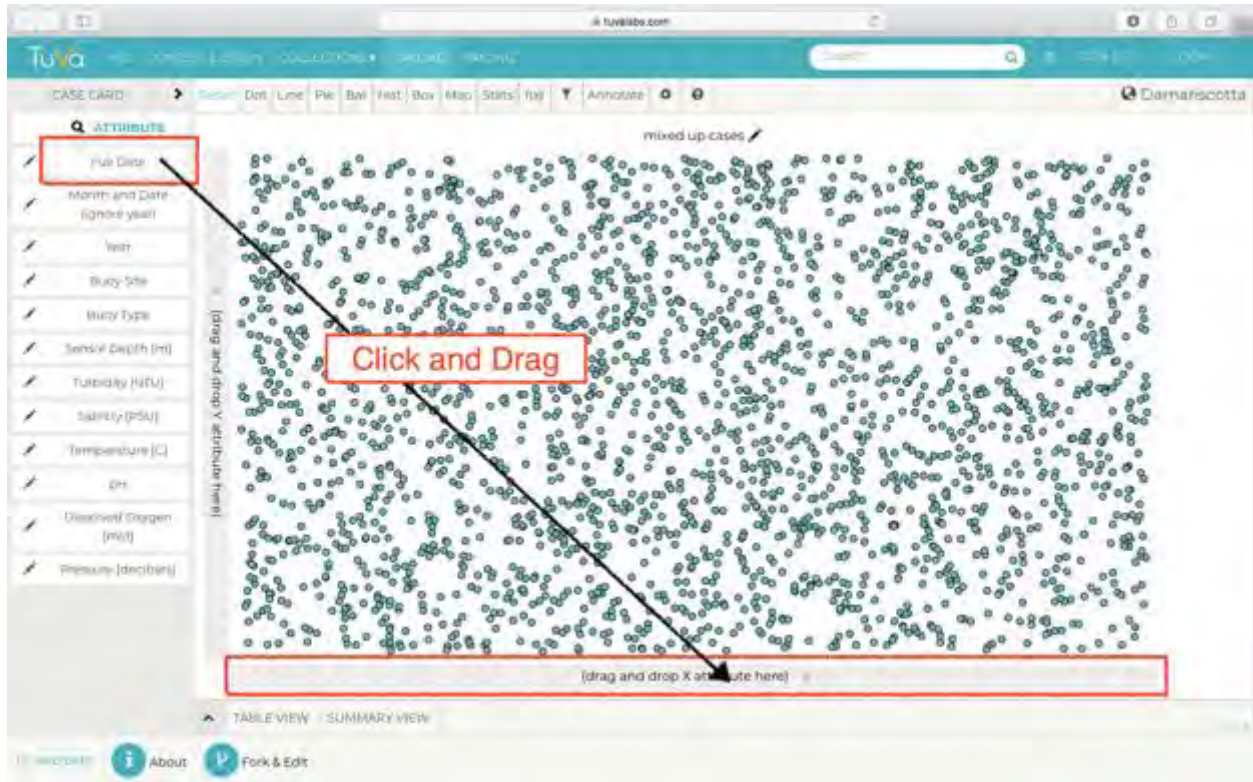
Tuva calls these characteristics 'attributes'.

Note: These datasets have been set up so that the attributes have their units in square parenthesis in the attribute name. For more information about buoys, attributes, and units, [Click here](#).

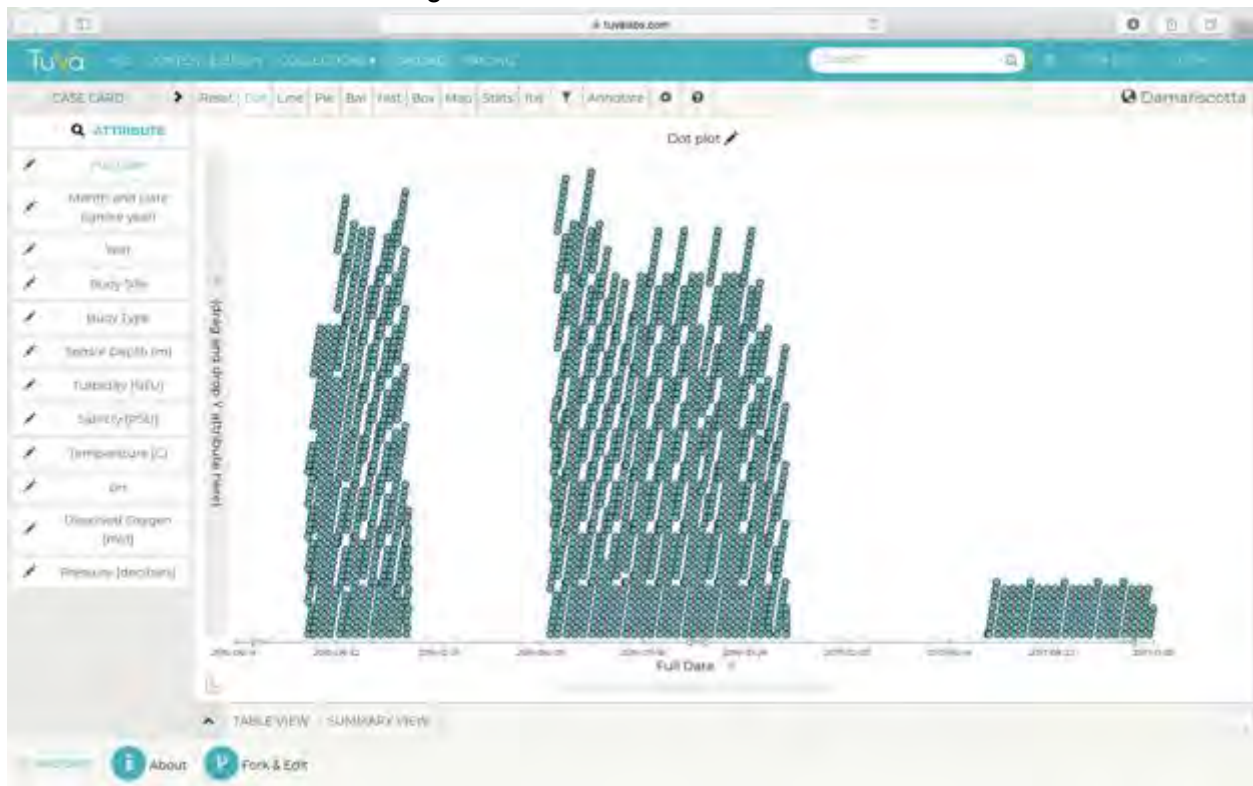
Make a Scatter Plot

First, we will try making a scatter plot.

Click-and-drag the attribute “Full Date” from the left side onto the x-axis:

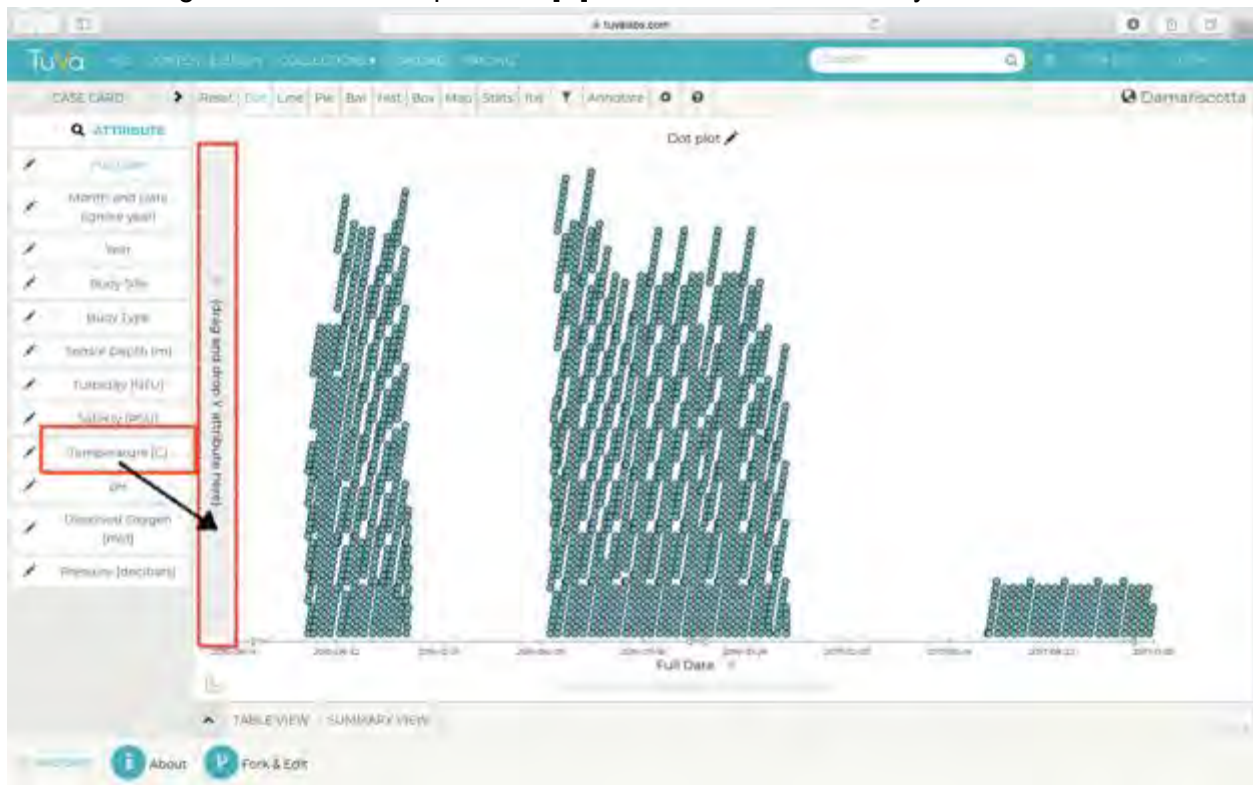


You should see the data rearrange itself to look like this:

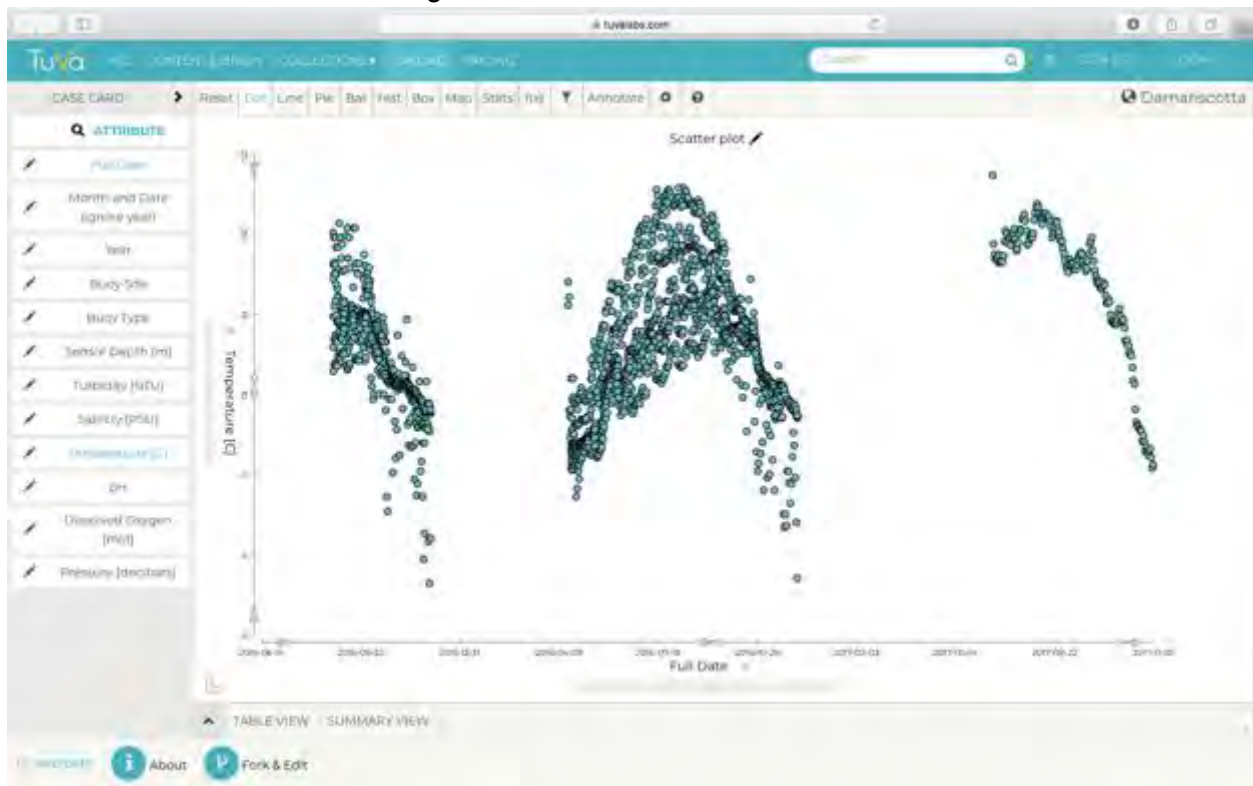


Next we need to put an attribute on the y-axis. Let's use temperature.

Click and drag the attribute "Temperature [C]" from the left side to the y-axis.



You should see the data rearrange itself to look like this:

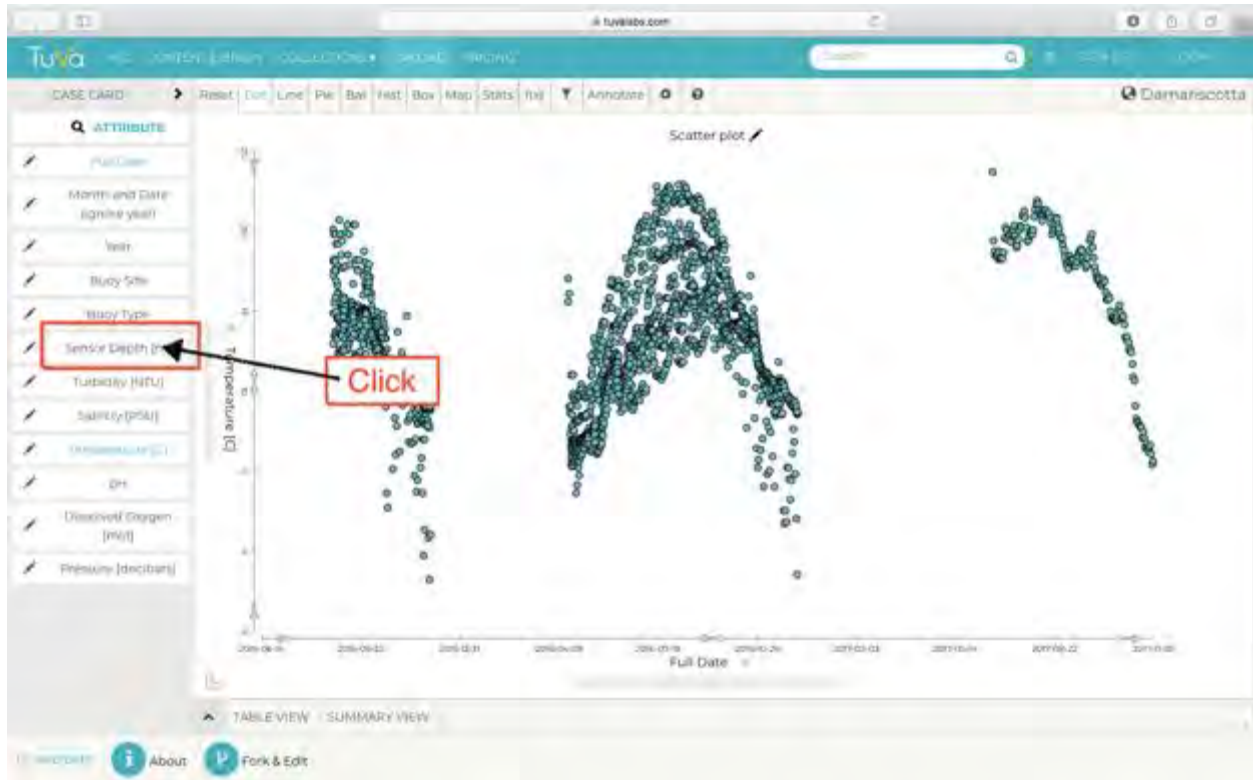


You have now made a scatter plot that shows temperature over time.

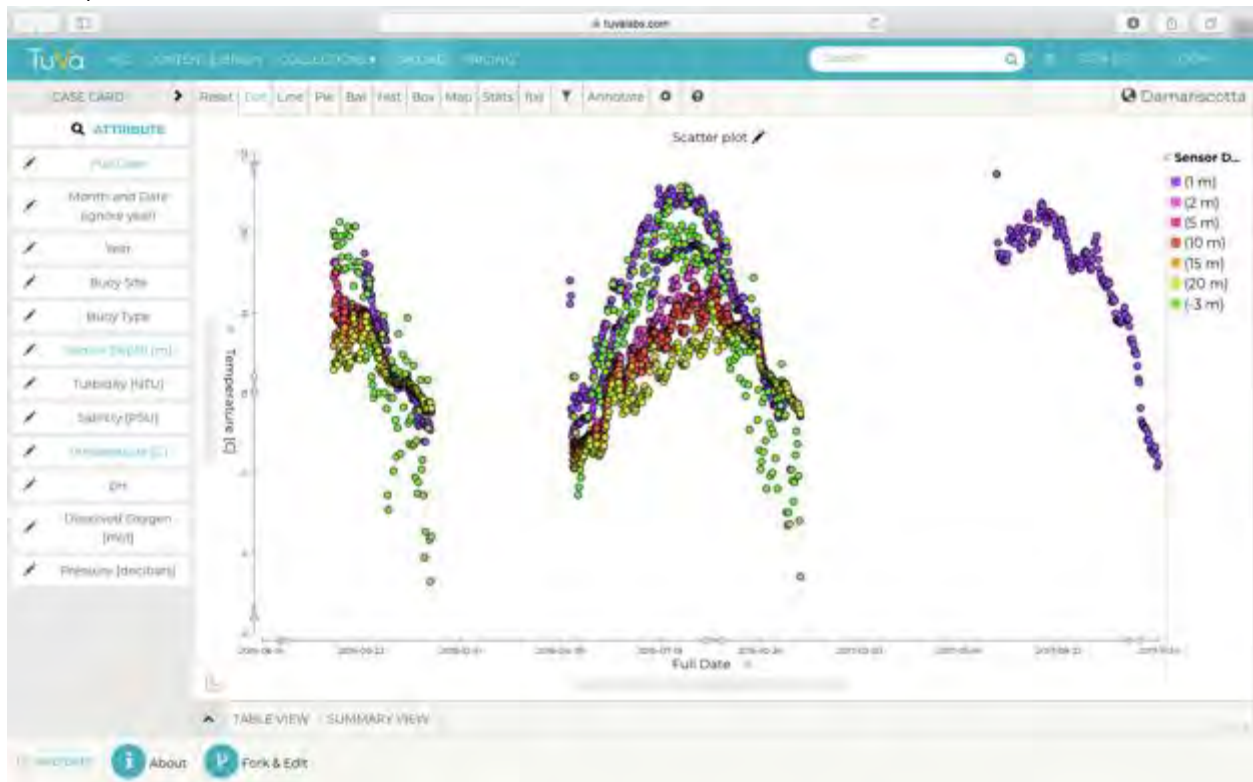
Adding a Third Attribute

You can show a third attribute in a scatter plot by clicking on another attribute. Some attributes have only a few values (these are 'categorical' attributes) - clicking on these will give you a key with multiple colors. Other attributes have a range of values (these are 'numerical' attributes) - clicking on these will give you a key with a color gradient.

Click on the attribute "Sensor Depth [m]". You don't need to drag it anywhere, just click and release.



You should see the data rearrange itself to look something like this (you may have different colors):



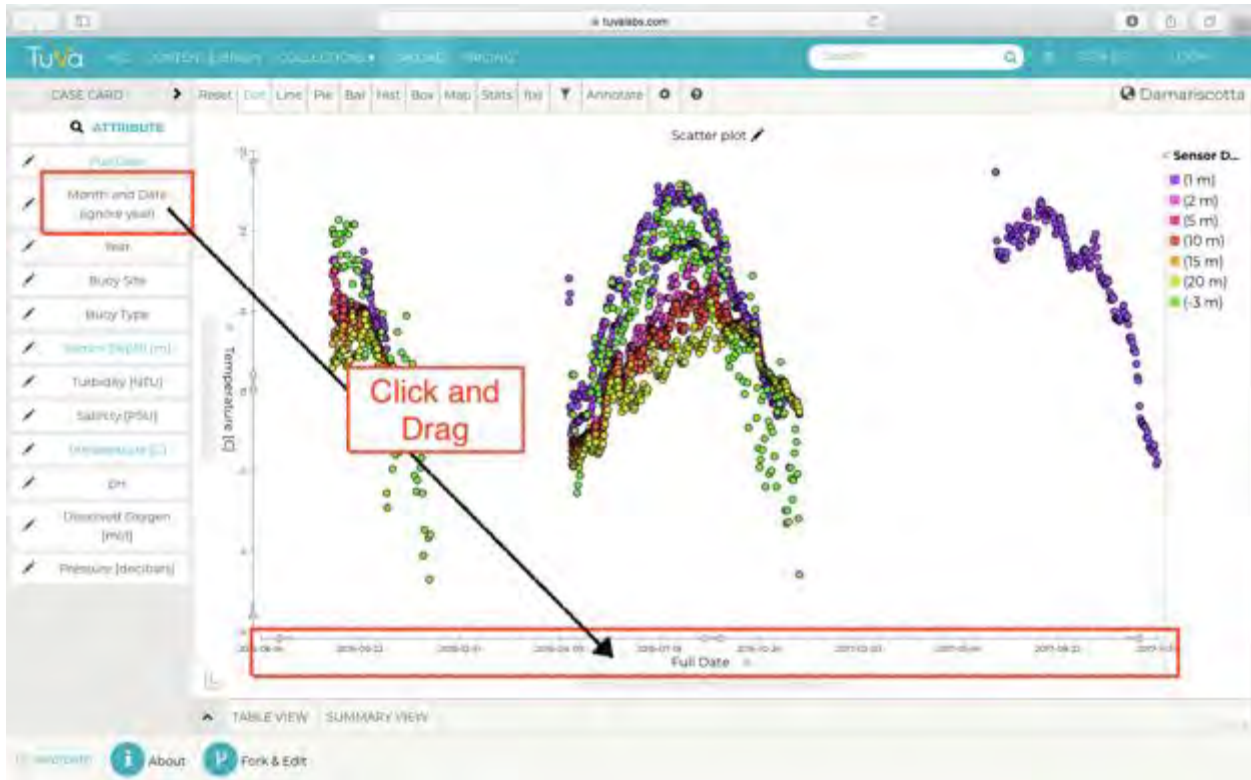
Now, in addition to the temperature value and date of measurement, you can see how deep below the water surface the temperature was measured.

(Optional: If you would like to see a gradient as the third attribute, try clicking on the attribute “Salinity [PSU]”.)

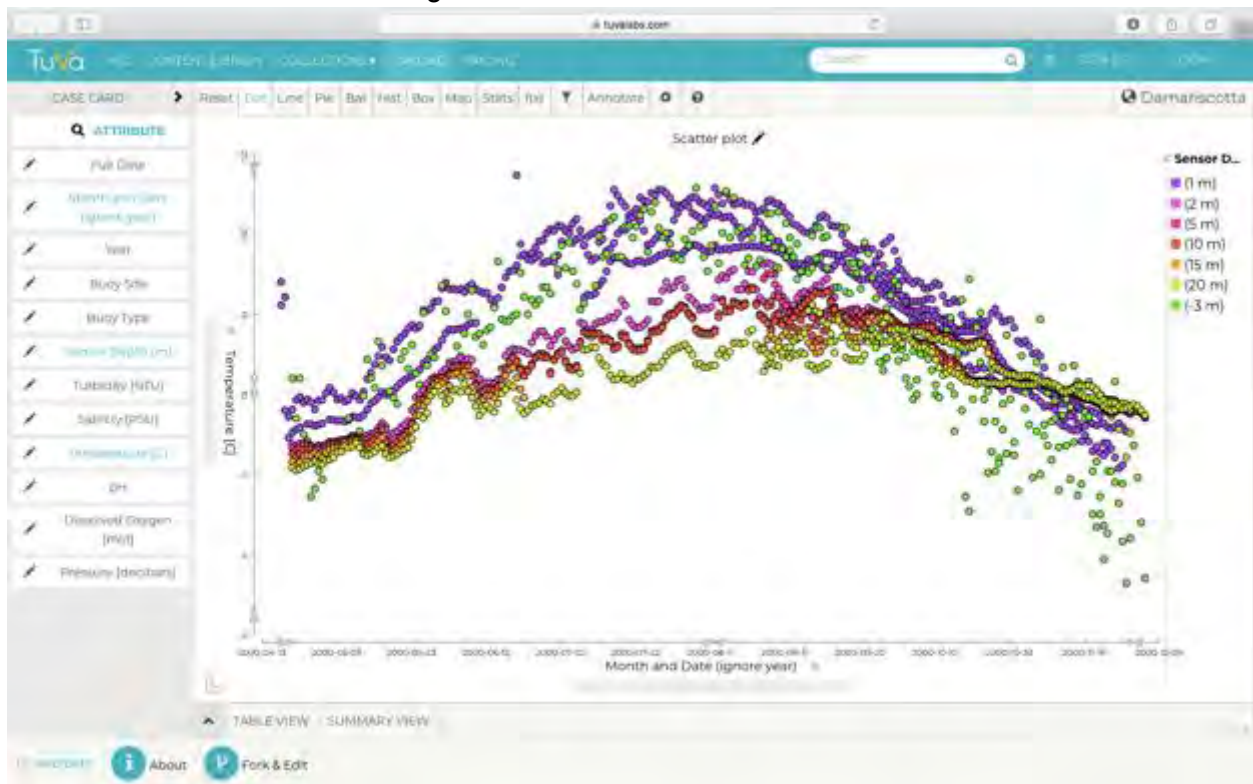
Replacing an Attribute

If you want to change which attributes you are using on the axes, you can do so by dragging a new attribute over the old attribute. (To replace the third attribute - the key - you click on a different attribute.)

Let's use the Month and Date attribute to see the data arranged by the day of the year it was taken, rather than over a three year period. Click on the attribute "Month and Date (ignore year)" and drag it over the x-axis.



You should see the data rearrange itself to look like this:

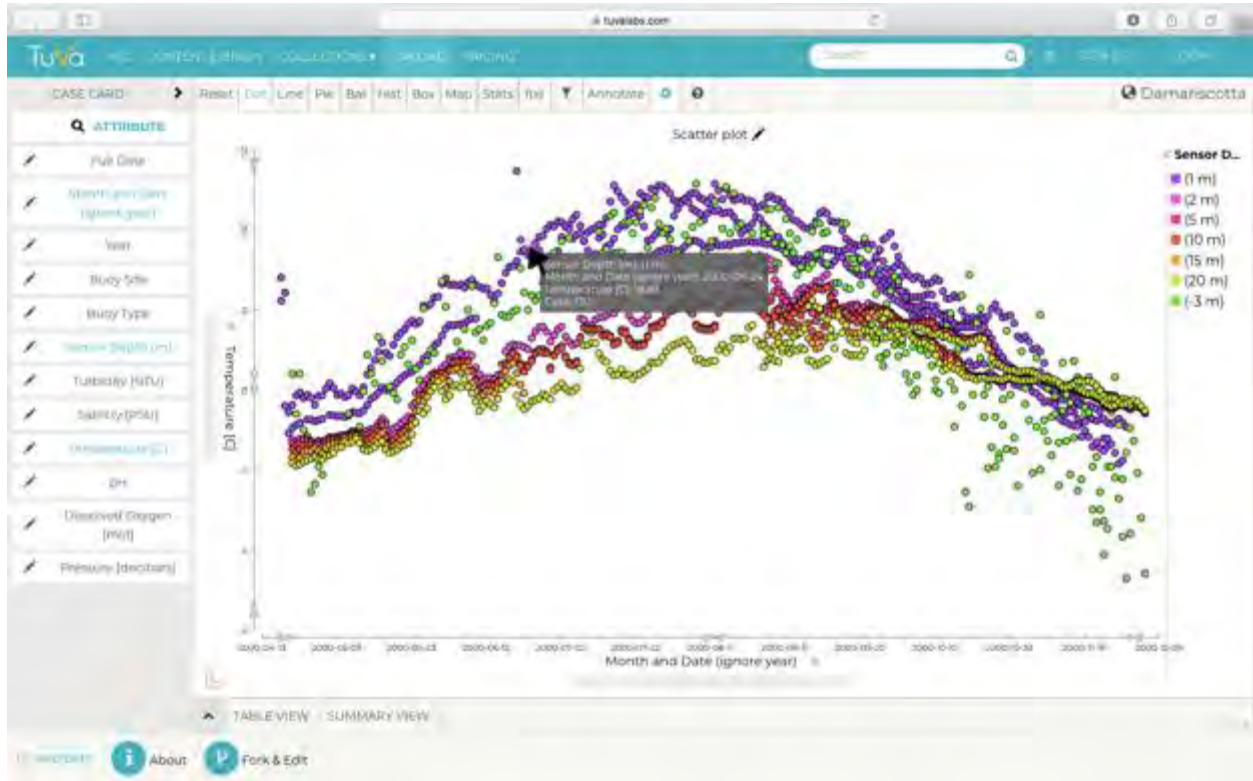


Note: while the Month and Date attribute includes a year, please ignore that year. The data is not actually from the year 2000. When the data was entered without a year it did not function properly in Tuva. If you would like to see which year the data are from, click on the attribute "Year".

Show All the Data

Pop-up Box

Hovering your mouse over a point on the graph will cause a box to pop up that tells the data for that point. Here is an example:



Note: the screen cap made the mouse invisible, so we tried to recreate it. It might look slightly different in reality.

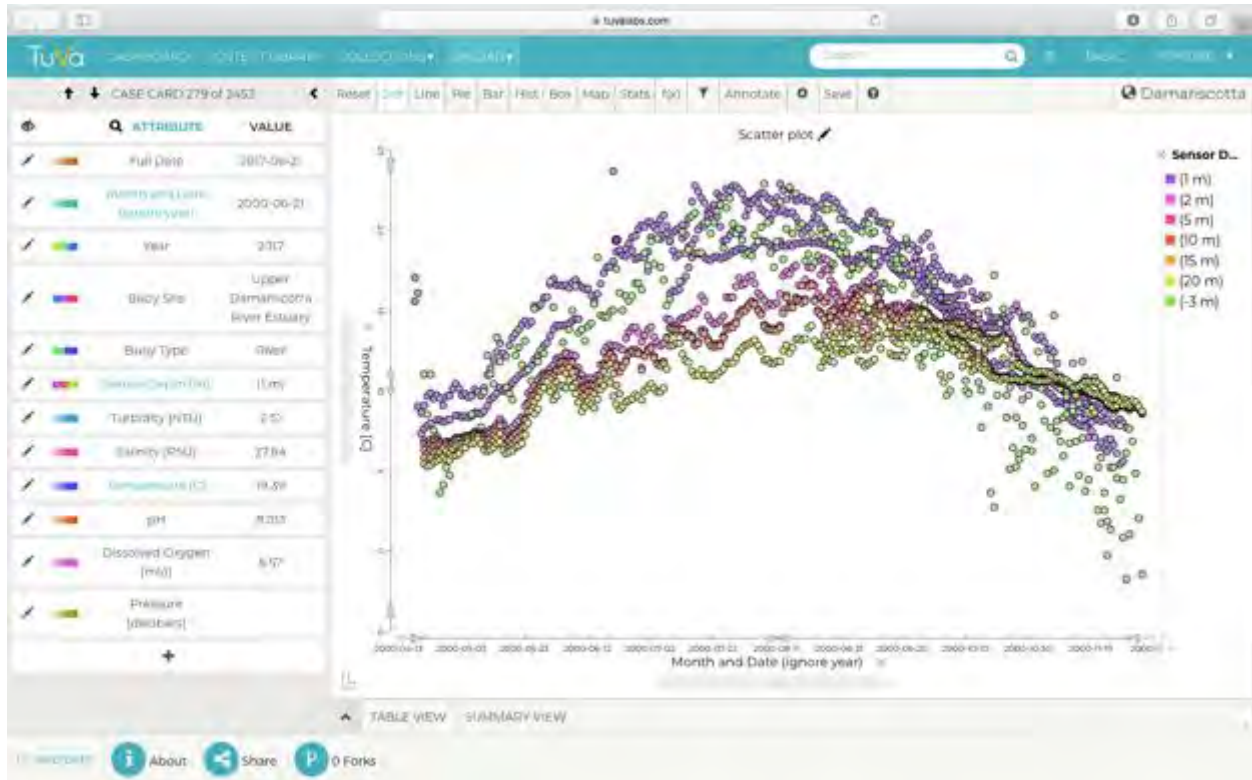
You will notice that the box only shows the attributes you have selected for your graph. This particular box shows the month and date, the temperature, the sensor depth, and the case number (a number assigned by Tuva to uniquely identify each data point, which always shows up in the box with your chosen attributes).

Case Card

A way to see all the data for a single point is the “Case Card”.

If you click on a point, that point will be selected, and all other points will be lightened (or ‘greyed’ out a little bit). The left side will also expand and show each attribute value for that point.

Here is an example of the Case Card for one of the purple points:



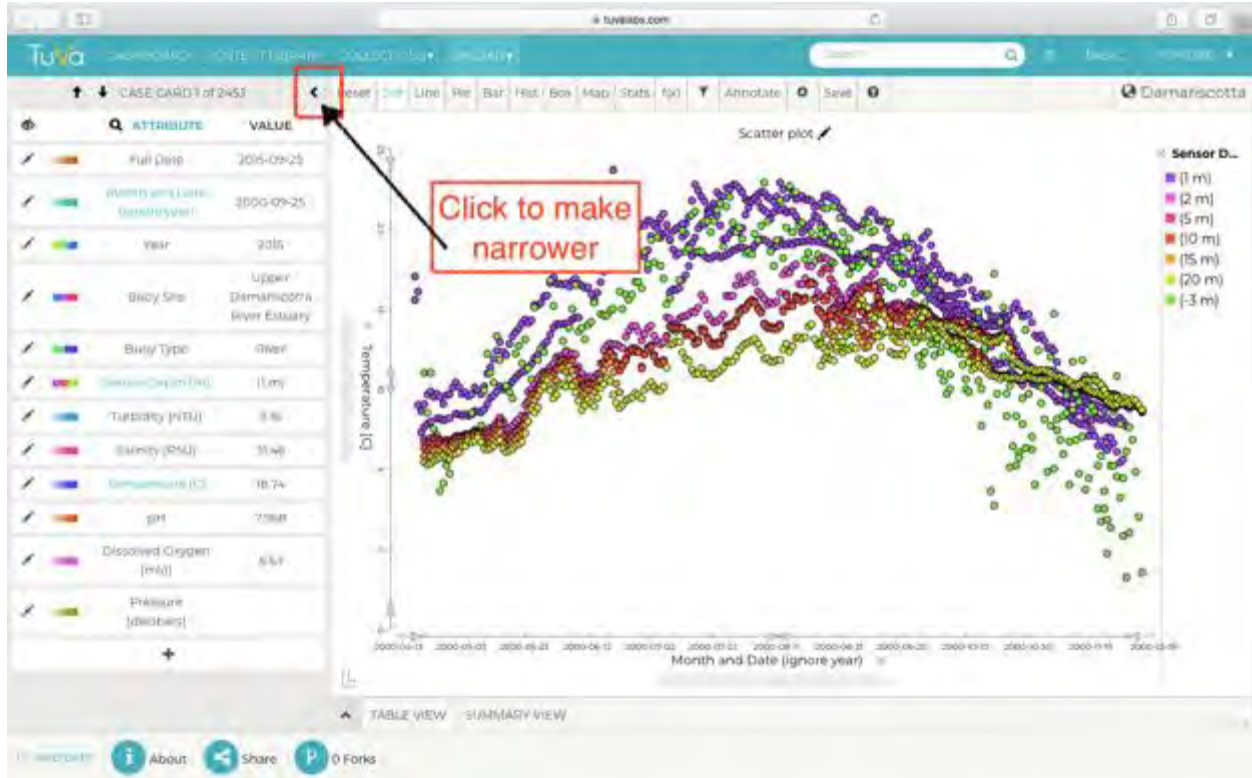
Note: you may notice that this point/case does not have a value for “Pressure [decibars]”, which is the attribute at the bottom of the attribute list. There are two types of buoys, and the two types do not all measure the same data. For more information on which type of buoy measures which water quality characteristics, [Click here](#).

You can deselect the point by clicking on empty space (the white parts of the graph). All points should be brightly colored again, though the Case Card may continue to display the data for that point.

Changing the Width of the Left Side / Attribute List

At this point, your left side is probably wider than it was before.

If you want your left side to be the narrower list of attributes again (it is your preference), you can do so by clicking on the sideways arrow (<) next to “Case Card ### of ###”.



If you want to go from the narrower to the wider left side, click the sideways arrow (>) next to “Case Card”.

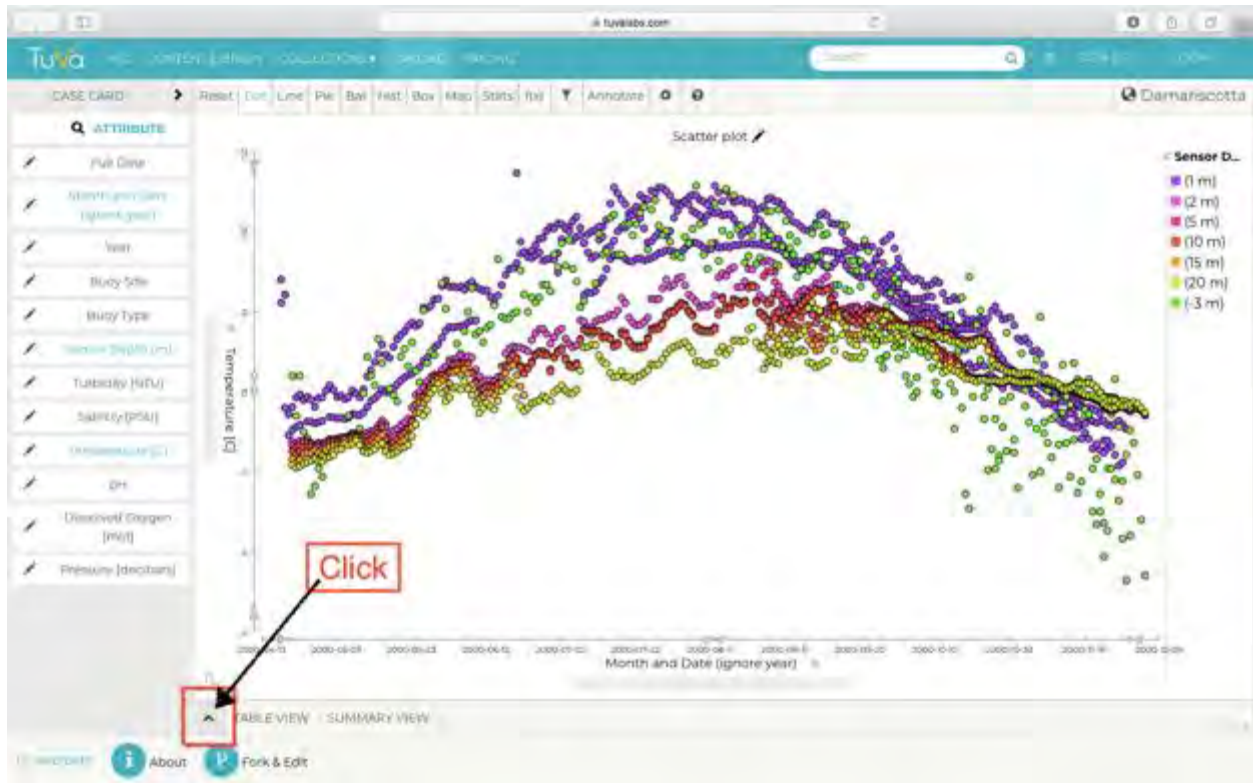


Note: the pictures in this guide mostly have the narrower version of the left side (attribute list). If you see the wider version as you are using Tuva, that does not mean that you have done something wrong. Again, the view is your choice. The narrower version makes the graph portion a bit bigger, while the wider version shows a bit more data. Try both and use whichever you like.

Table View

If you would like to see even more of the data in the Tuva file, you can do this by looking at the Table View. This will show an Excel-style table below the graph.

To see the Table View, click on the upward arrow (^) next to “Table View” at the bottom of the window.

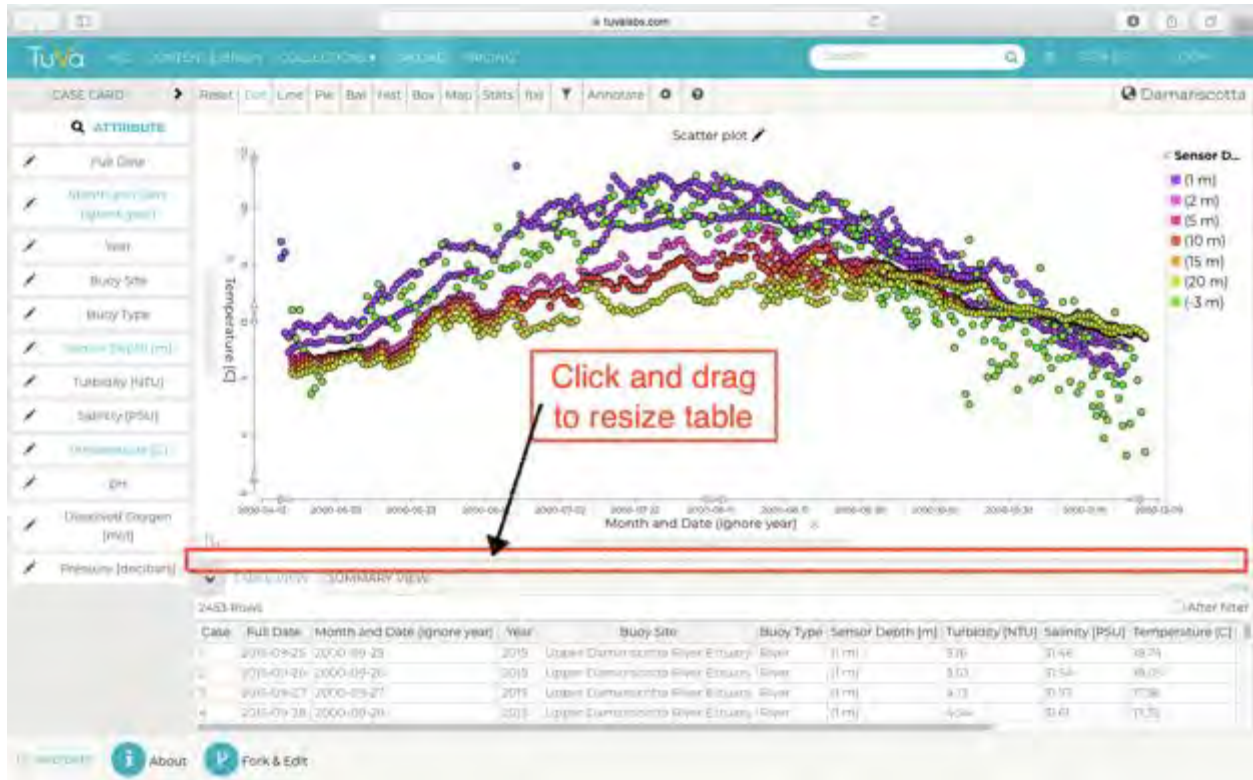


When the table pops up you should see something like this:



You can scroll through the table by hovering your mouse over it and using the scroll wheel, or by using your mouse to drag the scroll bars around.

You can make the table bigger (and the graph smaller) by clicking and dragging on the grey boundary between the table and graph.



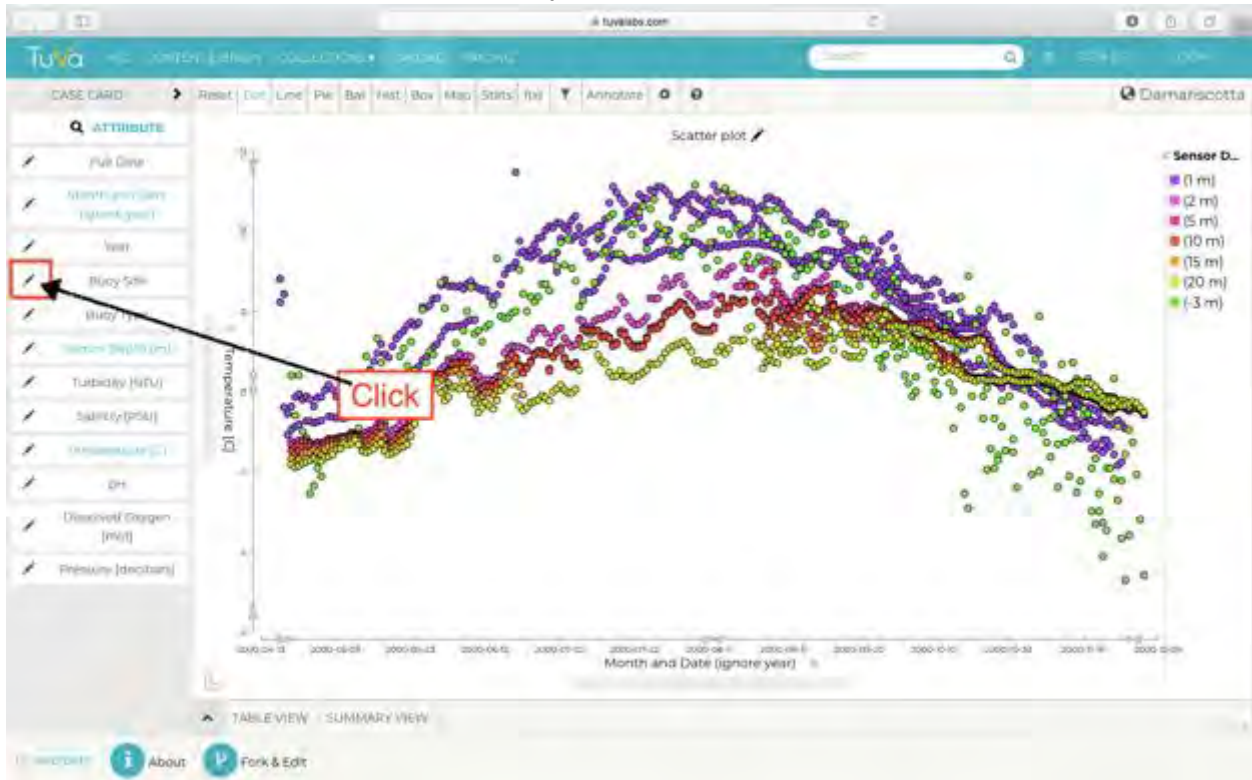
To hide the Table View, click on the downwards arrow (v) next to "Table View".

Filter Data

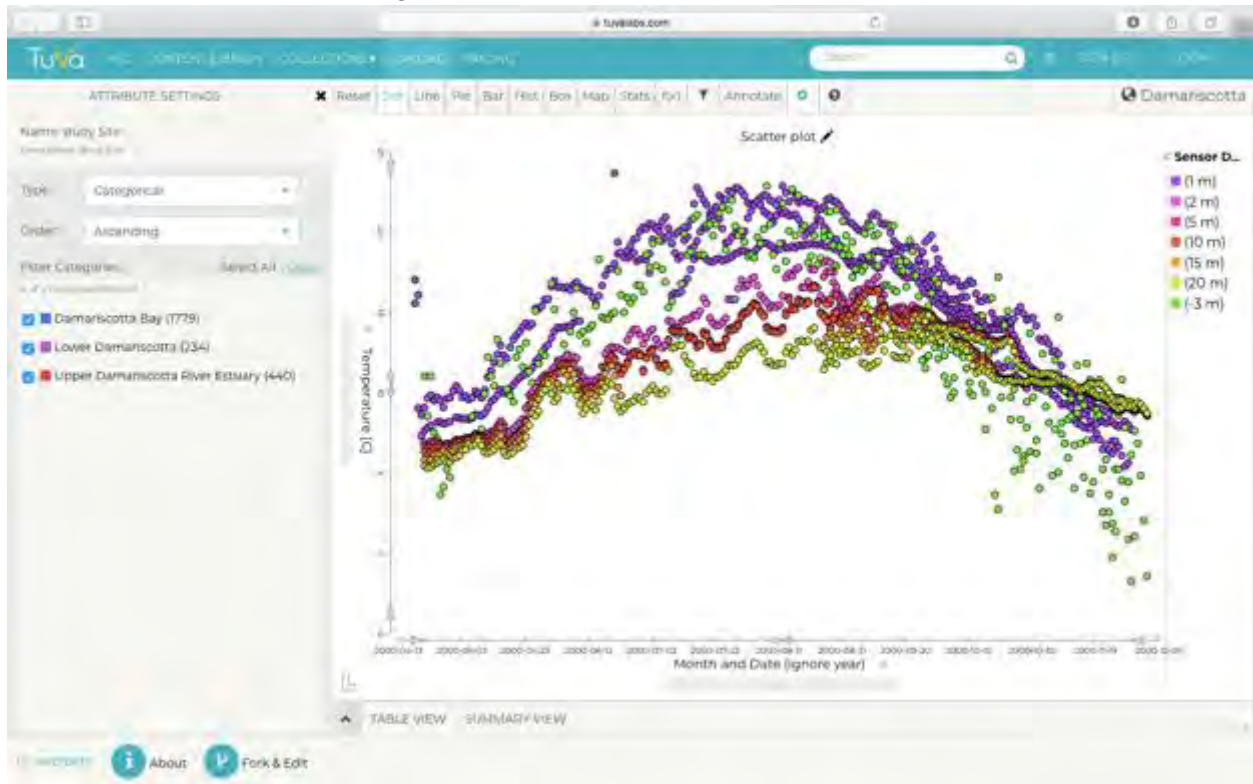
You can use filters to limit the data that is displayed in the graph. You can filter based on the numerical range of an attribute or based on the category of an attribute. We will show how to do both.

First, let's filter the data so that we see data from the buoy in Damariscotta Bay but not the two buoys in Damariscotta River.

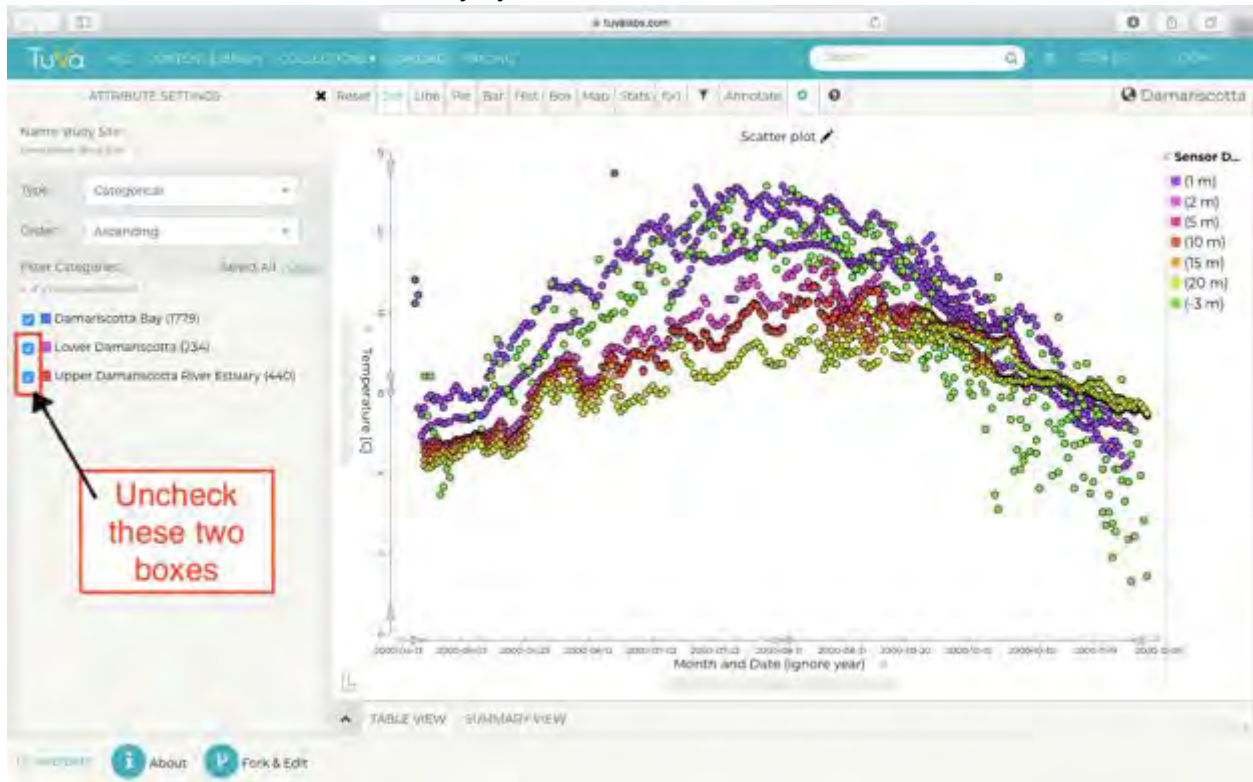
Click on the pencil button next to the "Buoy Site" attribute.



The left side of Tuva will change to look like this:

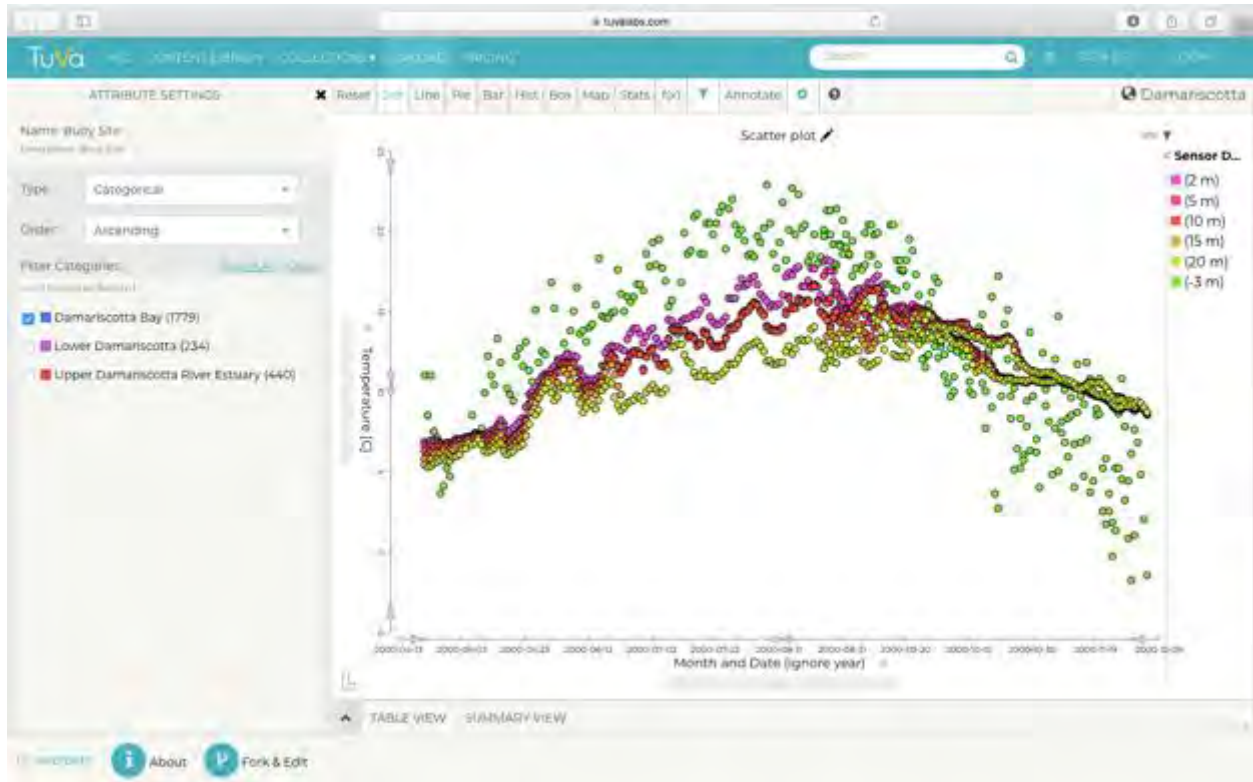


Uncheck the boxes next to the buoys you don't want to see:



The data from those buoys will be hidden, leaving you with a graph that looks like this:

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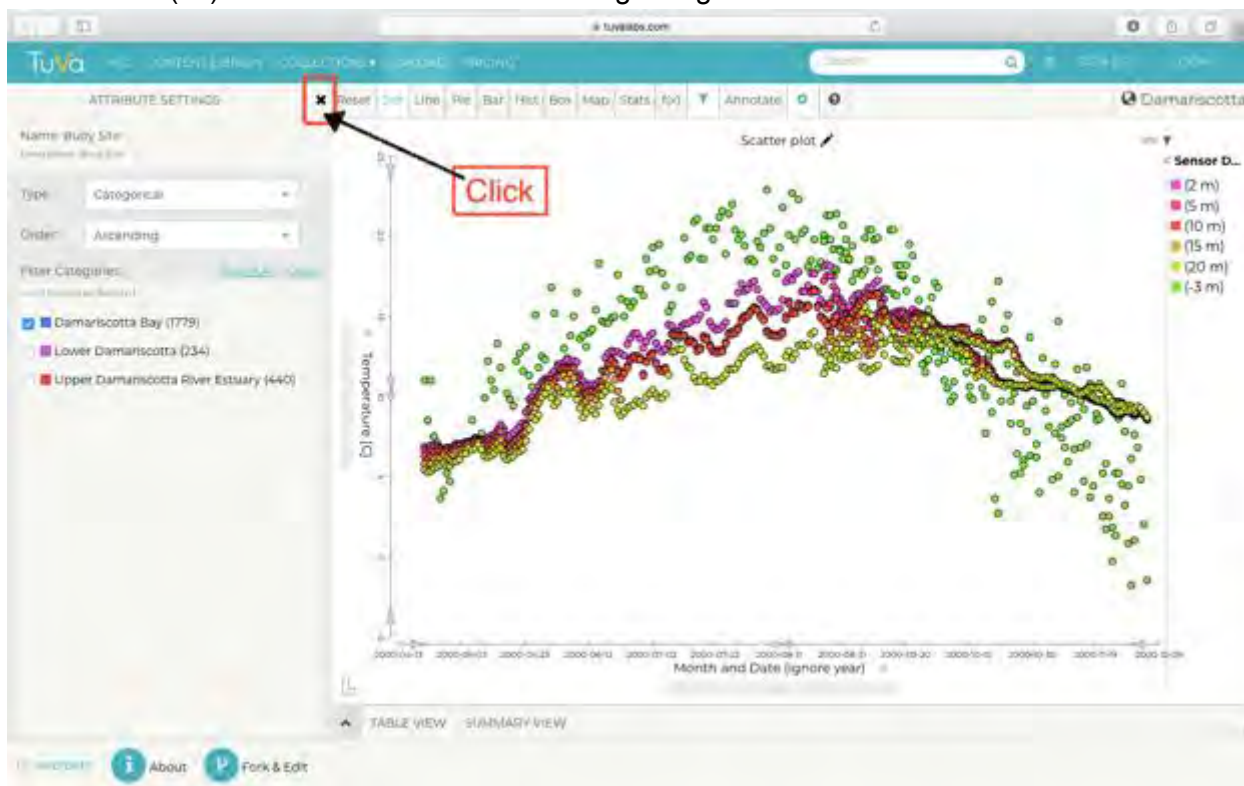


You are now seeing only the temperature data from the ocean-type buoy in Damariscotta Bay.

You may notice by looking at the sensor depth key on the right that “(1 m)” is no longer there - this is the depth of the river buoy temperature sensors; ocean buoys do not measure temperature at 1 m.

Now let’s filter the numerical range of the temperature data that is shown in the graph.

Click on the (x) button next to “Attribute Settings” to get back to the list of all attributes:



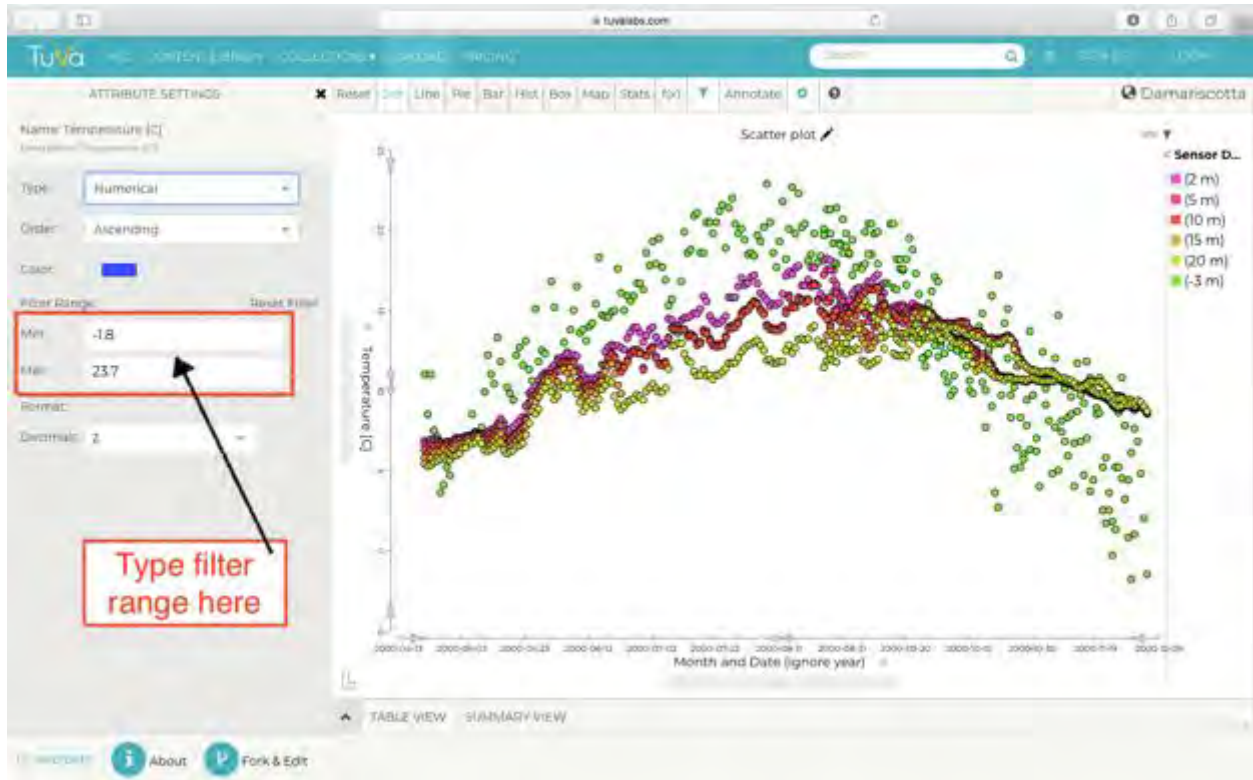
Remember, the pencil button gets you to the attribute filter, the x button gets you back to the list of all attributes.

The attribute menu will probably be wider than it was before. This is normal. (If you want the narrower menu, click the sideways arrow (<) next to “Case Card for ### of ###”.)

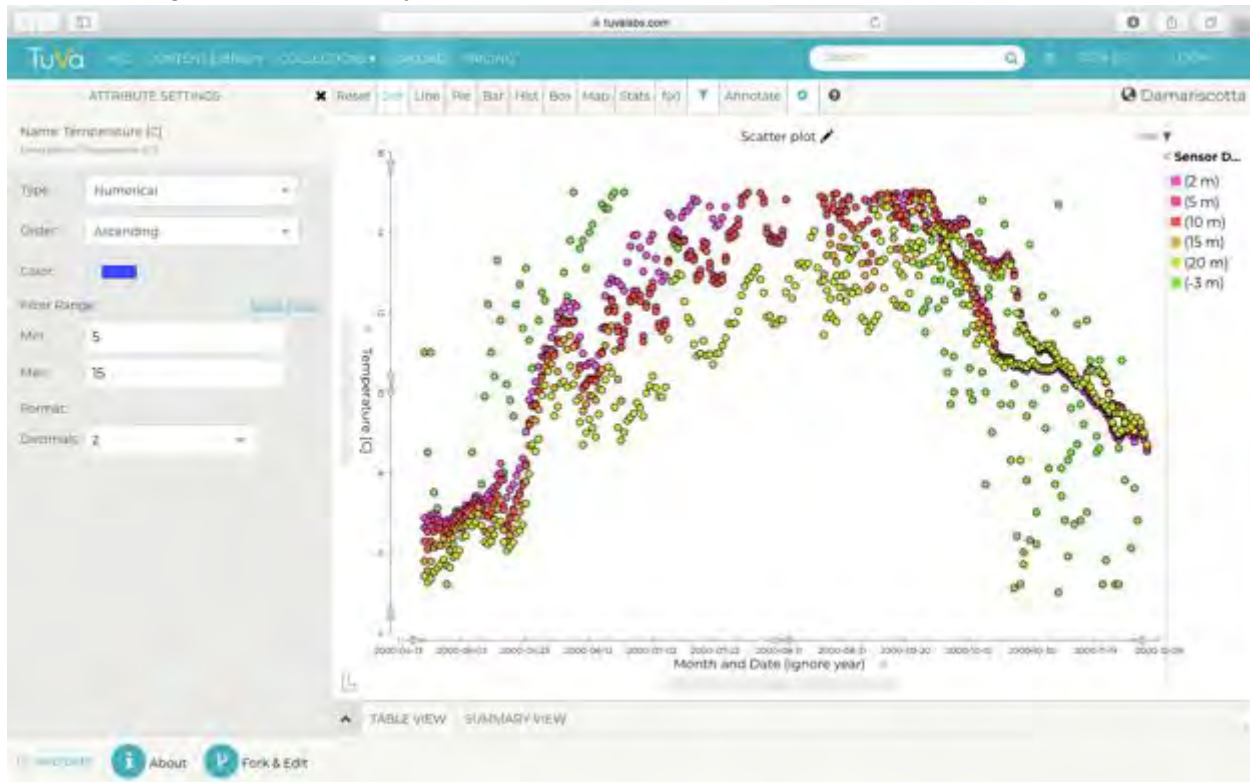
Now click on the pencil next to the "Temperature [C]" attribute:



Say you only want to see temperatures between 5°C and 15°C. Type these limits into the “Min” and “Max” boxes. To make sure the filter values have been entered, we recommend that, after you have typed the filter value, you hit the “return/enter” key on your keyboard or click in the grey area outside of the filter on the left side.



After entering the new values, you should see:

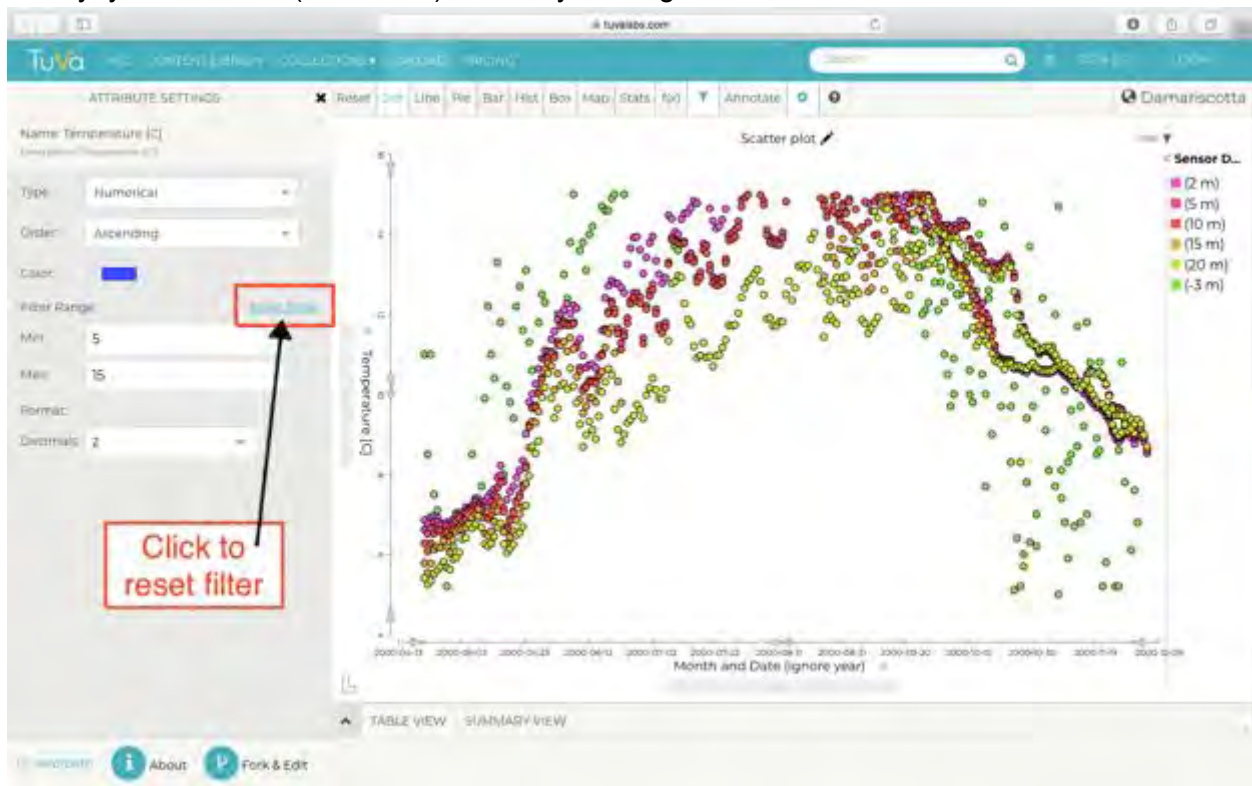


You may notice that the y-axis automatically adjusted to zoom in on the now-filtered data.

You can also change the y- and x-axis scales by dragging the grey arrows along the axis.

Note: We find filtering data to be an easier method than manually adjusting the axes with the arrows. Mostly because whenever we make a change to the graph (e.g. replacing an attribute, flipping axes), we need to redo our changes to the axes. We prefer to filter out the points we don't want so that the graph automatically zooms to show us the points we do want. Please try both methods, and use the one that you like best.

Finally, you can reset (or remove) a filter by clicking the “Reset Filter” link, like so:

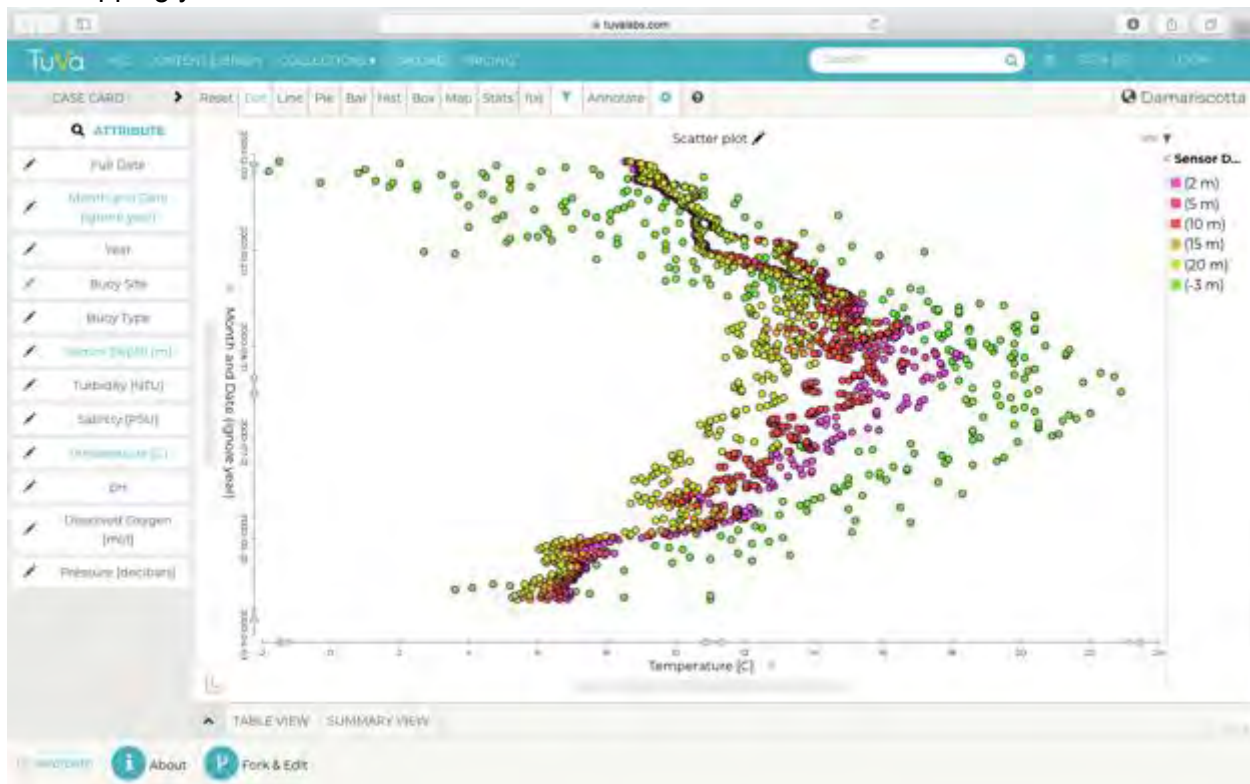


Flip the Axes

If you want to flip your attributes so that what was on the y-axis is on the x-axis and vice versa, you can do so by clicking the axis-flipping button:



After flipping you should see:



Explore!

Now you have a basic idea of some of the things you can do with Tuva.

We think you are ready to explore a little bit.

Here are some things you might want to try:

- Try using the other attributes.
- Try using the other graph types.
 - Click on the “Dot”, “Line”, “Pie”, ... buttons along the top to change the graph type. (You may need to click in a drop down menu to actually change to that type of graph.)
 - Use the Graph Choice Chart if you are having trouble deciding which graph is best for you. The Graph Choice Chart can be found here: https://tuvalabs.com/static/documents/Graph_Choice_Chart.pdf
- Try having multiple attributes on a single axis (drag the new attribute onto the (+) box next to the current axis)
 - Note: some combinations of multiple attributes do not work. Try different combinations until you find one you can use.

- Compare a variable for one buoy over multiple years (use Month and Date, not Full Date). Do the same things happen at the same time of year each year? Why or why not?
- Can you find the effects of any storms in the data? (Hint: yes, you can.) What was the weather event and are you seeing the expected changes in the data?
- Can you find any data that may be wrong? (Hint: yes, you can. There are instances where some of the sensors clearly are not functioning properly.) How can you tell if you are getting bad data? *Note: this may be easier to do after you have learned about each water quality characteristic, and are more familiar with expected data values.*

Remember: explore, have fun, and if you get really confused you can always click the “Reset” button (next to “Dot” at the upper left of the graph) to start over.

Other Tuva Data

You have been using the data from the three Damariscotta River buoys during this introduction. The Tuva links for the data from all of the buoys are provided bellow.

About the Data

Data was collected by SEANet and EPSCoR at the University of Maine. Data were collected in 2015, 2016, and 2017.

Two kinds of buoys were used. An ‘ocean’ buoy collects data at multiple depths. A ‘river’ buoy only collects data near the surface of the water, but does collect a wider variety of water quality characteristics than an ocean buoy.

[Click here](#) to see a Google Doc that explains more about the buoy types, data, and units you will see in these Tuva files.

Damariscotta Buoys

Three buoys: 1 ocean buoy and 2 river buoys

<https://tuvalabs.com/renzibeth/datasets/10ecf99b43e54609a4797e6490559a34/>

Saco Buoys

Two buoys: 1 ocean buoy and 1 river buoy

<https://tuvalabs.com/renzibeth/datasets/521994ddcab94910b8d66cf3bfda005b/>

Other Buoys

Bagaduce River: 1 river buoy

Casco Bay: 2 river buoys

Wood Island Harbor: 1 river buoy

<https://tuvalabs.com/renzibeth/datasets/79f265e4817d4f269827e5d1790eae27/>

All Buoys

Note: this is a **large** Tuva file. You will (almost) certainly experience some lag. We recommend using one of the other three Tuva files (found above), or, if you really must see all nine buoys at once, a *very large* dose of patience.

Damariscotta Bay: 1 ocean buoy and 2 river buoys

Saco Bay: 1 ocean buoy and 1 river buoy

Bagaduce River: 1 river buoy

Casco Bay: 2 river buoys

Wood Island Harbor: 1 river buoy

<https://tuvalabs.com/renzibeth/datasets/f15ad0f86ac24b1f9b90c9c8ac02c869/>