

Exercise 3: Query, Visualize, and Edit Data Using ODM Tools

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Objectives

In this exercise you will learn how Query, Visualize, and Edit data in an ODM database using the ODM Tools software.

Prerequisites

The computer that you will be using in today's exercise was set up ahead of time for the workshop. It has all of the software that you need to complete the exercises.

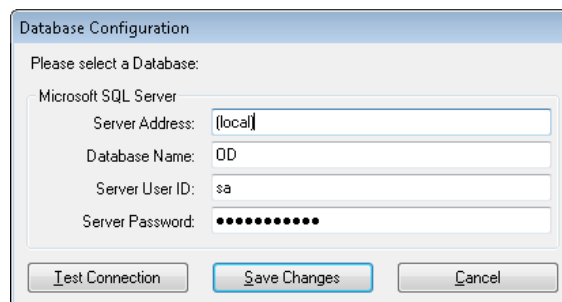
To complete this exercise on your own computer, you must install the ODM Tools software and have completed Exercises 1 and 2 so that you have an ODM database set up with data loaded.

Visualize and Manage Data in the ODM Database Using ODM Tools

Now that you have loaded some data into your ODM database, you can use ODM Tools to do some quick visualizations and manage your data. In this exercise we will use ODM Tools to examine the contents of your ODM database.

To examine the data you just loaded using ODM Tools:

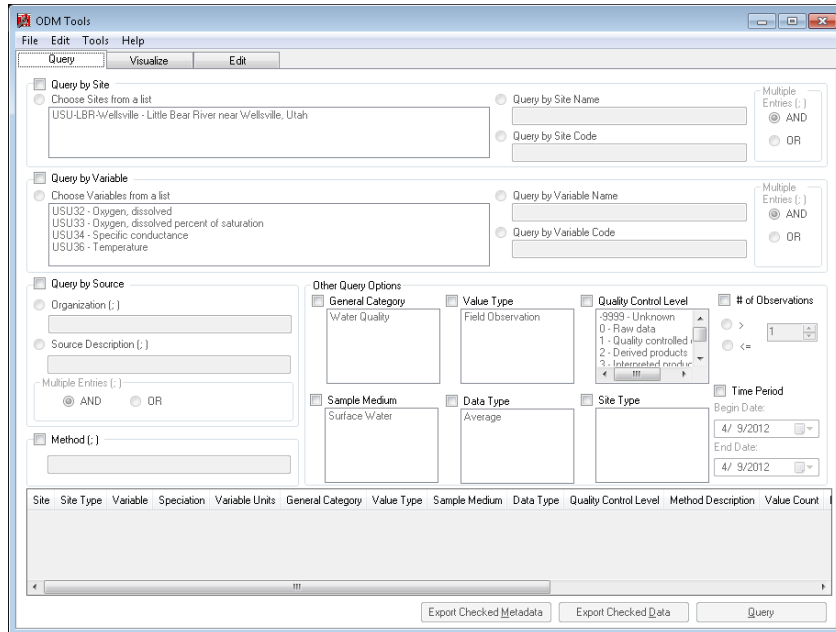
1. Open ODM Tools by clicking Start → All Programs → CUAHSI HIS → ODM Tools 1.1.3. The ODM Tools "Database Configuration" window will open. Enter the connection information for your ODM database (see the previous exercises). When your window looks like the following, click the "Save Changes" button. Click "OK" on the Successful Connection window that pops up.



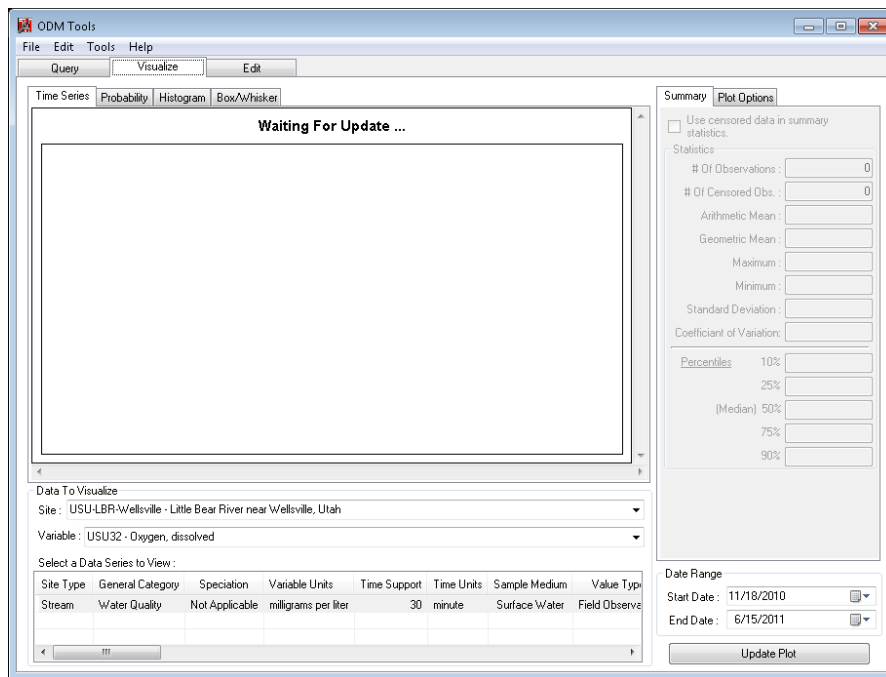
2. The ODM Tools application will now open with three tabs visible: Query, Visualize, and Edit. The Query tab is selected by default. On the Query tab you can specify various filters to search for time series in your ODM database. You can then select them for export to your local disk.

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This is handy when you have a large ODM database with many data series and you want to quickly export one for use in your favorite data analysis software like R or MATLAB.

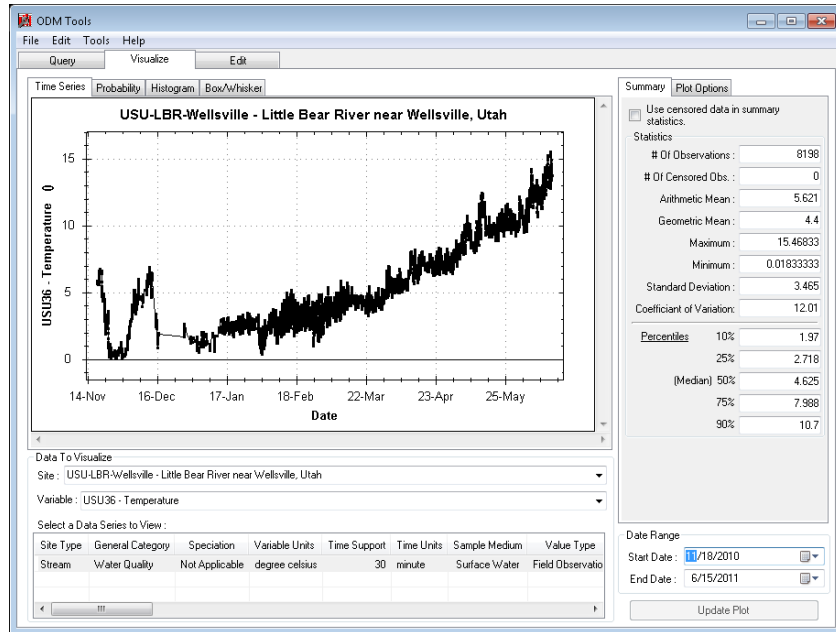


3. Since your ODM database only has a small number of data series, the Query tab isn't that interesting, so we will skip to the Visualize tab. At the top of the ODM Tools window, click on the Visualize tab. Your window should now look like the following:



4. At the bottom of the window you can specify what you would like to be shown in the plot window. For now, we have only loaded data for one site and one or more variables at that site.

Select one of the variables that you loaded in the “Variable” drop down list and click the “Update Plot” button. You should now see a time series plot of the selected variable.

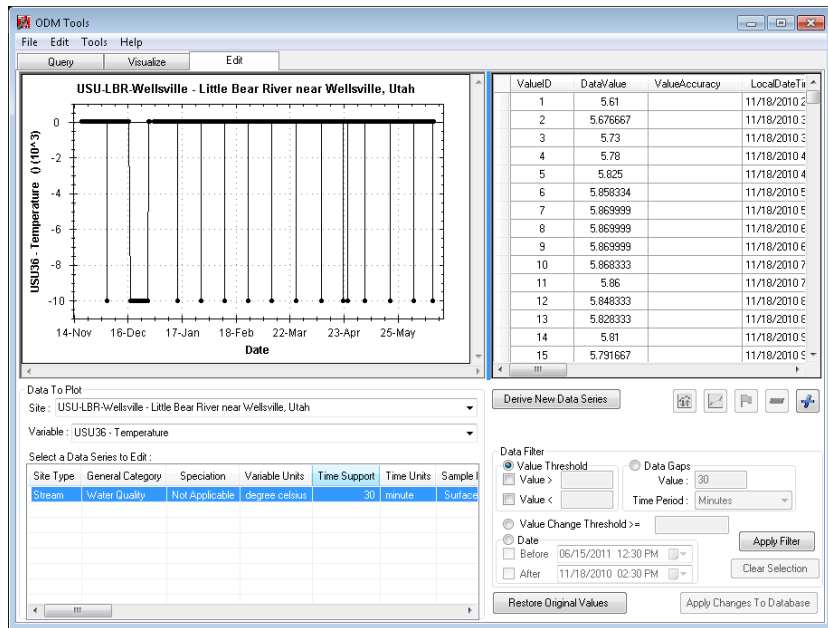


5. On the right side of the form you will see a “Summary” tab that gives summary statistics for the data shown in the plot. At the bottom right of the window, you can set the “Date Range” for the plot. Near the top of the Window, you will see several plot type tabs (Time Series, Probability, Histogram, and Box/Whisker). Click on any of these tabs to switch the plot type that is shown.
6. At the top right of the Window, you will also see a “Plot Options” tab. On this tab there are a few options for customizing the look and feel of the plots that are shown in the plot window. Click on the “Plot Options” tab and experiment with the options that are available there.
7. If you want a closer look at the data, you can click on the plot and drag a box to zoom in on the data. You can then use the scroll bars that appear on the plot to scroll through time to get a better feel for the data. To unzoom, right click on the plot and use the options on the context menu.
8. If you want to export the plot image, you can right click on the plot and select “Copy” to copy the image to the Clipboard or “Save Image As” to save the image to disk.

Editing Data Using ODM Tools

You may have noticed as you were visualizing the data that there are some “interesting” artifacts. These are raw data from the field and have not been subject to any QA/QC procedures. As an advanced step, we will explore using the data editing functionality of ODM Tools (the Edit tab at the top of the form) to clean these data up a little bit.

1. Click on the "Edit" tab at the top of the ODM Tools form. Select "USU36 - Temperature" from the Variable Drop down list. Then click on the row in the table at the bottom of the form to select the temperature USU36 data series that we loaded. Your window should look like the following:



- You will notice that you get a slightly different view of the data in the plot window. On the Edit tab, any NoData values are plotted, which is why you see the -9999 values in the plot window. In this dataset, there are a number of times that the datalogger reported individual no data values, and there is also a window of time where the datalogger consistently reported no data (corresponding to a period where our sensors failed). We will first delete the long period of no data values that you can see in December and then we will fix the individual no data values by interpolating.
- The first thing that we want to do is derive a new data series that we can edit so that we preserve the raw data series in our database. Click on the "Derive New Data Series" button which is near the center of the form. The following window will pop up:

- On this form, you can create several different types of derived data series, but for now click the radio button next to "Create a Quality Controlled Data Series for Editing" option near the top

left of the form. You will notice that a number of attributes have now been populated on the form.

The screenshot shows the 'Derive A New Data Series' dialog box. In the 'Derive Method' section, the radio button for 'Create a Quality Controlled Data Series for Editing' is selected. In the 'Method Description' section, the radio button for 'Automatically generate a Method Description' is selected. The 'Data Series Attributes' section is populated with the following information: Site: USU-LBR-Wellsville - Little Bear River near Wellsville, Utah; Variable: USU36 - Temperature; Units: degree celsius; Speciation: Not Applicable; Time Support Value: 30; Units: minute; Value Type: Field Observation; Data Type: Average; Quality Control Level: (empty dropdown); Source: Utah State University Utah Water Research Lab; Citation: Continuous monitoring data collect; Source Description: Continuous monitoring data collected by Utah State University as part of a National Scier; General Category: Water Quality; Sample Medium: Surface Water.

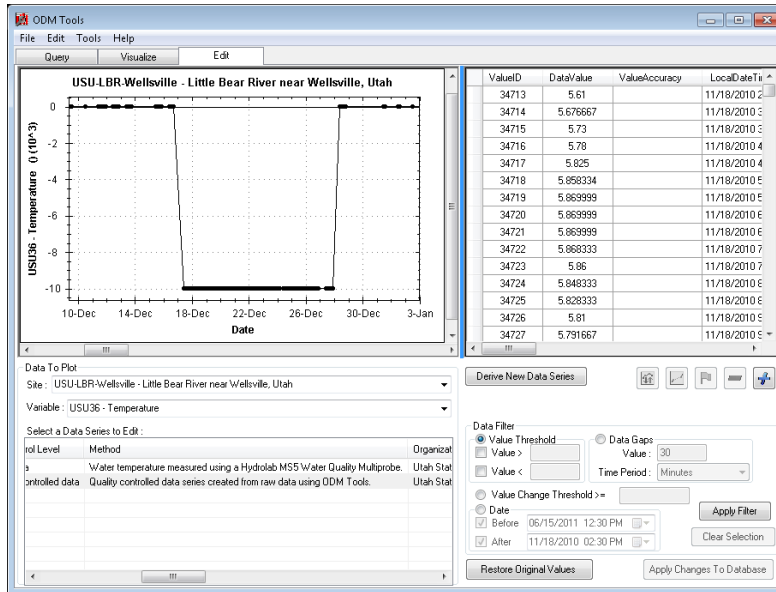
- In the "Method Description" area near the top right of the form, click the radio button next to the "Automatically generate a Method Description" option. Finally, at the bottom of the form select a Quality Control Level of 1 from the "Quality Control Level" drop down box. Your form should now look like the following:

The screenshot shows the 'Derive A New Data Series' dialog box after adjustments. The 'Quality Control Level' dropdown is now set to '1 - Quality controlled data'. The 'Method' field at the bottom is populated with 'Quality controlled data series created from raw data using ODM Tools.'

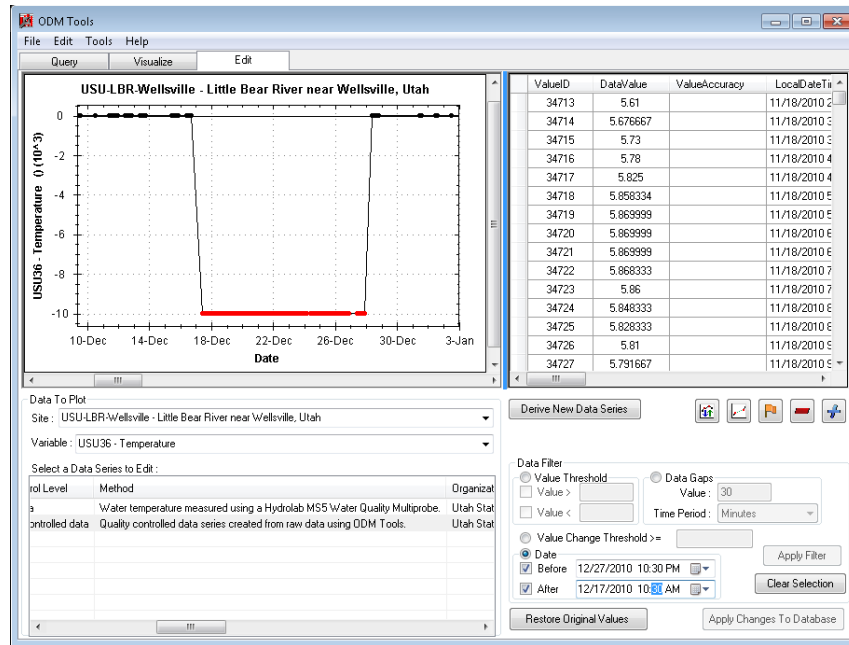
- Click the "Derive New Data Series" button at the bottom of the form. ODM Tools will then create a copy of your data series with a QualityControlLevel of that you can edit. When it is finished, you will see a new data series in the table at the bottom of the Edit tab. You may have to scroll to the right to see the QualityControlLevel field. You will also notice that the new data

series has a different Method description in the table, reflecting that this is a new data series that you have created using ODM Tools.

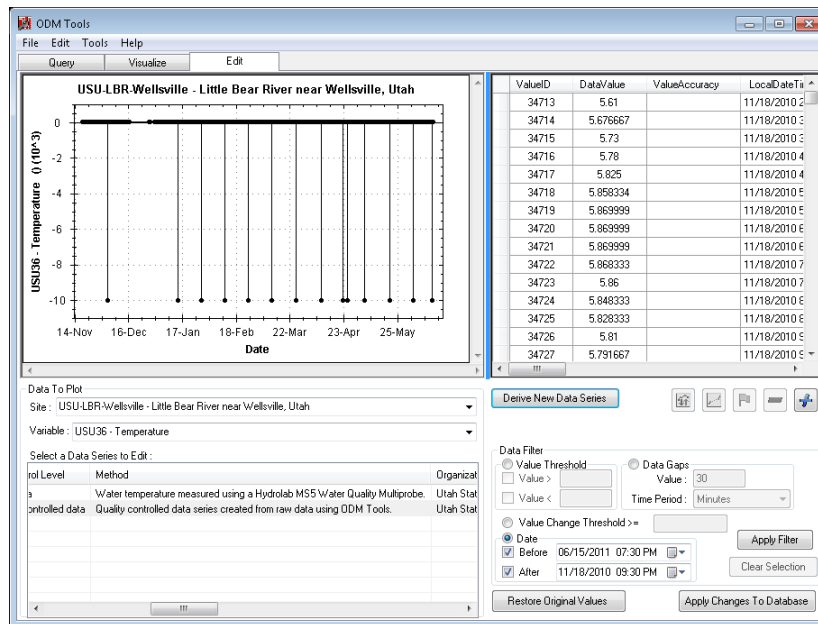
7. Make sure that the QualityControlLevel 1 data series is selected and shown in the plot (click on its row in the table).
8. Zoom in on the period of no data values in December by clicking and dragging a box around those values on the plot. Your plot should look something like the following:



9. We will use the selection filters at the bottom of the form to select the no data values that we want to delete. At the bottom right of the edit form, click the radio button next to "Date" and then enter "12/27/2010 10:30 PM" in the Before date and "12/17/2010 10:30 AM" in the After date (you may have to use the date-picker icons to the right of the dates). Then click the "Apply Filter" button. Your plot will now show that the period of no data values has been highlighted in red. You will also notice that the data values corresponding to those shown on the plot are highlighted in the linked table at the right of the form (you will have to scroll down to see them).

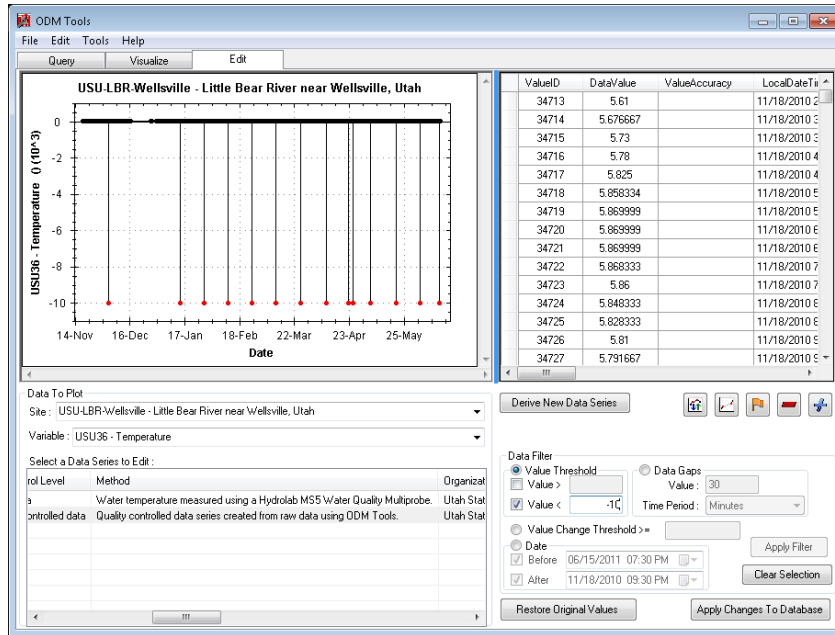



10. Click the Delete button, which is the button with the large red minus sign at the middle right of the Edit tab. A window asking you if you are sure you want to delete the values will pop up. Click "Yes" to continue. You will now notice that the period of no data that we selected has been removed.

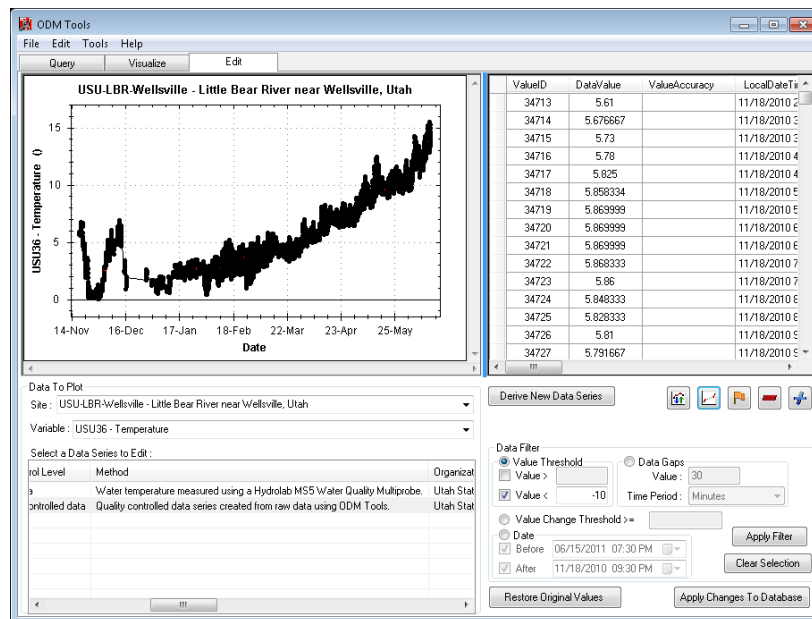


11. Now, we can use the Value Threshold filter to select the rest of the no data values and interpolate them using adjacent values. In the Data Filter section of the form, click the radio button next to "Value Threshold." Enter "-10" in the "Value <" text box and hit the "Enter" key. This should activate the "Apply Filter" button.

12. When you click the "Apply Filter" button, you should see that the remaining no data values have been selected and highlighted in red.



13. Next, click the Interpolate button . This will interpolate the selected values using the previous and following values. You will notice that the scale of the plot has changed as we no longer have any out of range data values in the plot.



14. If you want to, you can now apply the changes that you have made to the database to make them permanent. To do so, click the "Apply Changes to Database" button at the bottom right of the form.

NOTE: Until you click the "Apply Changes to Database" button at the bottom of the form, ODM Tools is working with a copy of the data in memory. If you make a mistake during an editing session, you can click the "Restore Original Values" button. ODM Tools will refresh its copy of the data in memory by retrieving them from the database again. However, once you have clicked the "Apply Changes to Database" button, your changes will be permanent.

15. If you zoom and scroll through the data series you will see that there are still some gaps in the data that resulted from battery failures. We could choose to edit this data series further, but for now it is relatively clean for a first pass.

NOTE: Unfortunately, the full functionality of the data editing capabilities of ODM Tools is too much to cover in the short time that we have. Additional editing functionality includes: flagging data values, adjusting data values, linear drift corrections, inserting data values, deriving aggregated data from higher frequency data, and smoothing data series. Detailed documentation and instructions for editing data using ODM Tools are available in the software manual for ODM Tools on the CUAHSI HIS website (<http://his.cuahsi.org/odmtools.html>).