TECHNICAL NOTE

In-Situ

CORRELATING WATER QUALITY FIELD DATA WITH GRAB-SAMPLE DATA

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OVERVIEW

A correlation is a regression equation that compares one or more parameters measured with field-sensor technology to parameters for which quantities can only be measured using lab equipment. Field parameters, such as turbidity and specific conductance, are commonly used as surrogates for parameters that can't be measured without collecting discrete water quality samples, such as metals and nutrients.

Similarly, units such as relative fluorescence units (RFU) can be translated into a concentration unit (like μg/L). These correlations are necessary for loading calculations and to ensure that water quality constituents remain within regulatory requirements.

COLLECTING DATA

To create a correlation, two pieces of information must be collected in the field: water quality data and a discrete water quality sample.

Typically, two scenarios will determine where a water quality sample should be collected.

1. If continuous water quality monitoring is not performed at the site, ensure that sample collection occurs at the same location every time. This may be at the same point in a reservoir, off the coast at a specific buoy, or at a particular depth in a well. (In the VuSitu app, GPS location can be recorded in addition to the field parameters.)
2. If continuous water quality monitoring is performed at the site, the discrete sample should be collected as close to the monitor as possible, or in a location that matches the monitor's representation of water quality in the system. (For additional information on this instance, read about mixing in the Tech Note "Site Selection for Continuous Surface Water Monitoring")

Discrete water quality samples should be collected according to the methods required by your laboratory. Sampling collection vessel requirements, preservation needs, and maximum hold times before delivery to the lab vary depending on the constituent to be analyzed.

For example, total suspended solids samples may need to be collected in plastic bottles and delivered to the laboratory below 4°C in 48 hours, while total phosphorous samples may be collected in plastic bottles, must be preserved with acid and cooled, and have 28 days to get to the laboratory for analysis.

In both cases, field water quality data should be collected with a recently calibrated independent sonde or sensor. Water quality data should be compared to the monitor located at the site if data is being collected continuously. But if the meter at the site is not calibrated on the same day, its data may not be accurate enough for correlation computation. (The graphing feature in VuSitu can ensure that parameter stabilization has been achieved before a data point is collected.)

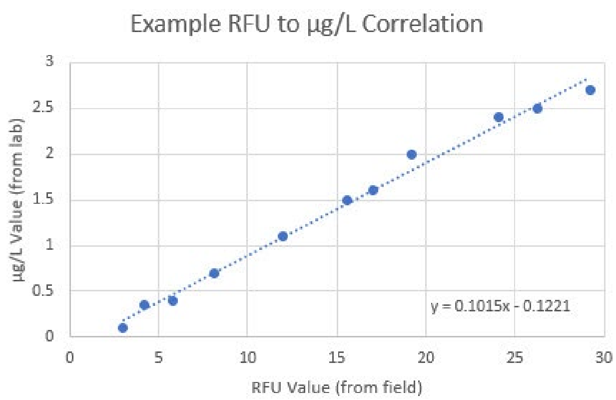
After a field trip, the collected sample will be sent to the laboratory and that data will be returned later. The sonde data from the sample collection will be saved until the laboratory-analyzed data is returned.

COMPUTING CORRELATION REGRESSIONS

Once the laboratory-analyzed data has been returned, laboratory and sonde data points are input into a database for processing. Common computer software programs used for computing correlations include Microsoft Excel, R, Python, and Matlab.

Sonde data is typically plotted on the x-axis of a graph and laboratory concentrations on the y-axis. A linear regression equation is then developed to find a best-fit line that accommodates all the sample points.

In the plot below, an example correlation between RFU and μg/L has been created, and the regression equation for the best-fit linear regression trendline is in the bottom righthand corner. More complex computing programs may allow for multiple field parameters to calculate a single computed laboratory parameter.



Graph shows correlating data.

Now that a correlation has been developed, the equation can be used to convert continuous data as it's received. It is important to periodically collect samples throughout the year to assess changes in the ecosystem and verify that the equation is still valid. Also, there will naturally be some error associated with these comparisons and this should be considered in the correlation creation process. For example, a correlation between turbidity and suspended solids may have an error of 30 percent due to possible sensor fouling, turbidity-type changes over the year, and other environmental factors.

CONCLUSION

High-quality field data can be compared with laboratory data to monitor additional parameters of interest in real time. Correlation regressions require a significant amount of work to develop and require sampling efforts to verify the continued integrity of the equation. But the value of knowing these relationships augments knowledge of an environment leading to better decision making and response.

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