

Efficacy of GREON Sampling Buoys

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Introduction

The Great Rivers Ecological Observatory Network (GREON) was conceived with the ultimate goal of deploying automated sampling buoys in great rivers throughout the world. In May, 2013, we deployed our first automated sampler in Ellis Bay, an impounded backwater on the Mississippi River near Alton, IL (Figure 1), adjacent to a fixed site sampling location for the Long Term Resource Monitoring Program (LTRMP). Deploying the buoy in this location allowed us to compare data from this new technology to our LTRMP data which is collected and analyzed using standard methods.

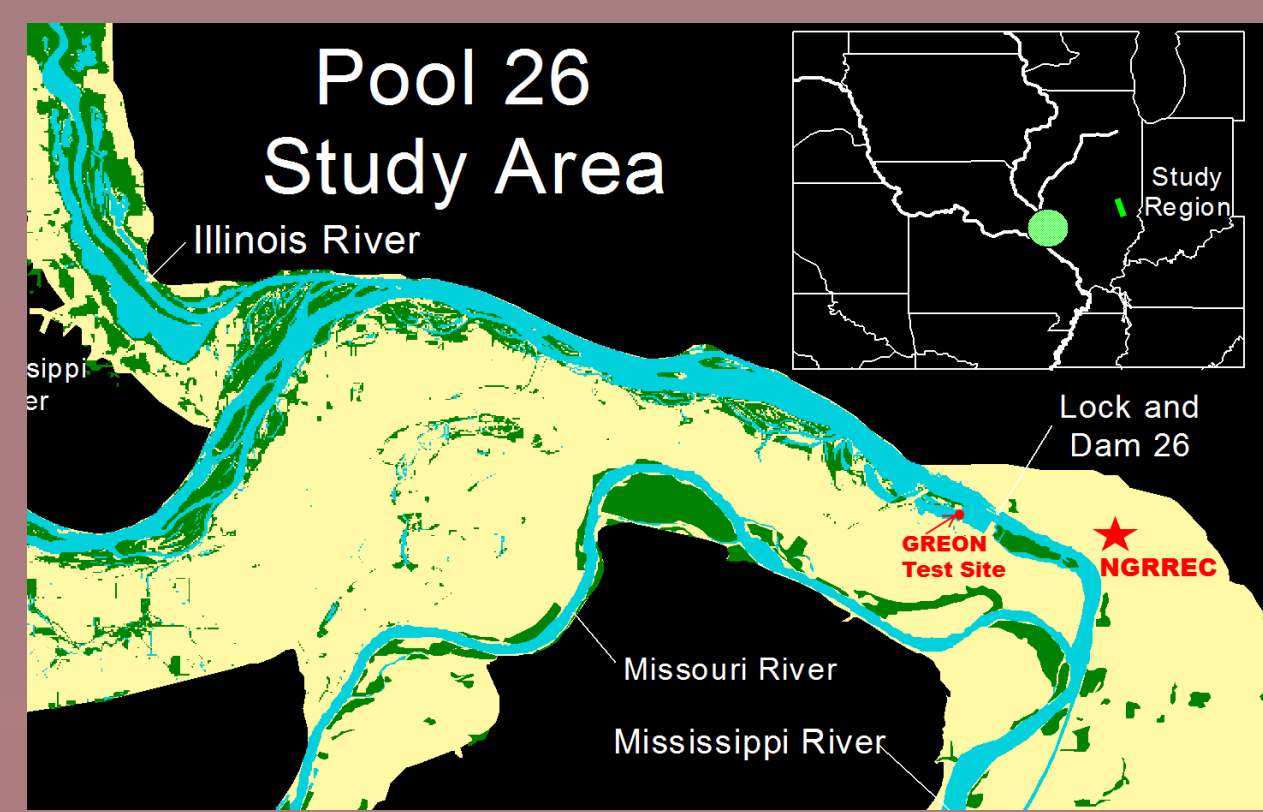


Figure 1. Pool 26 of the Upper Mississippi River, and GREON test site.

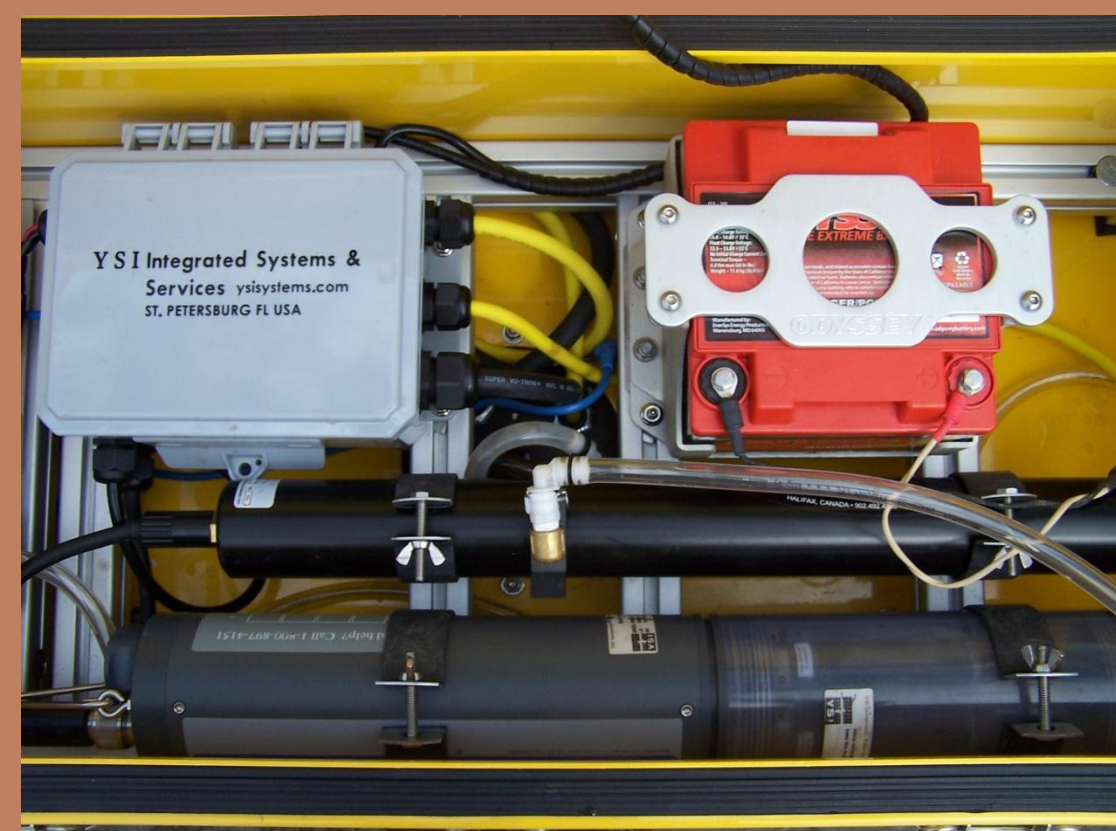
The GREON Buoy

The sampling platform is a YSI PISCES platform, which includes a pump, a YSI 6600 sonde and a Satlantic SUNA nitrate sampler. Parameters measured include:

- Temperature
- Oxygen
- Conductivity
- Turbidity
- pH
- Chlorophyll-a
- Blue-green algae
- Nitrate



The buoy also collects weather data and has cellular data download.



Field Efficacy

Calibration and Environmental Factors

- Sonde in buoy for 4-6 week periods and held calibration
- Some fouling of sonde sample cup due to sediment, algae, and/or macroinvertebrate colonization
- Sensors themselves stayed clean due to wipers that clean sensor surfaces before and after every reading
- Amount of fouling varied with environmental conditions
- Fixes for upcoming sample season:
 - Additional sondes for easier, quicker, and more frequent cleaning and calibration
 - Adding a rinse cycle into the sampling protocol to ensure sample cup is flushed adequately
 - Replacing YSI 6600 sondes with new YSI EXO2 sondes



Continuous Data

While the buoy was deployed, the test area experienced the 5th highest recorded flood. During the height of the flood, water quality sampling crews were unable to sample in the river, but the GREON buoy was sampling hourly for the duration of the flood. As expected, the GREON automated sampling buoy was able to track water quality parameters at a much finer resolution than traditional LTRMP methods. Though unplanned, collecting automated data during this historic flood demonstrates the value of this type of sampling: though spatial resolution is limited, the enhanced temporal resolution can increase our understanding of water quality dynamics, especially when events such as flooding and droughts occur.

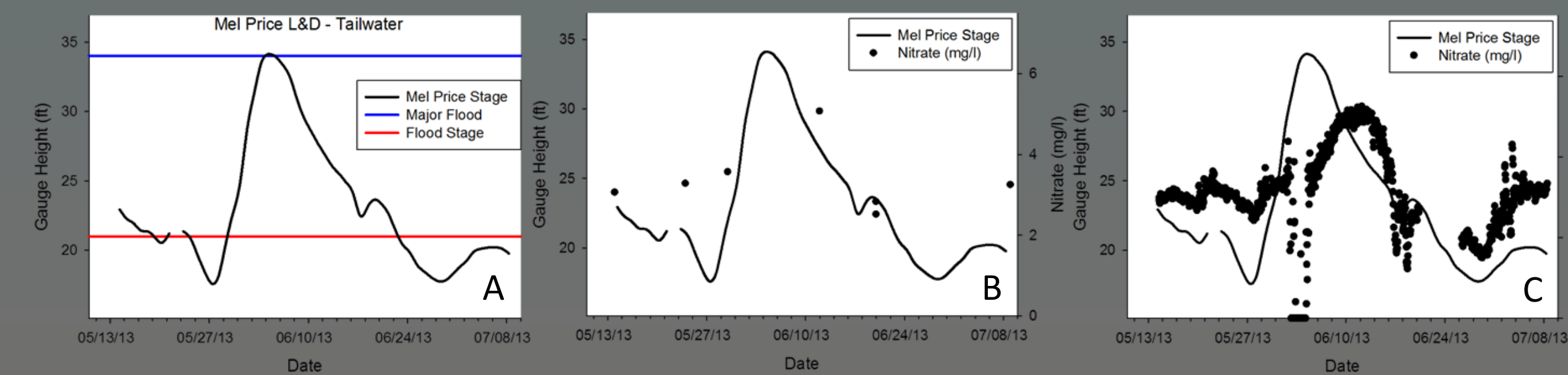


Figure 2. An example of the finer resolution of the automated sampling buoy. A) Gauge height during sampling period B) nitrate as measured by LTRMP during this period, C) nitrate as measured by GREON during this period.

Instrument Accuracy

Comparisons between water quality data collected from the GREON buoy and the more traditional LTRMP methods show highly similar readings, despite the instruments in the buoy being calibrated far less often. Though still significant, the relationship for chlorophyll-a was weaker than other parameters.

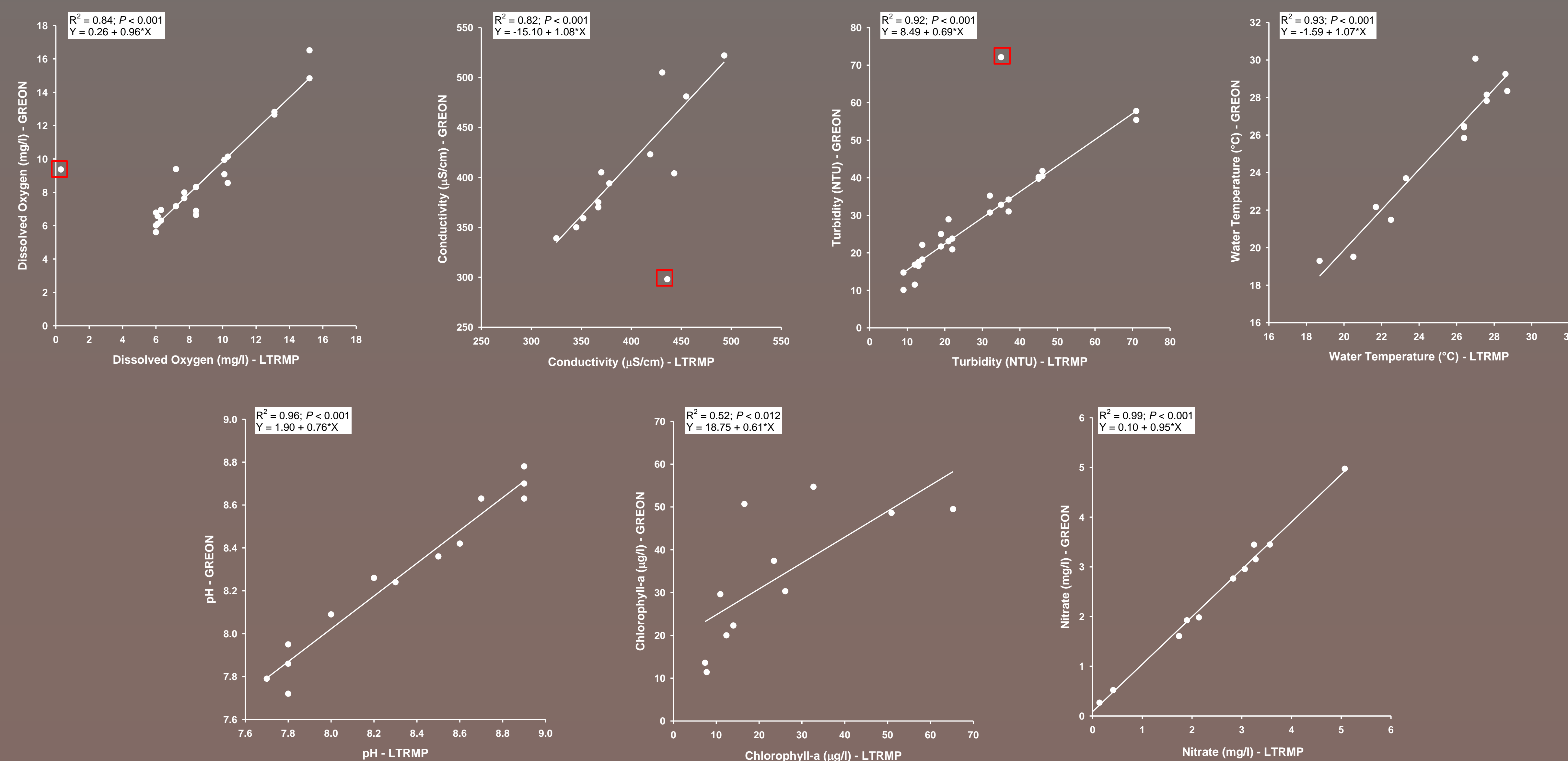


Figure 3. Regressions of GREON sampling data vs. LTRMP data for various parameters. Red boxes represent questionable data that was removed from regression analyses.

Conclusions

This new technology will never replace traditional sampling methods, but it does supplement it. We believe the value of GREON lies in:

- Improved ability to detect trends
- Increased data to aid in management decisions
- Ability to compare and contrast different rivers
- Increased ability to address pressing issues such as:
 - Nutrient loading
 - Sediment loading
 - Climate change

This spring we will be deploying an additional unit in the main channel of Pool 26. We are in talks with potential partners to deploy sampling buoys in other pools of the Mississippi River, as well as the Ohio, Missouri, and Illinois Rivers sometime this summer.

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