Quality Control of Observational Datasets Collected in a Real-Time Monitoring Network

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Introduction

- Real time environmental observatories allow characterization of episodic events
  - High volume data
  - Significant effort required to maintain data quality
  - Data quality subject to errors
    - Instrumentation errors
    - Environmental factors
    - Software issues
  - Multi-tiered QA/QC process
    1. Laboratory calibrations
    2. Automated data post processing to remove outliers and data with improper format (no examples shown)
    3. Temporal analysis
    4. Cross comparisons

Platform Types

- Stationary
  - High temporal resolution
  - Continuous monitoring
  - High data volume
  - Subject to fouling
- Mobile
  - High spatial resolution
  - Higher temporal resolution
  - May be affected by environmental parameters

Shallow-Water Profiling (Texas)

- Designed for Shallow-Water Deployments
- Customizable Sensor Payload
- Package parked outside of the water

Rivers and Estuaries: Challenges

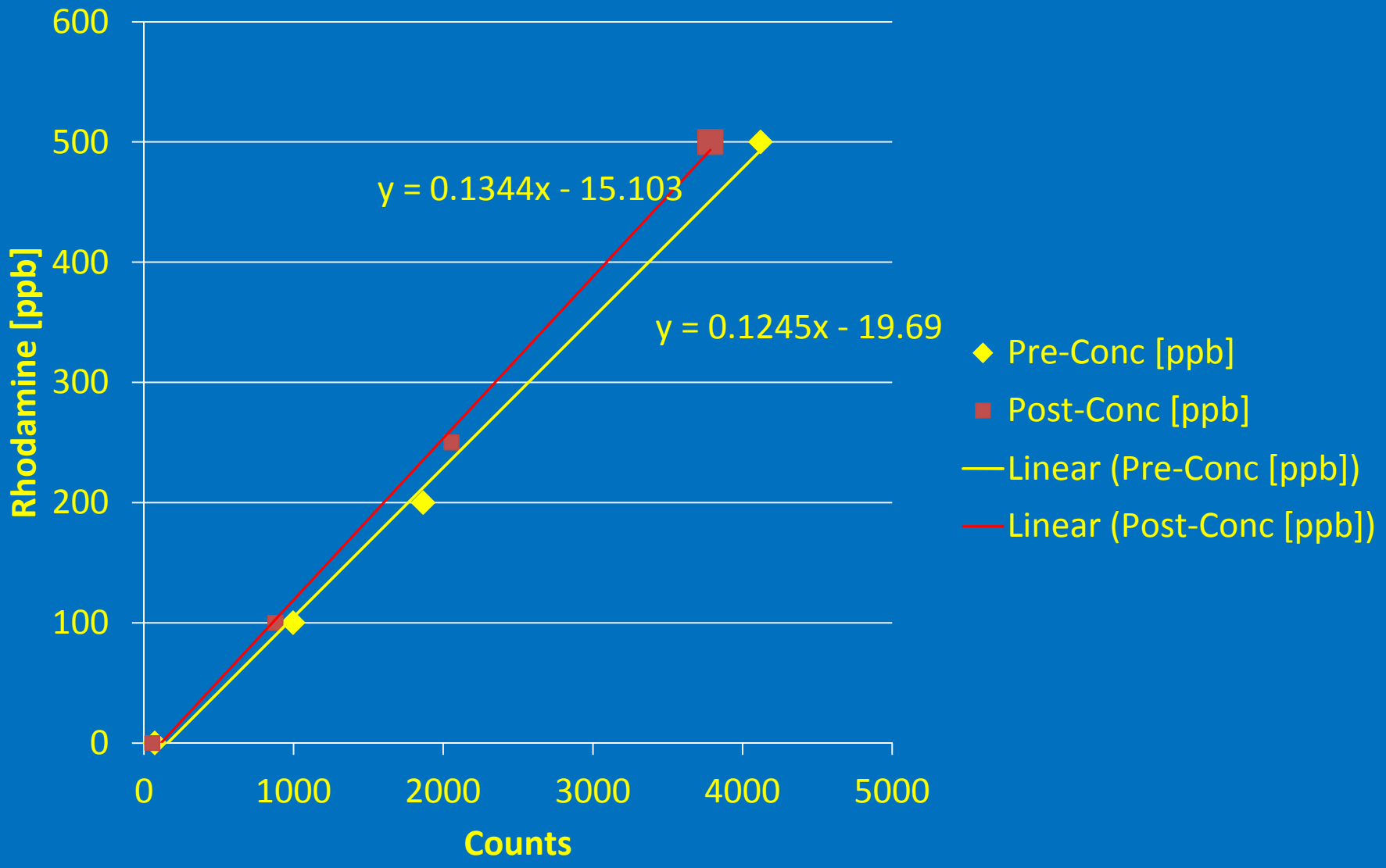
- Ice
  - Surface Deployments must be seasonal
- Flooding

- Debris
- SAV
  - Interfere with System Operation

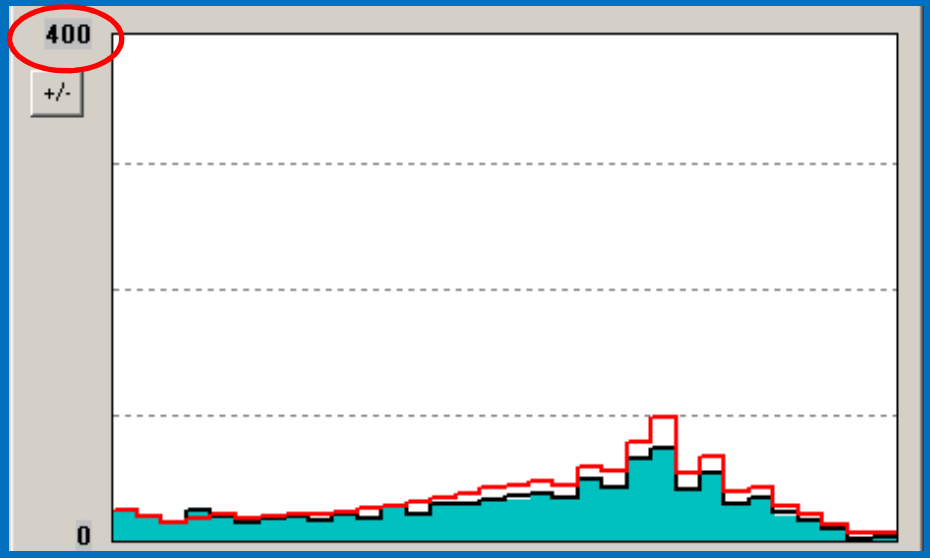
Tier 1- Laboratory Calibrations

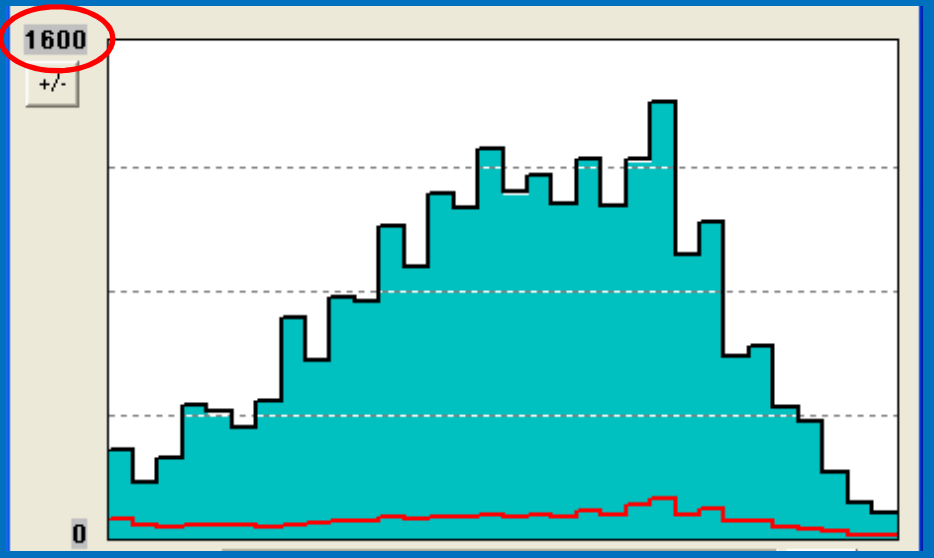
- Pre-deployment
  - Ensured that instrument is functioning
- Post-deployment
  - Provides confidence in measurement through deployment period
  - May provide means to correct and/or reject measurements at end of instrument deployment

Fluorometer Pre- and Post- Deployment Calibrations for Rhodamine



Laboratory Calibrations





- Pre- deployment background scatter
  - Clean optics
  - Similar to factor

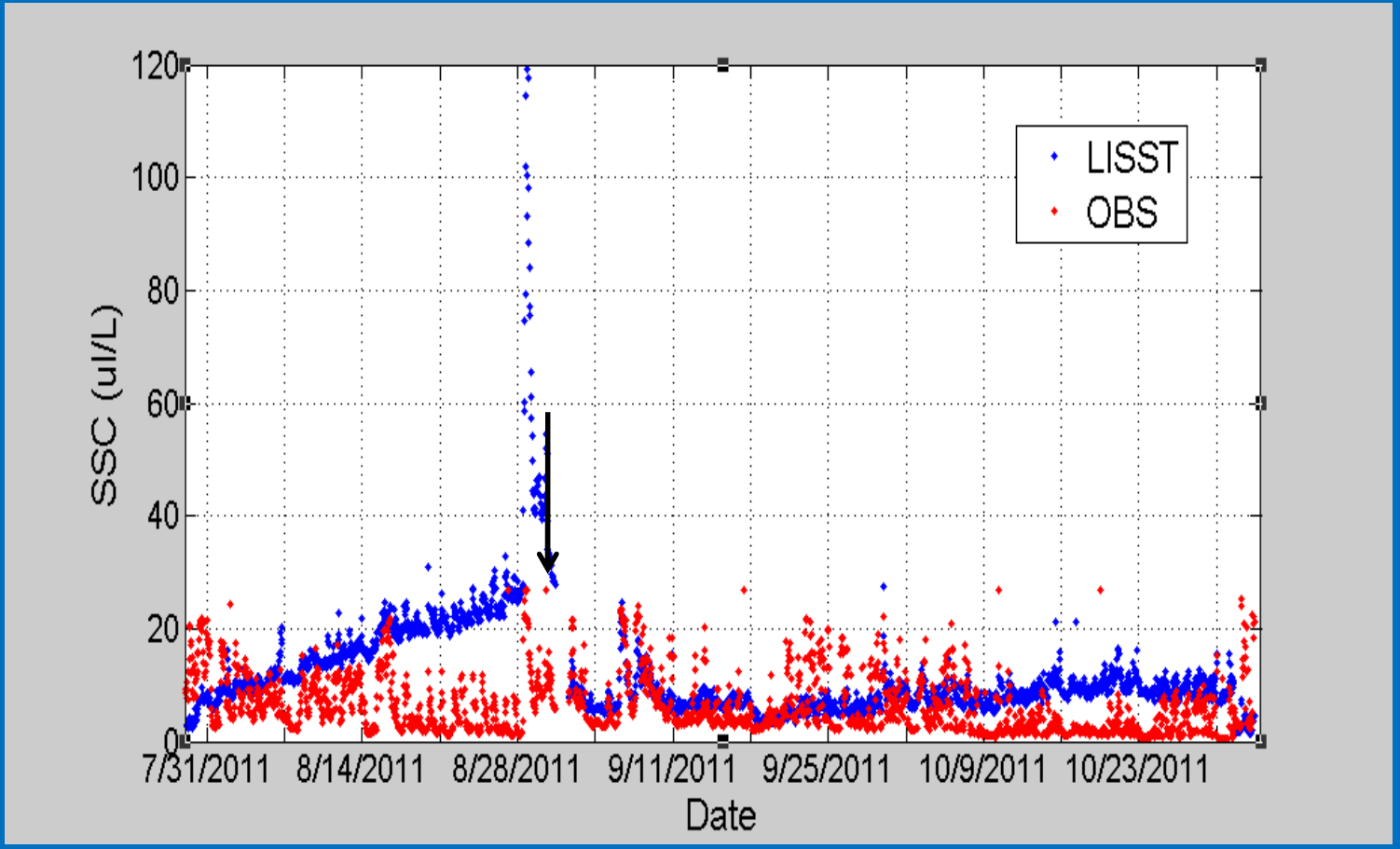
- Post- deployment background scatter
  - Optics are fouled
  - Elevated scatter & reduced laser
  - Should be considered during data analysis

Tier 3- Spatial/Temporal Analysis

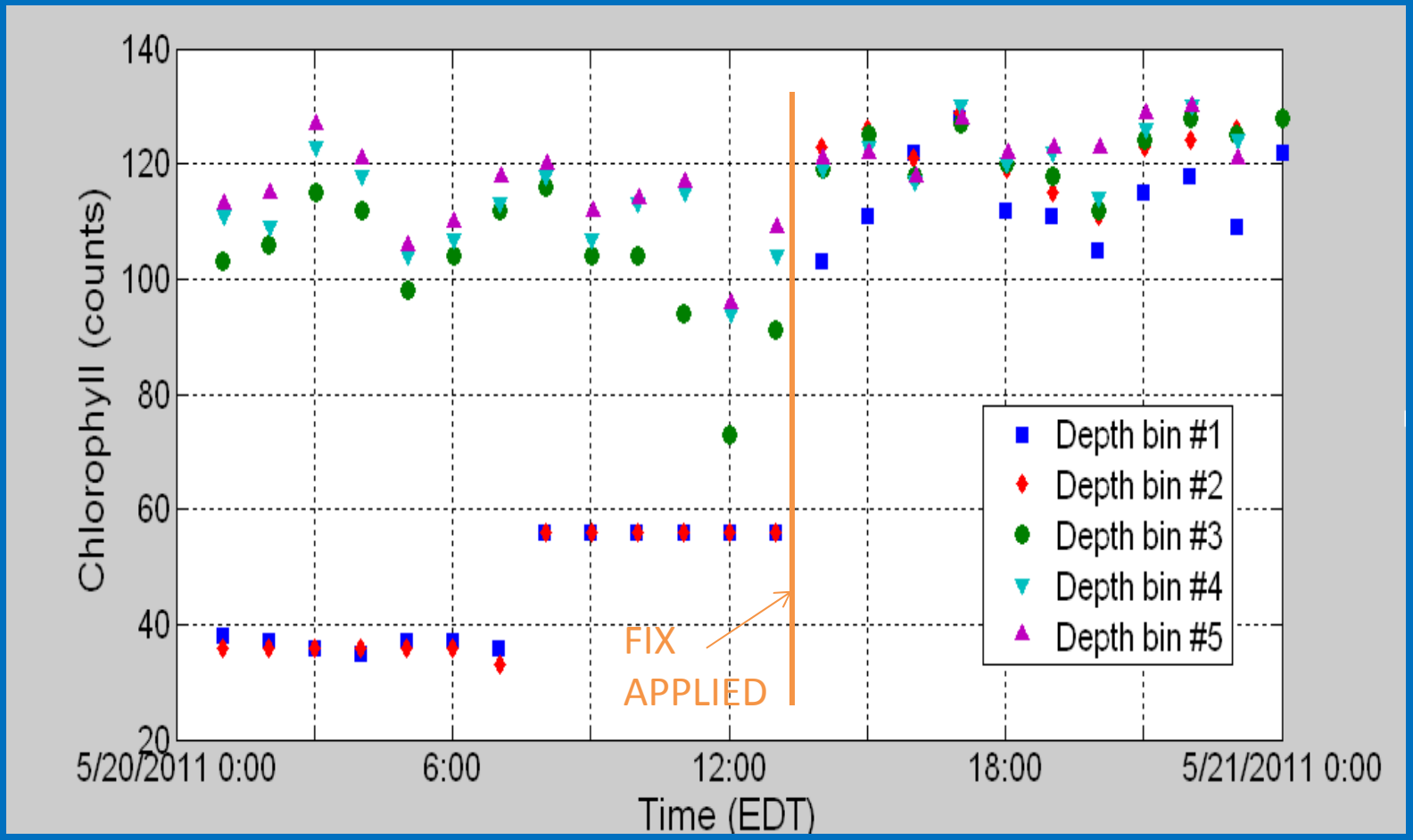
- Allows error detection due to
  - Fouling
  - Data communication glitch
  - Instrument response time

Effect Fouling on Optics

- LISST 100X – Tended to give elevated readings with fouling
- OBS- Tended to have reduced response with fouling
- Cleaning optics showed immediate correction
- Time series analysis allows identification of fouling
- Fouling can vary with biological productivity

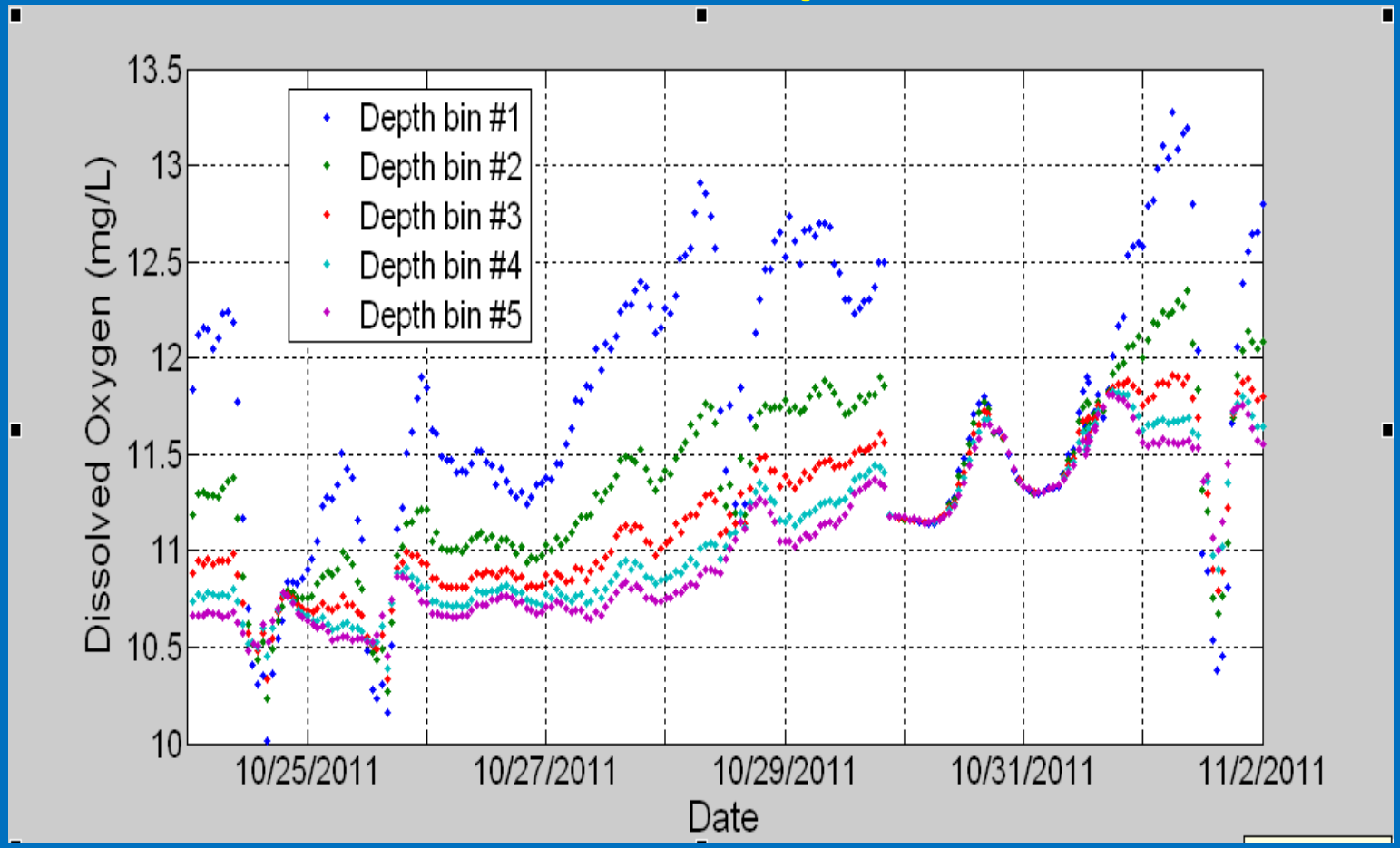


Data Communication Glitch



- Data profiles collected periodically (hourly)
- Continuous data stream from instrument filled buffer between profiles
- Data for Depth Bins 1 & 2 were collected when instrument in park position
- Resolved by clearing buffer before each profile

Instrument Response Time

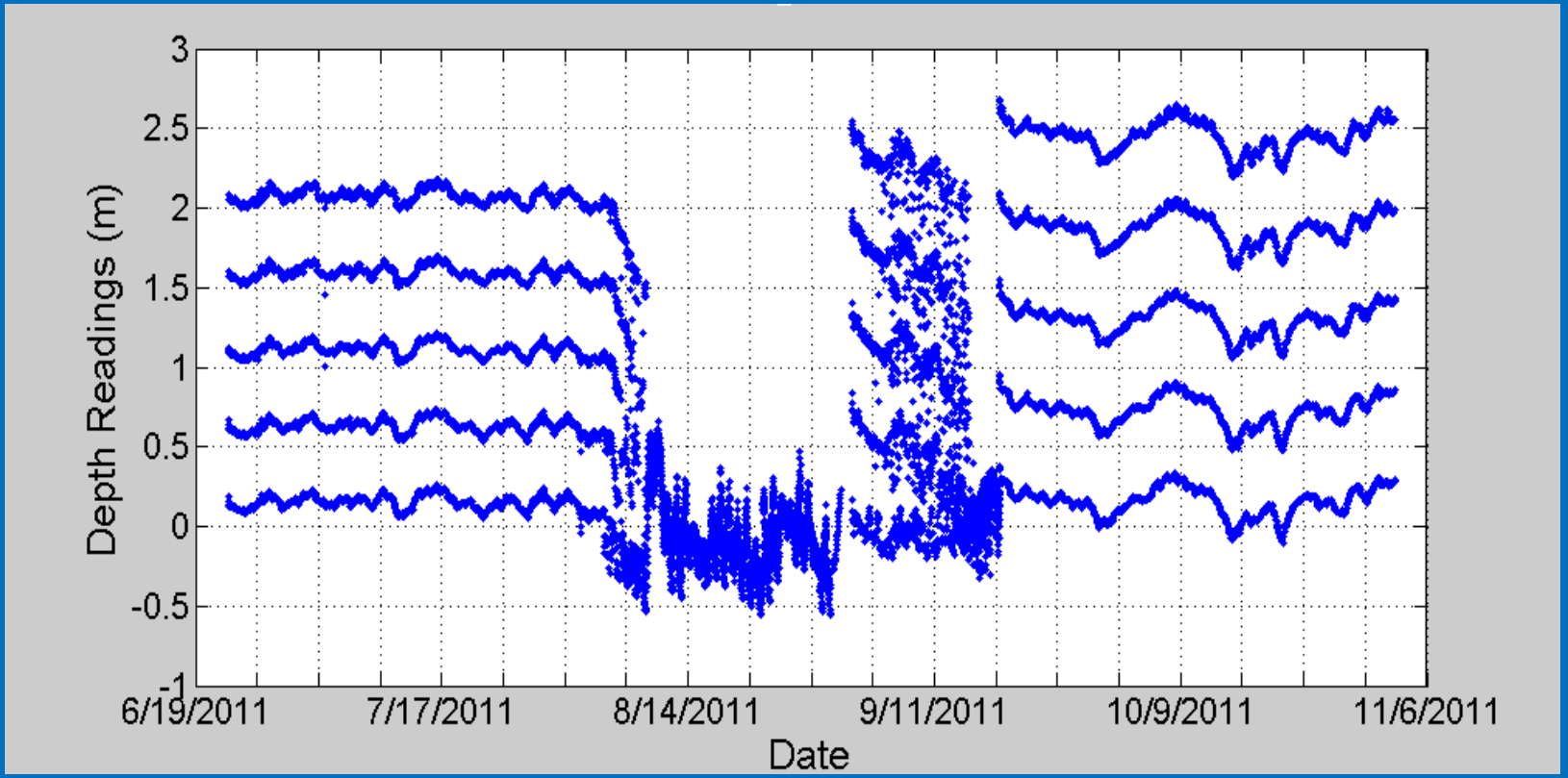


- Between profiles instrument payload is parked in air
- Elevated DO concentrations measured at shallow depth bins
- Oct 30, payload was parked submerged to protect from freezing temp.
- Gradient no longer observed. Gradient returned Nov 1, when parking in air resumed.

Tier 4- Cross Instrument Comparison

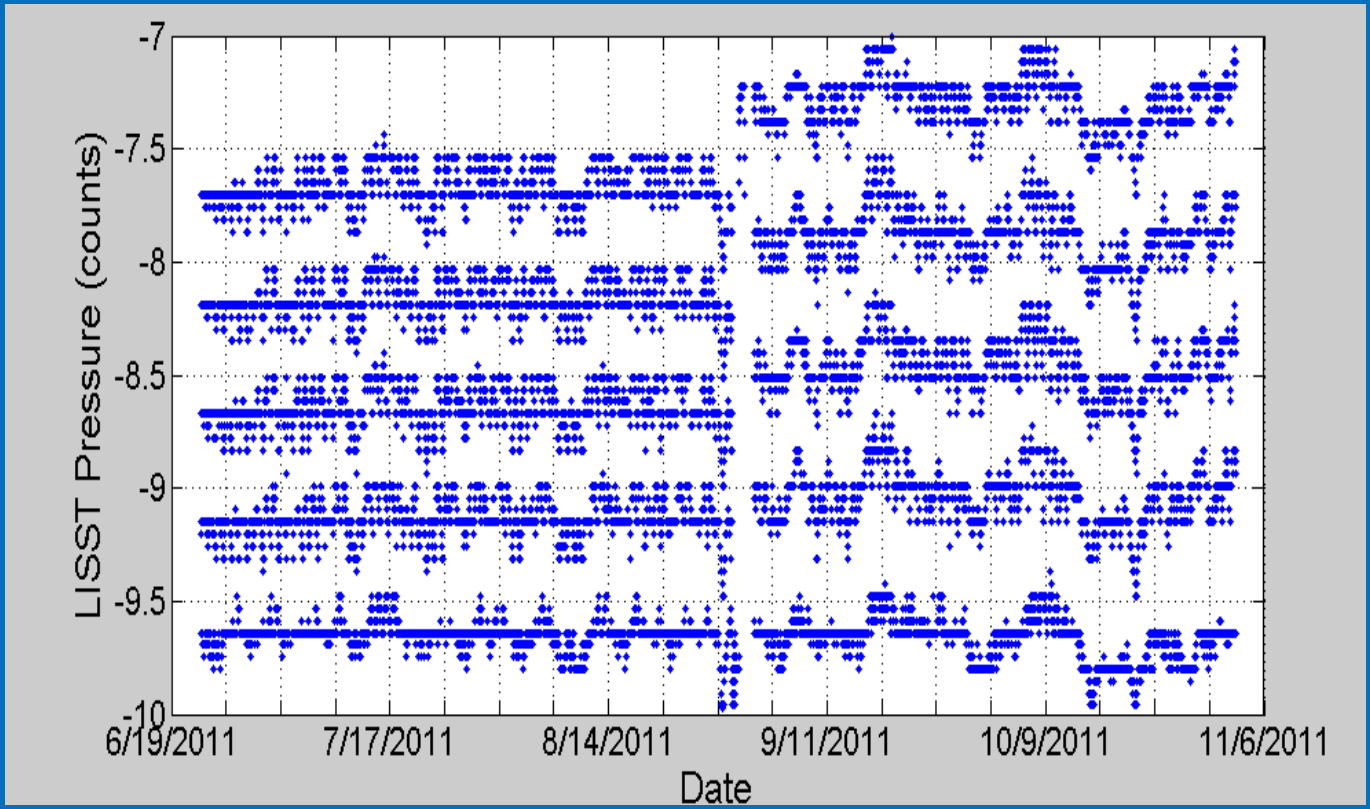
- Data validation
- Permits error correction
  - Instrument errors
  - Measurement artifacts
- Allow fouling effect to be quantified

Depth Data



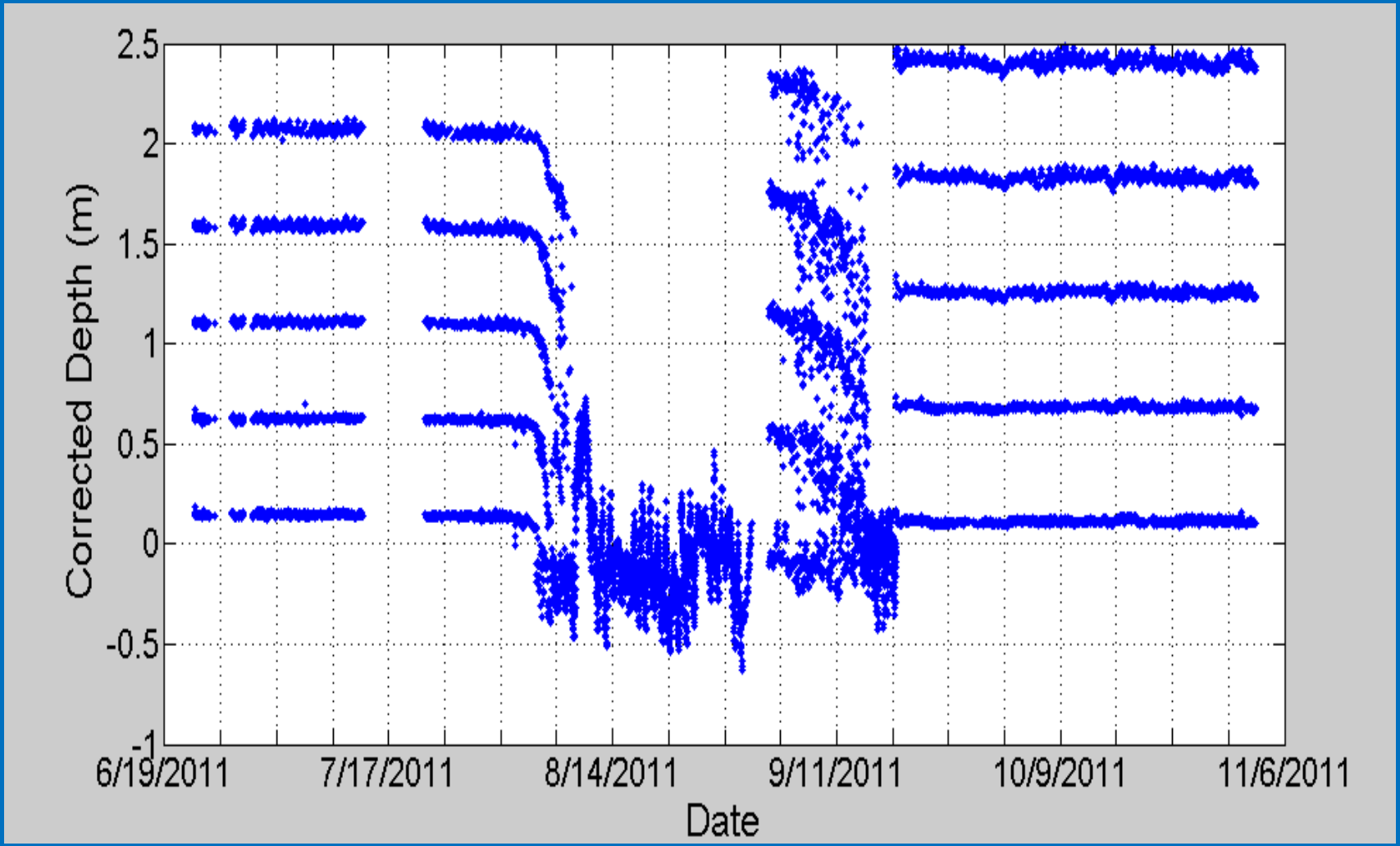
- Profiles programed for specific depths
- Depth time series is not constant
- In August pressure sensor fouled, not noticed immediately in daily checks

Co-located Instrument Comparison



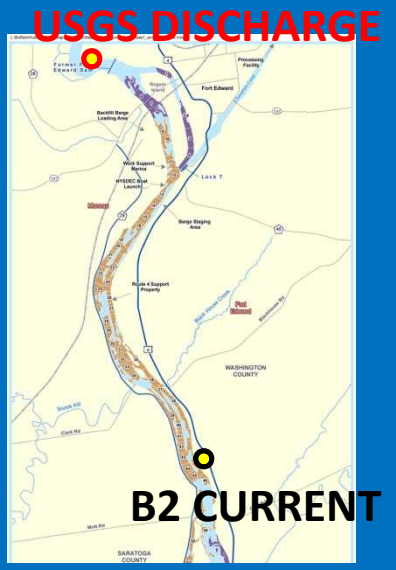
- Co-located LISST-100X also equipped with pressure transducer
- Data evaluation showed that robotic profiler was operating properly.
- Therefore validating depth profiles generated for other water quality parameters.
- Data visualization page was augmented with inclusion of depth profile time series to facilitate anomaly detection.

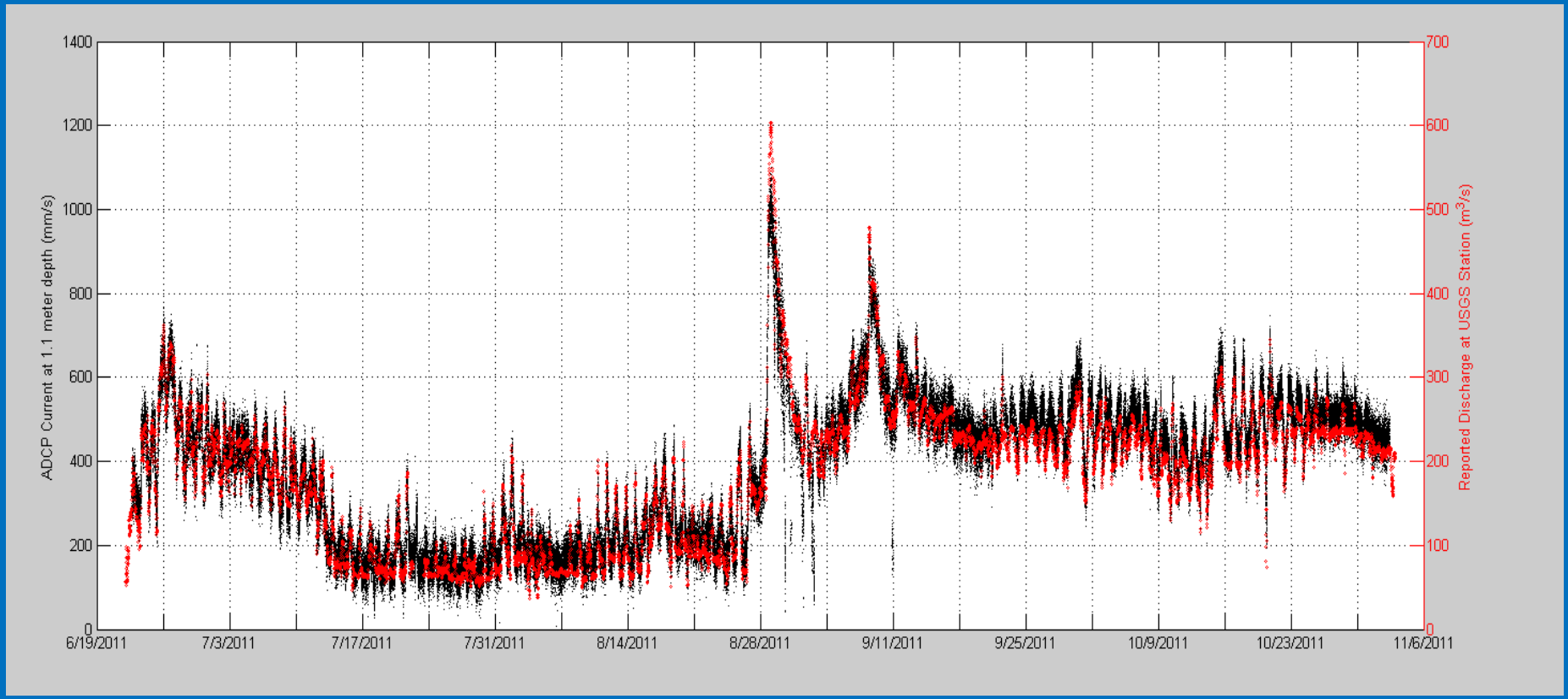
Barometric Pressure- Depth Correction



Acoustic Doppler Current Profiling

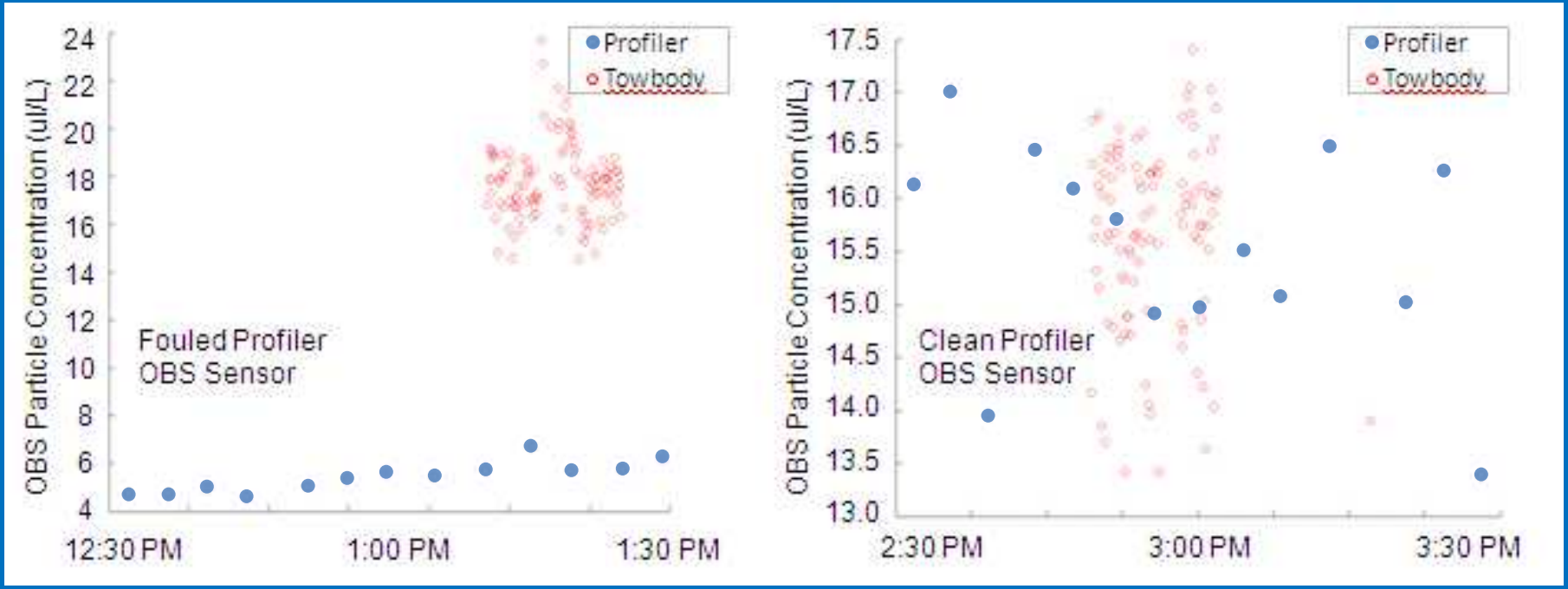
- Measures current using Doppler shift in signal
- Comparison of velocity data to established data monitoring stations can provide confidence in observation
- In this case ADCP velocity magnitude tracked discharge measurements made at USGS sites





Systems Comparison – Effects of Fouling

- Tow body positioned in line with profiler cage
- Multiple profiles were run with tow body held at each depth
- Procedure was repeated before and after cleaning the optical sensors



Conclusions

- Ensuring data quality requires significant effort.
- Time series evaluations facilitate identification of subtle anomalies.
- Cross sensor comparisons allow data validation and permit correction of erroneous data.
- Frequent servicing required to maintain data quality with sensors subject to fouling (i.e. optical, membrane).
- Data storage
  - Calibration coefficients
  - Metadata