Continuous Water Quality monitoring in New Jersey

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Providing reliable, impartial, and timely data to assess the quantity and quality of New Jersey’s water resources
History of Continuous Water Quality Monitoring by USGS in NJ

- Water temperature monitored continuously on Delaware River in 1940’s
Why does USGS measure water quality parameters continuously?

- Investigate environmental processes
- Study trends
- Provide data to other agencies for stream classification and development of water quality standards
- Compute loadings to assist other agencies with TMDL studies
- To supply water purveyors with data needed to plan for water treatment needs
- Water supply planning
- Boaters and fishermen use data to plan activities
Advantages of continuous water quality data

- Measures the water quality changes at night and during storms when samples are seldom collected and storm events can have major effects on concentrations and loads.
- Faster data availability, critical for warning the public for recreation purposes and for water treatment purposes.
- Continuous data compared to a few samples collected during a year allows for better comparison to instream water-quality standards, especially criteria like DO based on 24 hour averages.
- Increased data-collection frequency improves understanding of cause-and-effect relations.
- Provides data sets for developing water quality models.
Active Continuous Water Quality Monitoring Locations

- 26 Water Temperature sites
- 8 D.O. & pH sites
- 10 SC sites
- 3 Turbidity sites
Real-time Continuous Dissolved Oxygen Data in New Jersey

http://nj.usgs.gov

Dissolved oxygen, water, unfiltered, milligrams per liter
Most recent instantaneous value: 9.8 08-05-2008 15:00

USGS 01400500 Raritan River at Manville NJ

Graph showing dissolved oxygen levels from July 29 to August 5, 2008.

Provisional Data Subject to Revision

- Dissolved oxygen
- ▲ Value exceeds "standard difference" threshold,

Legend:
- ▼: <1
- ▼: 1-2.9
- ▼: 2-4.9
- ▼: 4-6.9
- ▼: 6-8.9
- ▼: 8-11
- ▼: >11
- ▼: No Data

*Site operated on a seasonal basis or currently is not operating.
Continuous DO monitors

- AC power
- 4 of 8 are in heated enclosures and operate year round
- Sample water is pumped from stream
- 6 of 8 have optical sensors
Raritan River at Manville

Continuous QW Monitor

- Temp., SC, DO, DO%
- Sat., pH, Turbidity
- 120 volt submersible pump
- YSI 6920V2 in self draining flow tank

Satellite Telemetry at all continuous monitors
Sensor evaluations performed by the NJ-WSC

- Optical versus Polarographic DO
- Nitrate
  - Ion selective Electrode – YSI (only worked for 3 days)
  - Photometric Cadmium reduction (WS Oceans unit tested for 4 weeks) YSI model 9600 now in continuous service at Mississippi R. @ Baton Rouge & Atchafalaya R. @ Morgan City, LA
  - Ultraviolet-visible Spectrum analyzer (S::CAN currently being evaluated)
- DOC (S::CAN currently being evaluated- supported by DRBC)
Study comparing Clark cell to optical DO probe

- Optical dissolved oxygen sensor deployed in-tandem with a Clark-type sensor at Pompton Lakes, NJ.
- Optical sensor collected data over extended periods in summer and fall without correcting for drifts in calibration.

Results

- Optical sensor maintained calibration over a longer period of record allowing for greater time between servicing.
- Report published in USGS HIF instrument newsletter (internal website however)
- Successfully deployed for routine continuous monitoring at 6 sites in the Delaware River & Bay, & NJ Rivers
Comparison of YSI 6150 ROX and YSI 6652 Clark-style Sensors
(5/10/2007 to 9/04/2007)
Nitrate sensors

Automated colorimetric – Cadmium Reduction

- Very steep learning curve – proprietary software, operation of reagent metering and spectrophotometer
- Strong technical background needed to calibrate and troubleshoot instrument
- Liquid reagents are consumed
- Generates a hazardous waste – one mole of Cd generated for every mole of N reacted. 10 mg/l Cd, 3 mg/L Cu, pH ~2
- Battery powered
- Small footprint about the size of a 5 gallon bucket
- YSI 9600 is a better engineered package than WS Oceans, uses micropumps instead of a syringe pump
Nitrate & DOC Sensors, cont.

**S::CAN Spectrolyzer** — Funded by DRBC

- Proprietary software, fast learning curve
- Fresh water use only
- Quantification ~2 orders of magnitude
- High turbidity >120 NTU causes light extinction, 35 mm unit does not work
- No reagents
- Remote calibration by factory via cellular modem (required)
- Digital signal output is a European Union standard
- Analog output did not plug directly into USGS communication system
- Servicing frequency about 1 every 3 weeks to clean optic windows
- Direct comparison with lab data for 11 weeks and continuing for another 3 to 4 weeks
- Report in ~ 3 months after experiment completion
- Strong interest in this comparison and possible purchase of instrument by USGS HIF
Hurricane Hannah

--- Provisional Data Subject to Revision ---
Quality Assurance of Data

- Comparison to standards and field meter; fouling and drift
- USGS Report: Guidelines and Procedures for Continuous Water Quality Monitors: Station Operation, Record Computation, and Data Reporting
  http://pubs.usgs.gov/tm/2006/tm1D3/
USGS Resources

- Reports
    http://nj.usgs.gov/publications/OFR/02-383/
  - Techniques and Methods Report 1-D3: Guidelines and Procedures for Continuous Water Quality Monitors: Station Operation, Record Computation, and Data Reporting
    http://pubs.usgs.gov/tm/2006/tm1D3/
  - Techniques in Water Resources Investigations Reports
    Book 9 Section A: National Field Manual for Collection of Water Quality Data
Resources Continued

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