9/13/12

Data Streams of Interest to the NYC Water Supply

Continuous sources of data

Ray Homolac

Watershed Water Quality Science & Research

2012 Watershed Science & Technical Conference

Outline

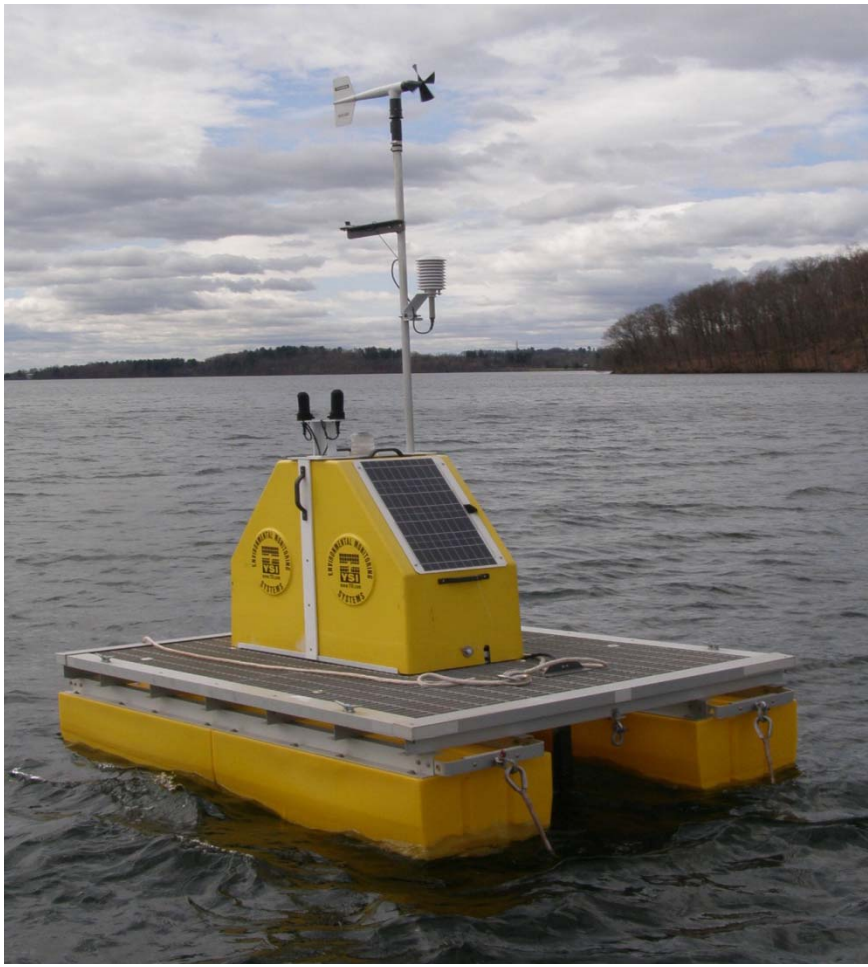
Continuous sources of data DEP is utilizing or is available.

- Monitoring
  - Automated earth-based Limnology buoys.
  - USGS gauges
- NOAA and NASA satellite-based data
  - GOES geosync satellites
  - Landsat satellites
  - NPP polar satelites
- Modeling
  - SnowDAS
  - SWAT
  - RHESSys
- DataONE
- Conclusions
- Acknowledgments

Automated monitoring Limnology buoys

Profiler

- Takes aprox. 20 measurements at various depths up 21 m
- Measures water temperature, turbidity, and specific conductivity
- Data is stored in LIMS
- User interface or data can be exported to Excel & Word
- Data is being used as input to CE-QUAL-W2 reservoir model, developed to simulate turbidity in the Catskill System reservoirs.

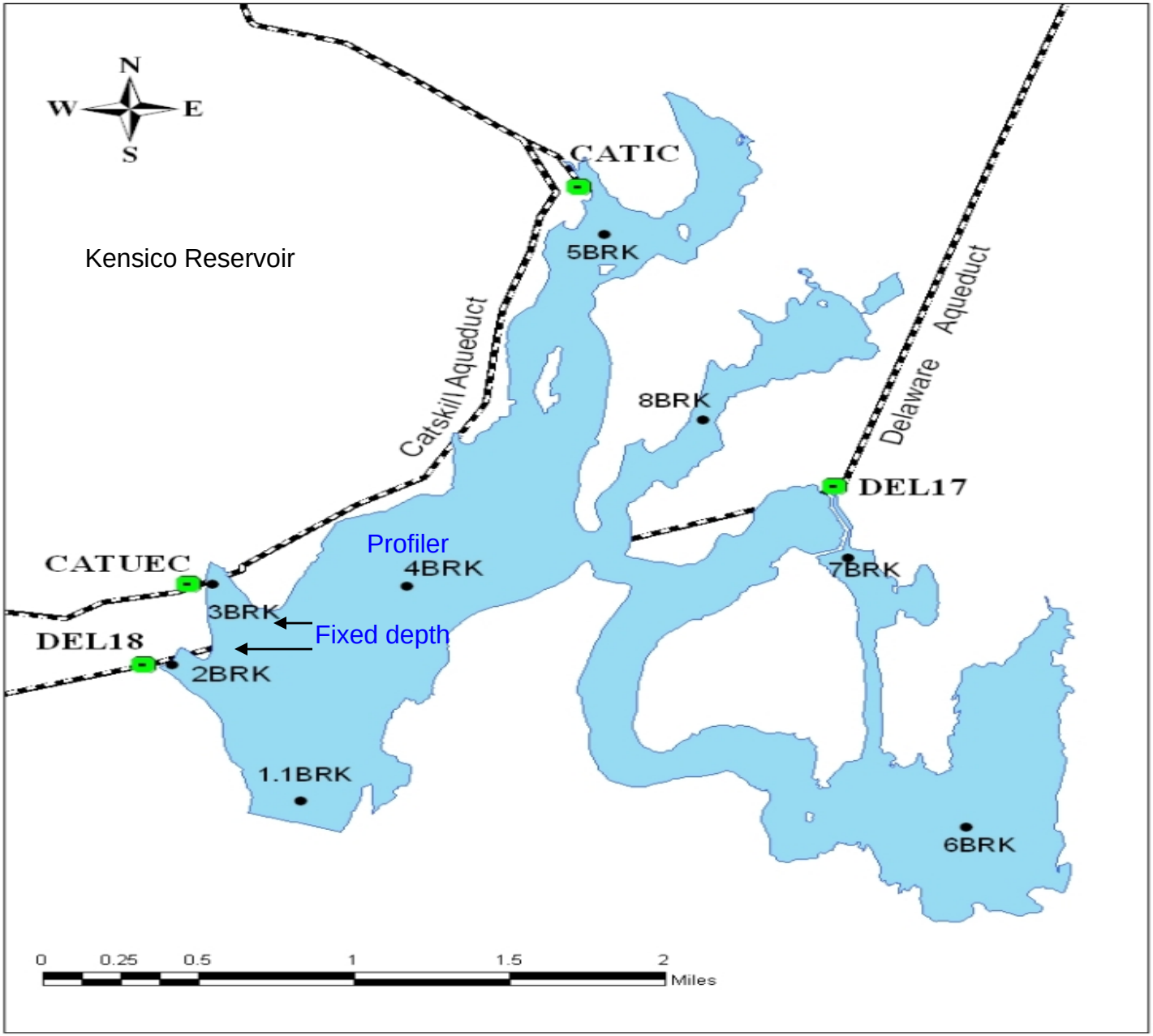


Automated monitoring Limnology buoys

Fixed Depth

- Takes measurements every 15 minutes at three fixed depths of 5, 10, and 15 m
- Measures turbidity
- Data is stored in LIMS
- User interface or data can be exported to Excel & Word
- Data can be used as input for reservoir modeling
- Data are also used for operational decision making (e.g. selecting intake level)

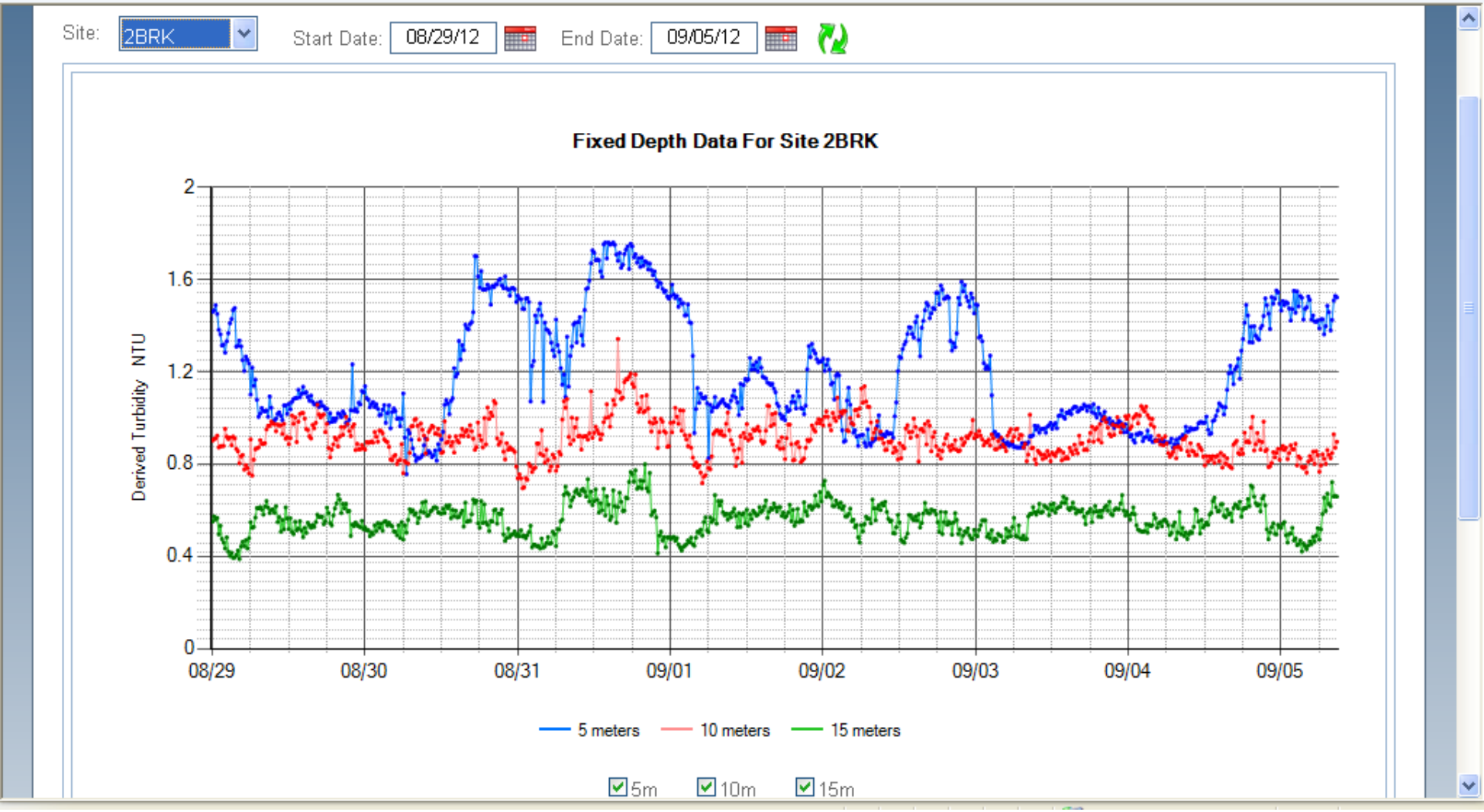
Location of buoys



User interface to buoy data

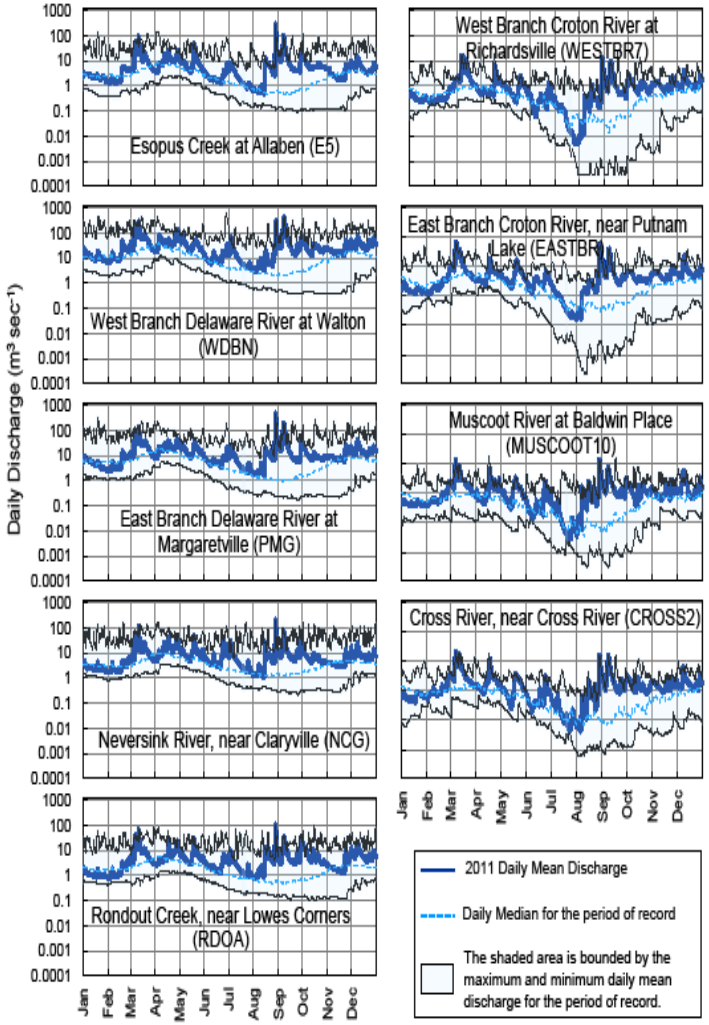
User interface to buoy data

Kensico Fixed Depth



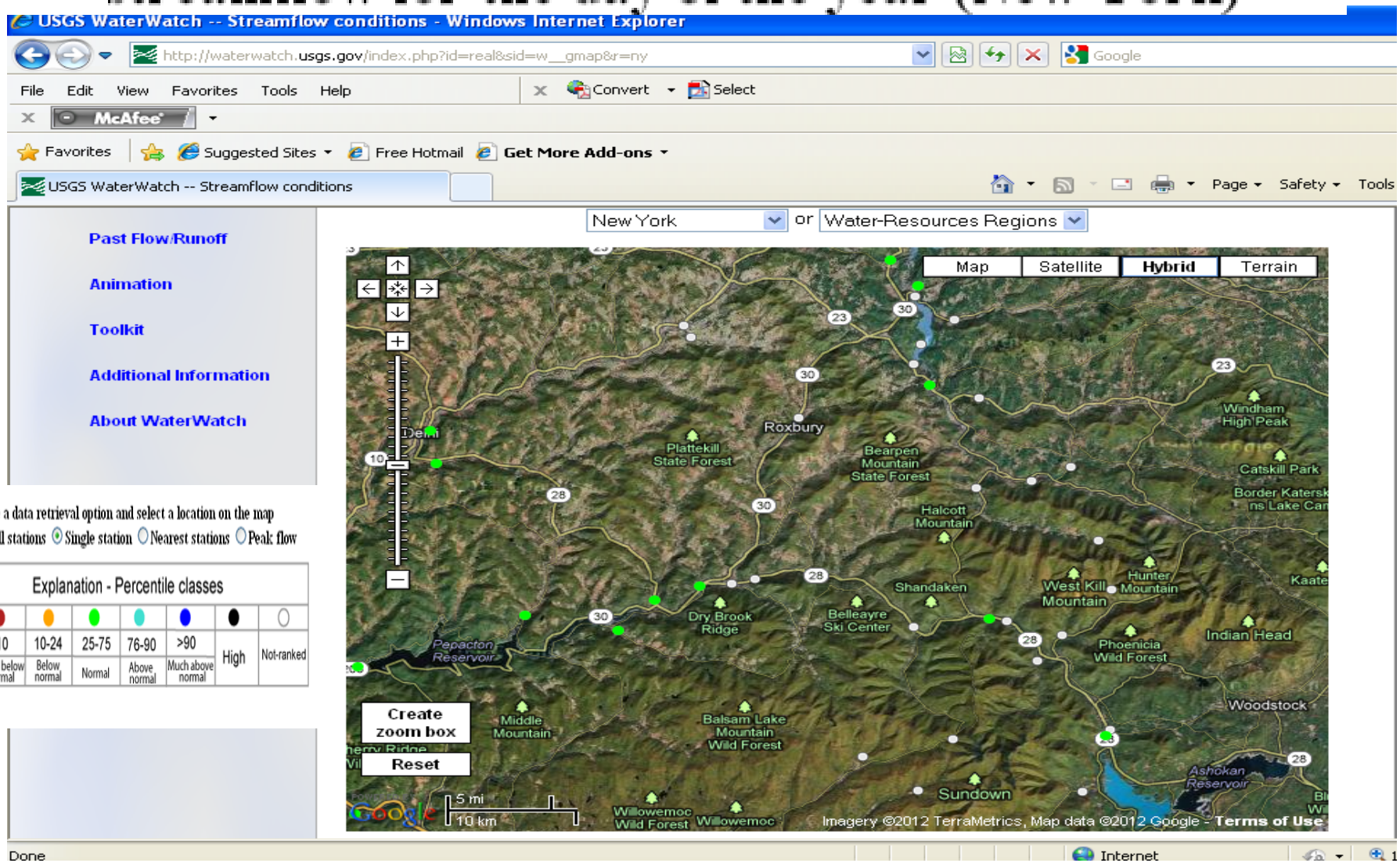
USGS gauges

- US Geological Survey has a network of 59 stream gauges within and outside DEP's watershed. In 2011 there were 40 in the West of Hudson section.
- They primarily measure stream flow
- Some measure turbidity and temperature
- Some provide flood forecasting data to the National Weather Service



USGS's website

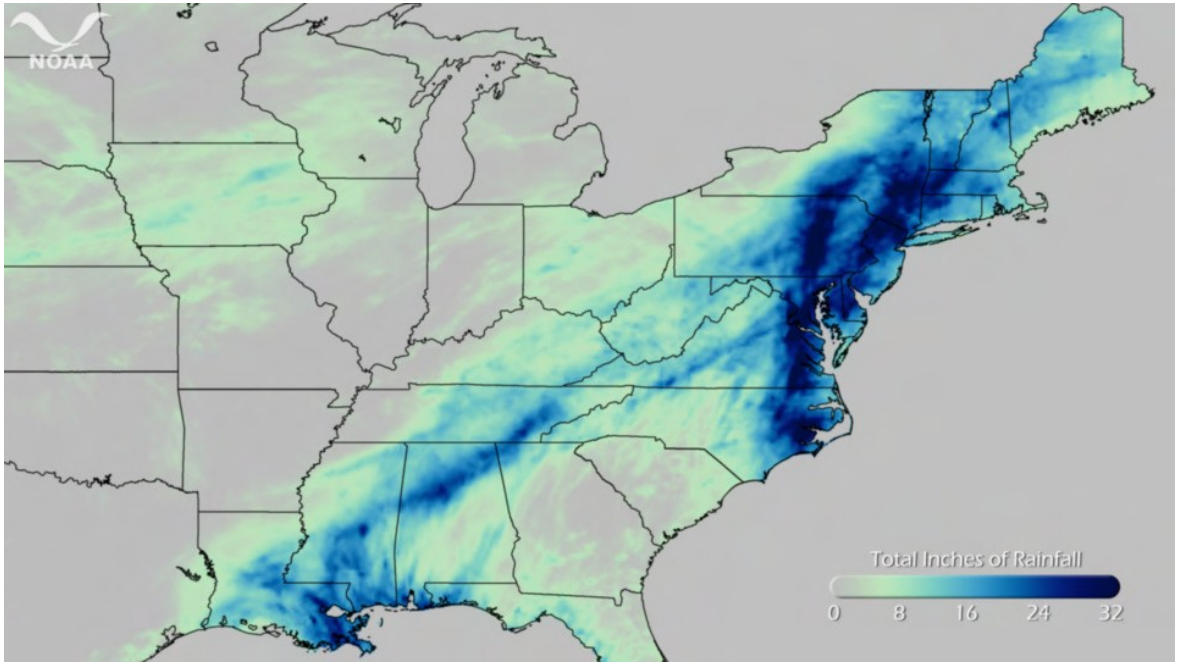
Map of real-time streamflow compared to historical streamflow for the day of the year (New York)



NOAA and NASA satellite data

- GOES geosync satellites
- Landsat satellites
- NPP polar orbiting satellites

NOAA



Total rainfall from 8/26 – 9/9, 2011 as estimated the National Weather service using a combination of radar, rain gauges, and satellite (GOES) rainfall data. Figure is from NOAA Environmental Visualization Lab: www.nnvl.NOAA.gov. Figure was included in 2011 Watershed Water Quality Annual Report

Annual climate summary of rainfall: www.ncdc.NOAA.gov
Statistics were included in 2011 Watershed Water Quality Annual Report

Satellite data

Eastern U.S. Imagery - Satellite Services Division / Office of Satellite Data Processing and Di - Windows Internet Explorer

http://www.ssd.noaa.gov/imagery/eaus.html

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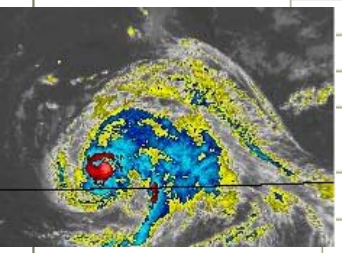
Eastern U.S. Imagery - Satellite Services Division / Of...

GOES Imagery

Single Image		Image Loops (Toggle Lat/Lon)	
With Lat/Lon	Without Lat/Lon	Java	Flash
Visible	Visible	Visible	Visible
Shortwave (IR2)	Shortwave (IR2)	Shortwave (IR2)	Shortwave (IR2)
Water Vapor (IR3)	Water Vapor (IR3)	Water Vapor (IR3)	Water Vapor (IR3)
Infrared Channel 4 Enhancements			
None	None	None	None
AVN	AVN	AVN	AVN
Dvorak	Dvorak	Dvorak	Dvorak
JSL	JSL	JSL	JSL
RGB	RGB	RGB	RGB
Funktop	Funktop	Funktop	Funktop
Rainbow	Rainbow	Rainbow	Rainbow

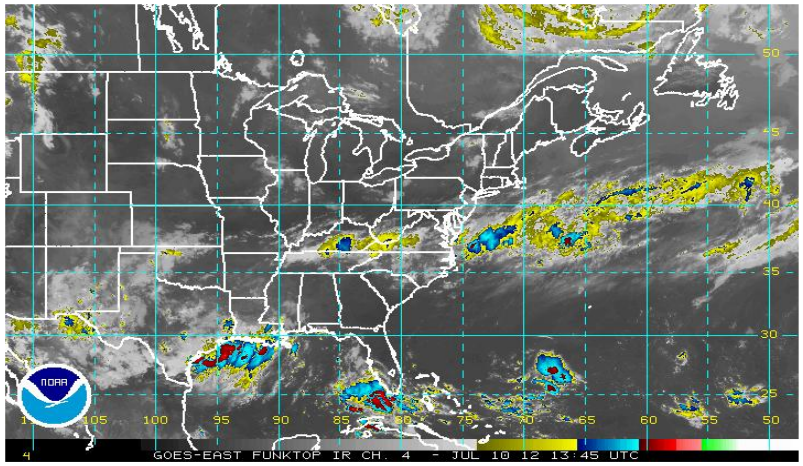


Hurricane Leslie 6th

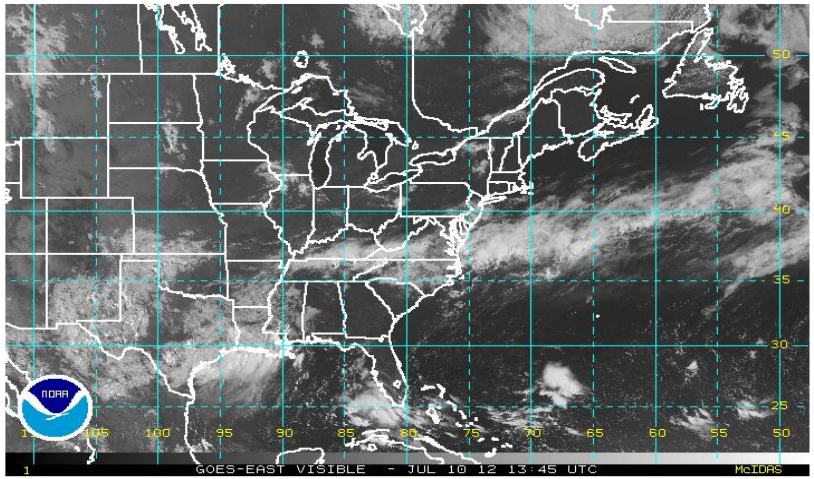
Polar Imagery

Single Image		Image Loops (Toggle Lat/Lon)
With Lat/Lon	Without Lat/Lon	Flash
DMSP SSM/IS Imagery		
85 GHz Radiance	85 GHz Radiance	85 GHz Radiance
Precipitable Water	Precipitable Water	Precipitable Water
Rain Rate	Rain Rate	Rain Rate
Surface Winds	Surface Winds	Surface Winds

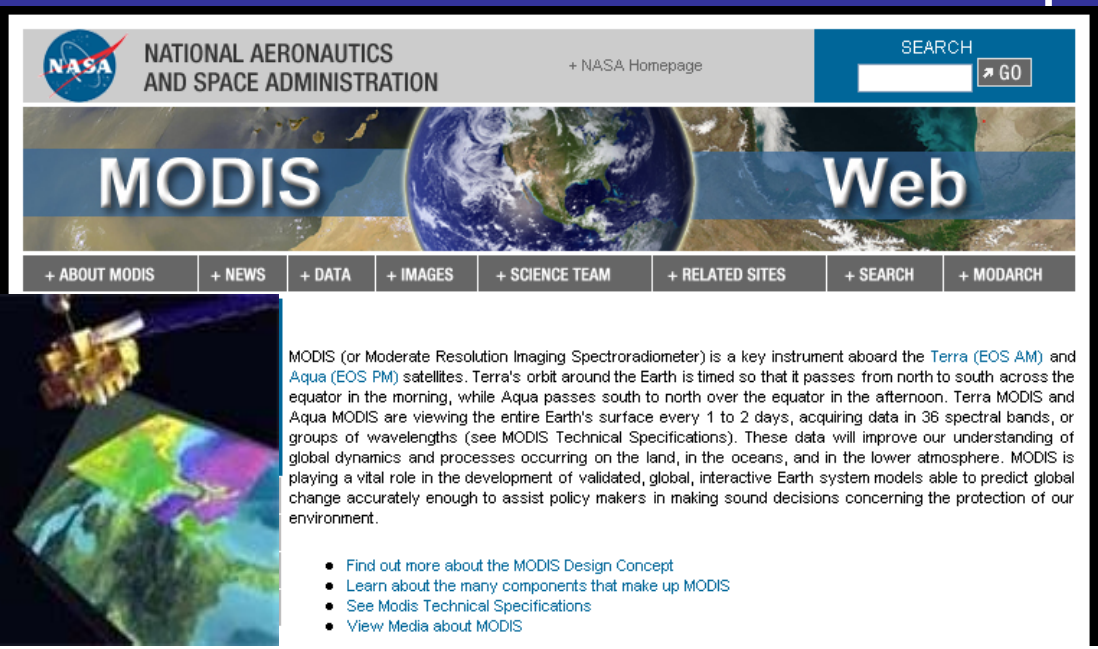
http://www.ssd.noaa.gov/goes/east/eaus/ft-l.jpg - Windows Internet Explorer



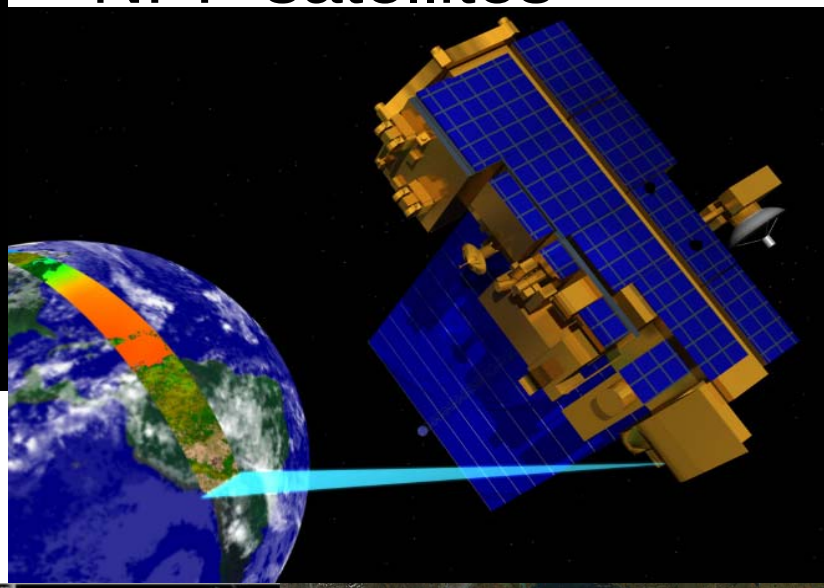
http://www.ssd.noaa.gov/goes/east/eaus/vis-l.jpg - Windows Internet Explorer



MODIS instrument package

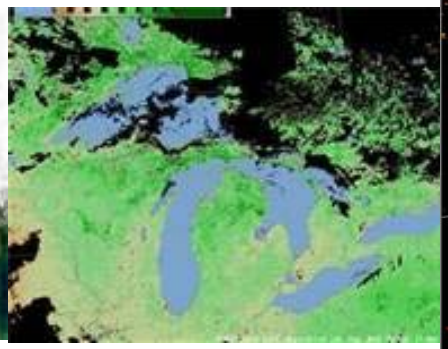


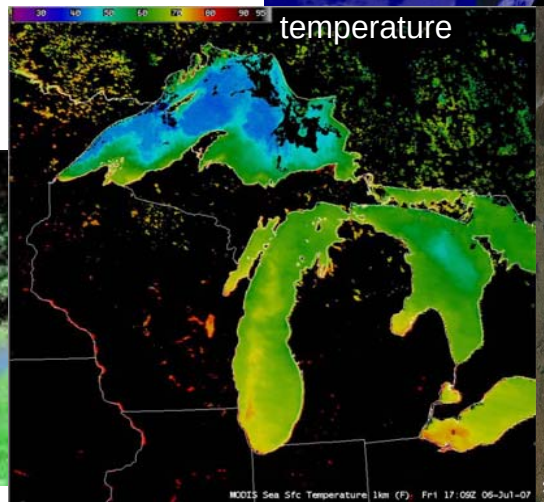
Installed on two NPP satellites



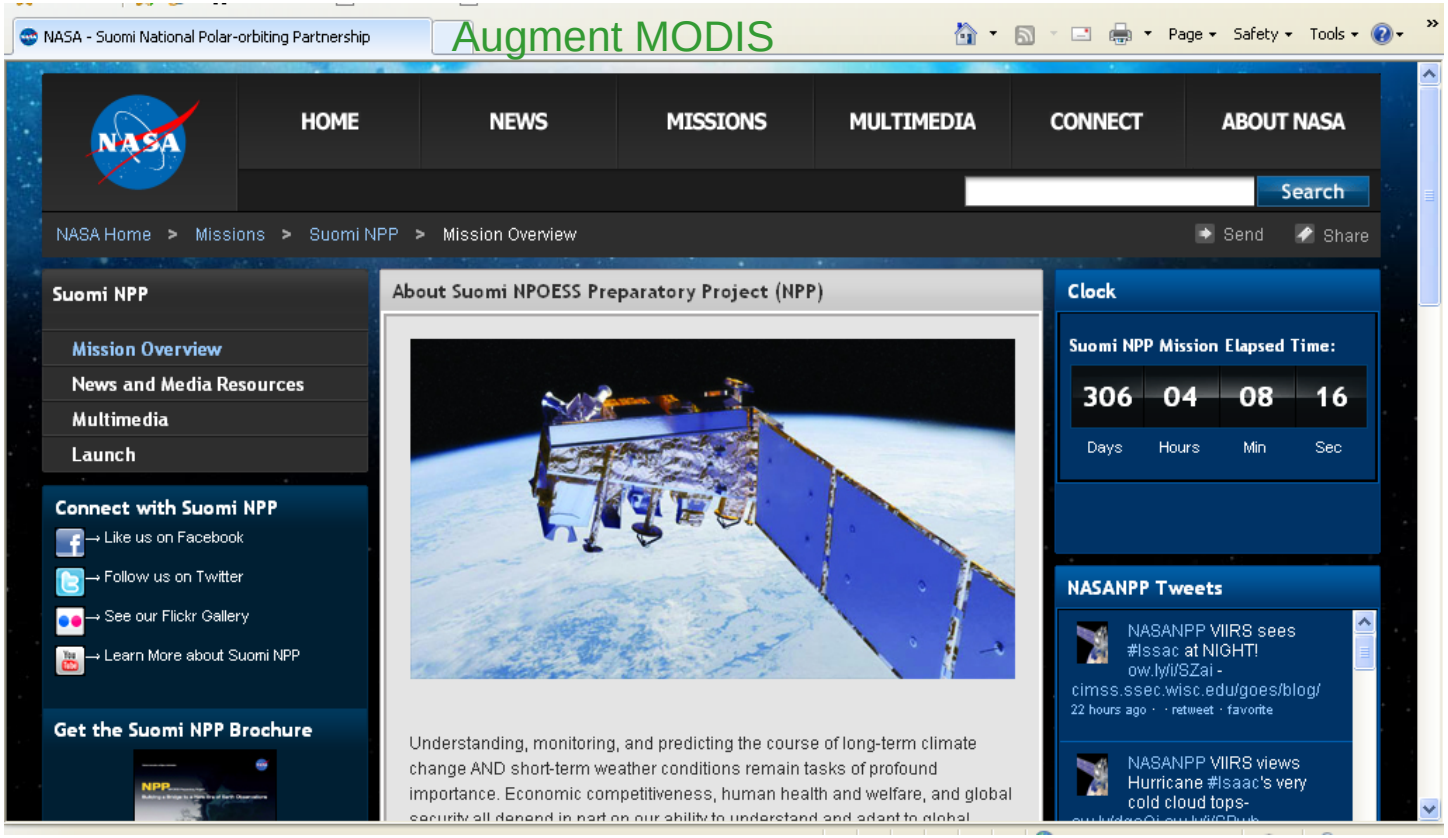
Plans to use MODIS data to measure:

- leaf area index
- vegetation index
- plant growth index





National Polar-orbiting Partnership



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Objectives

Weather
Natural extreme events – hurricanes, floods, storms…
Climate change
Temperature
Ice cover
Vegetation – map land vegetation & monitor plant productivity
Ozone

Assimilation of Snow and Ice Data

Used as input for climate change modeling

Used to determine snow pack and water equivalents in watershed

Used to test watershed model simulation of snow pack and snow cover predictions

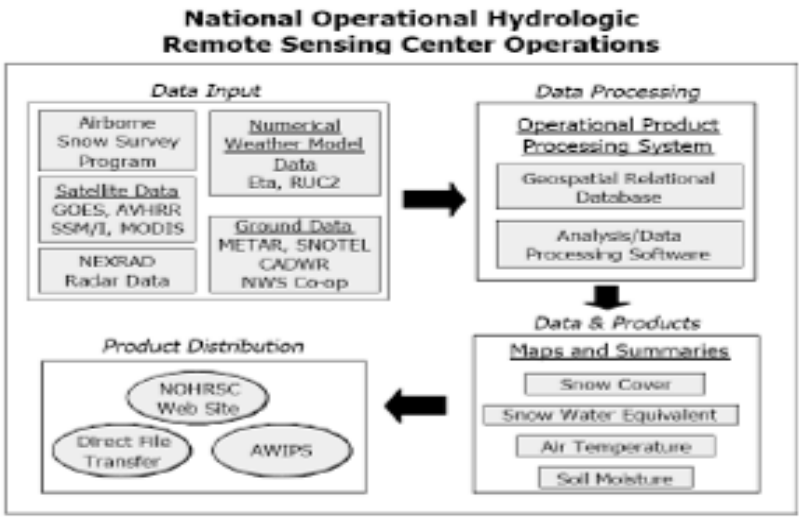


Figure 1. Ground-based, airborne, satellite, numerical weather prediction (NWP) model, and radar data for the country are ingested daily at the NOHRSC. The input data are processed and archived by the Operational Products Processing System (OPPS). OPPS generates a variety of products in map and alphanumeric format that are distributed in near real-time to NWS and non-NWS users.

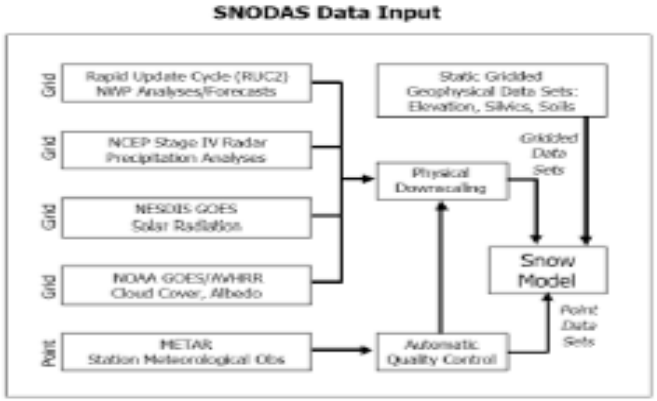


Figure 3. The gridded data input are physically downscaled from the 40 km NWP model resolution to 1 km required by the snow model. Ground-based point observations are automatically quality controlled, used in downscaling, and ingested by the snow model.

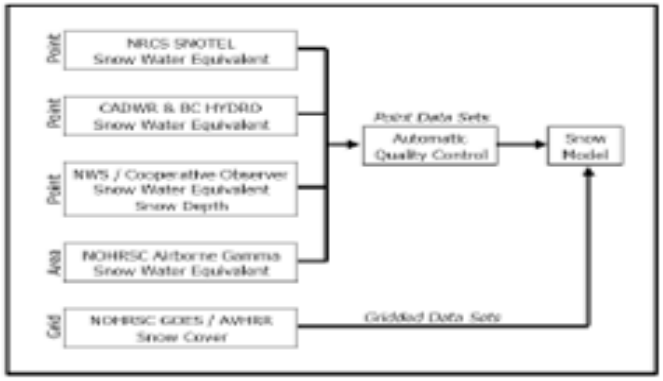


Figure 5. Ground-based and airborne snow water equivalent data are used to update the snow model. Snow depth and satellite-derived areal extent of snow cover observations are also used to update the model.

Watershed Models

- SWAT United States Department of Agriculture Soil and Water Assessment Tool. Used for agricultural watersheds and simulates farm management practices.
- RHESSys spatially-distributed forest ecosystem model. Assessing forest management strategies.
- Models need: Meteorological input. NEXRAD is used, a ground based network.

  Land use, land cover data. Derived from aerial studies and updated periodically.
- Satellite images are used to test models for things like snow cover and plant growth.
- Possibility exists for supplanting inputs to models with satellite data.

Satellite Water Quality Monitoring

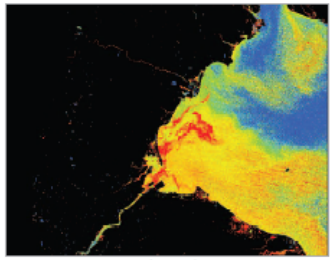
HACH Hydromet

BLUEWATER

Satellite Water Quality Monitoring

Hach Hydromet has partnered with Blue Water Satellite, Inc. (BWSI) to provide comprehensive monitoring options to water quality professionals. Satellite imaging provides the "big picture" health of a water body, highlighting problem areas where in-depth spot sampling is needed with Hydrolab sondes.

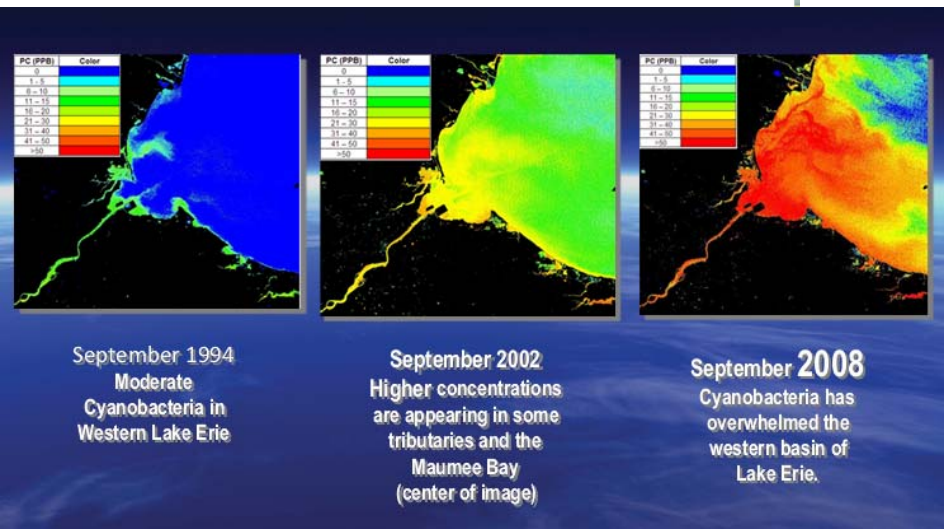
Normal Satellite View

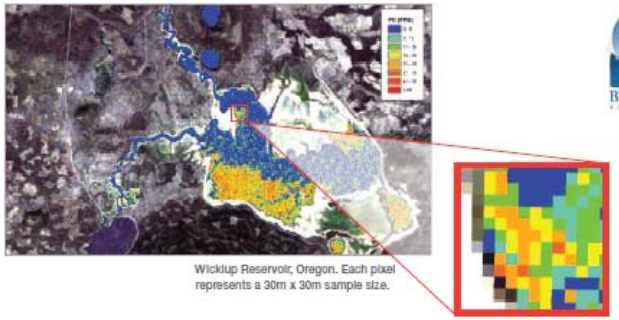


BWSI Water Quality View

As pollutants are constantly moving and are never equally distributed in a body of water, it is important to assess the water body as a whole before sonde deployment. This process, known as "smart sampling," focuses resources only where they are needed, leading to a reduction in time and operating costs for monitoring programs. Satellite monitoring and spot sampling with Hydrolab sondes compliment each other as each method provides information that either one alone does not. Pairing the two together provides a higher level of data density that allows water quality professionals to make decisions with greater certainty.

BWSI also has the ability to retrieve historical satellite water quality data from as far back as 1984, allowing easy identification of the root cause and time period of pollutants entering a water body.





Wickiup Reservoir, Oregon. Each pixel represents a 30m x 30m sample size.

BLUEWATER

Using data from USGS Landsat satellites and processing it through the company's patented algorithms to retrieve water quality data, BWSI has the ability to measure any size of water body in detail around the world.

Specifications

Sample Size
30m x 30m

Constituents Measured
Cyanobacteria, Chlorophyll-a, Total Phosphorus (in water and on surface soils)

Temporal Frequency
Every eight days (cloud cover permitting)

Geographic Range
Global

Measurement Units
Cyanobacteria, Chl-a, Phosphorus in Water – Parts Per Billion (ppb) Phosphorus in Surface Soils – Parts Per Million (ppm)

Range and Accuracy

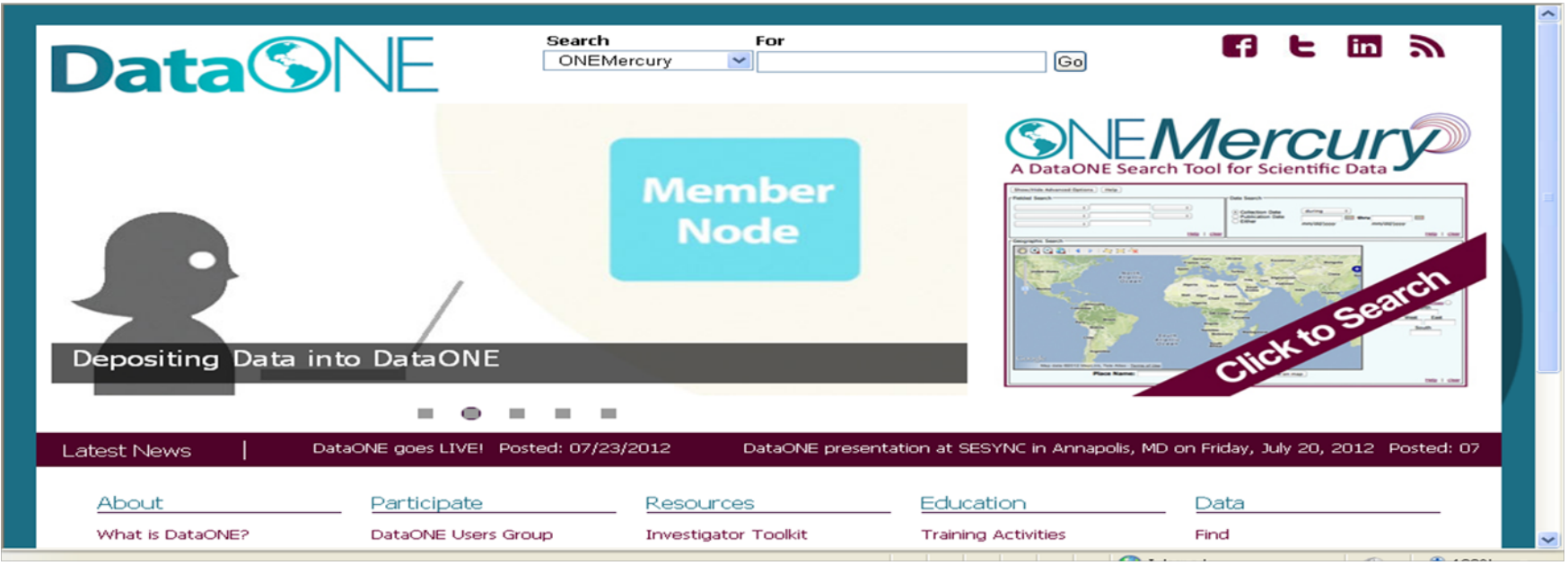
Constituent	Range	Accuracy
Cyanobacteria (Phycocyanin)	0-17 ppb	±2 ppb
Cyanobacteria (Phycocyanin)	17-60 ppb	±17 ppb
Total Phosphorus Water (TPW)	0-20 ppb	±6 ppb
Total Phosphorus Water (TPW)	20-100 ppb	±11 ppb
Total Phosphorus Land (TPL)	0-4000 ppm	±530 ppm
Chlorophyll-a	0-155 ppb	±20 ppb

Pricing

Pricing is determined on a "per-acre" basis. The overall price-per-acre is dependent on the number of acres and constituents measured, sampling frequency, and the length of contract. Price-per-acre significantly decreases as the project size grows. For a detailed quote based on your monitoring needs, please contact Hach Hydromet Sales at (800) 949-3766 ext. 1 or sales@hachhydromet.com.

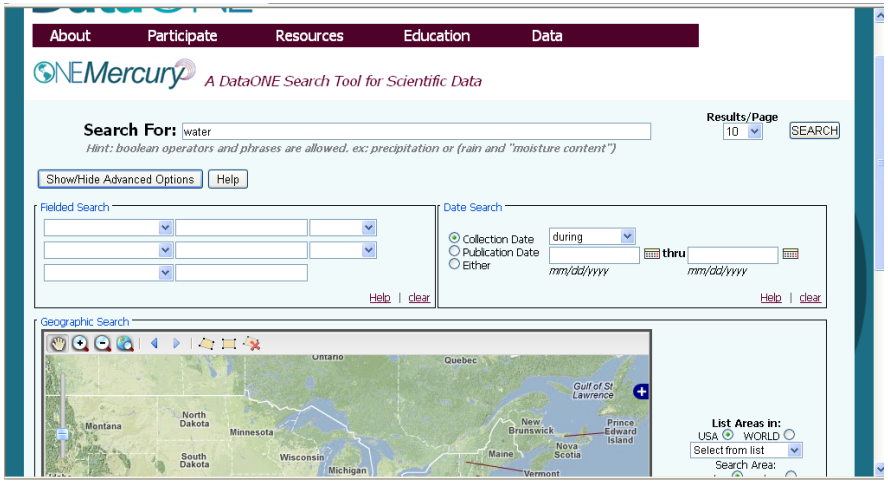
$0.01 – $2.2/acre

DataONE



- Data Observation Network for Earth is the foundation of new innovative environmental science through a distributed framework for open access to Earth observation data. Supported by National Science Foundation.
- Made up of members who contribute and access data.
- One-stop, advanced search engine.

DataONE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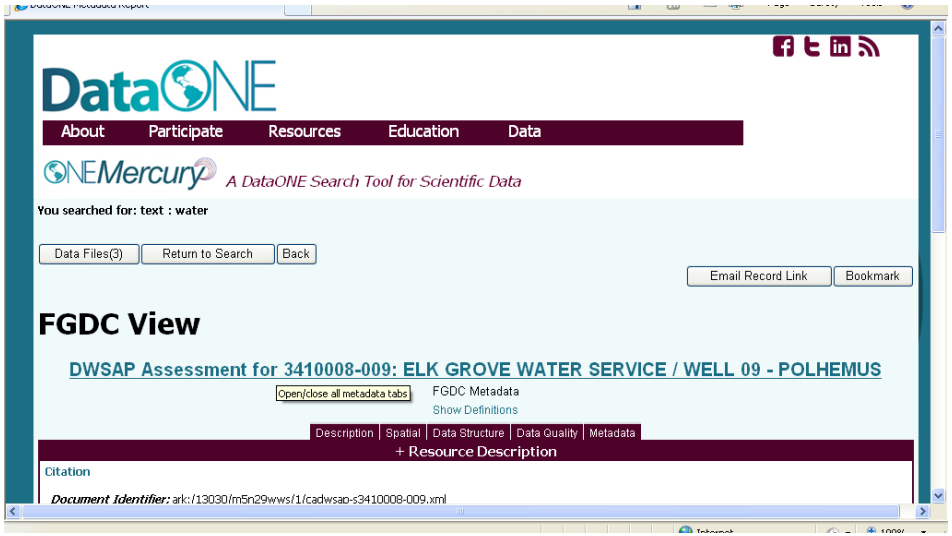
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Description
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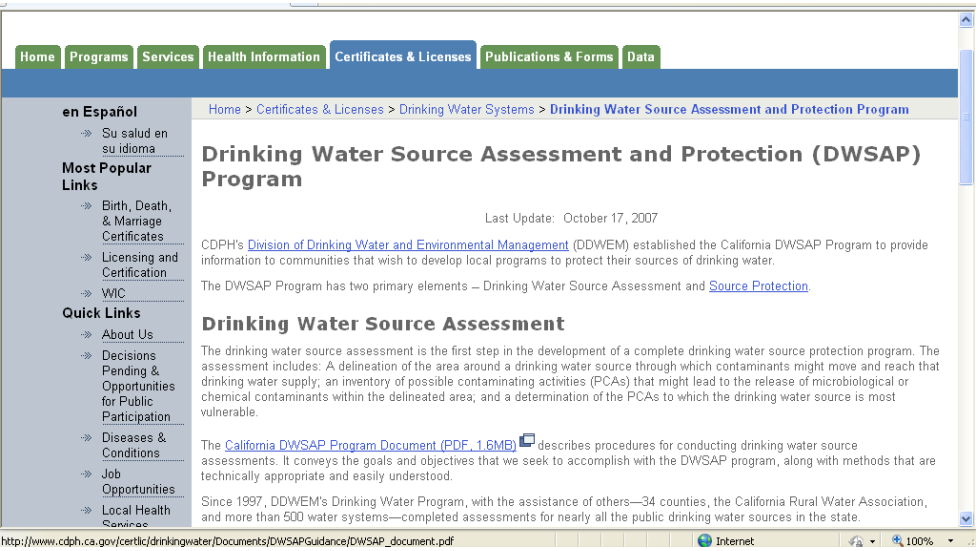
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Home > Certificates & Licenses > Drinking Water Systems > Drinking Water Source Assessment and Protection Program
Drinking Water Source Assessment and Protection (DWSAP) Program
Last Update: October 17, 2007
CDPH's Division of Drinking Water and Environmental Management (DDWEM) established the California DWSAP Program to provide information to communities that wish to develop local programs to protect their sources of drinking water.
The DWSAP Program has two primary elements – Drinking Water Source Assessment and Source Protection.
Drinking Water Source Assessment
The drinking water source assessment is the first step in the development of a complete drinking water source protection program. The assessment includes: A delineation of the area around a drinking water source through which contaminants might move and reach that drinking water supply; an inventory of possible contaminating activities (PCAs) that might lead to the release of microbiological or chemical contaminants within the delineated area; and a determination of the PCAs to which the drinking water source is most vulnerable.
The California DWSAP Program Document (PDF, 1.6MB) describes procedures for conducting drinking water source assessments. It conveys the goals and objectives that we seek to accomplish with the DWSAP program, along with methods that are technically appropriate and easily understood.
Since 1997, DDWEM's Drinking Water Program, with the assistance of others—34 counties, the California Rural Water Association, and more than 500 water systems—completed assessments for nearly all the public drinking water sources in the state.
http://www.cdph.ca.gov/certlic/drinkingwater/Documents/DWSAPGuidance/DWSAP_document.pdf
Internet
100%

Conclusions

- Many possibilities to tap into existing and future sources of data.
- Make more use of available satellite data.
- Sources of continuous monitoring data is important to Water Supply Operations and modeling.
- Join data sharing cooperatives.

Acknowledgments

- Elliot Schneiderman, Jim Mayfield, Kurt Gabel, Lorraine Janus, Kerri Alderisio.