Multi-Agency Integration of Remote Sensed GOES DCS Telemetered Hydro-Meteorological Observations

LySanias Broyles
Water Control, Rock Island District
Rock Island, IL
Chair, Satellite Telemetry Interagency Working Group (STIWG)
Chair, CWMS Users Representative Group (CURG)

Real-Time Water Quality Workshop
St. John’s, Newfoundland, Canada
07 - 08 OCT 2018
STIWG Membership

- US Army Corps of Engineers
- U.S. Geological Survey
- U.S. Bureau of Reclamation
- National Park Service
- U.S. Forest Service
- U.S. Bureau of Land Management
- NOAA (NWS, NESDIS/NCDC and NOS)
- State, Local and International groups actively participate and contribute
STIWG

- Formed in 1976; Coordinating with NOAA as the Satellite Data Collection System Interagency Working Group (SDCSIWG)
- November 1979: Presidential Directive mandating NOAA to operate the Geostationary Operational Environmental Satellite Data Collection System (GOES DCS)
- 1985: Chartered as STIWG by the Interagency Advisory Committee on Water Data (IACWD) and Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR)
  - Facilitated user coordination with NOAA on use of GOES DCS
- STIWG now sits under the Advisory Council on Water Information (ACWI) and the Office of Federal Coordinator for Meteorology (OFCM)
- Promotes information exchange/sharing of data, research and development
- Undertakes projects that benefit the GOES DCS community
Working Groups

- **DCS Preservation**
  - Tasked with addressing issues pertaining to matters that impact the viability, availability and integrity of GOES DCS data from the GOES satellites.

- **OpenDCS Standardization**
  - Tasked with establishing an executable plan that will unify existing OpenDCS variants and capabilities into a single platform. The second objective is to establish a way to jointly plan and fund the new platform’s development and support by the STIWG agencies.
What is GOES DCS

- DCS is a data relay capability on the GOES East and West satellites
- Data Collection Platforms (DCP’s) deployed in the field collect readings and perform scheduled transmissions to one of the GOES spacecrafts (dependent upon geography) for relay back to Earth ground stations
  - Nearly ~8 million hydro-met observations are transmitted/day
  - Direct Read-out Ground Stations (DRGS) collect data directly from the initial GOES relay
  - L/HRIT DCS is GOES DCS data that is received by processing centers, repackaged and transmitted to GOES and relayed back to earth for L/HRIT ground stations with smaller dish antennas to receive
- Stations allocated timeslots to transmit between 300 and 1200 baud
  - Transmissions per hour dependent on assignment: e.g. hourly, half/quarter-hourly, etc.
- GOES DCS is a primary system for many agencies supporting water resource management, navigation, flood control, agriculture, hydro-power, etc.
GOES DCS Operation
GOES Footprint
15,900 location subset of all GOES transmitting sites ingested by the National Weather Service (NWS) Hydrometeorological Automated Data System (HADS)
GOES DCS Data Collection

- Local Read-out Ground Station (LRGS) software suite
  - Network-based tool - e.g. Cove Open-DCS, Sutron DCS-Toolkit
  - Connects to GOES receive systems to ingest, decode, process, QA/QC, validate, transform, store and disseminate incoming messages
    - Capable of interfacing with other sources
  - Communicates using various protocols (including DAMS-NT) over TCP/IP
  - Various routing options
    - File format: SHEF, SHEF-IT, HydroJSON, Hydromet, Hydstra, etc.
    - Can write directly to various database systems
      - USACE Oracle Corps Water Management System (CWMS)
      - USBR Oracle Hydrologic Database (HDB)
      - Postgres OpenTSDB
      - And others
LRGS: RiverGages-WIBS

UTC: August 31, 2018 17:44:33 (Day 245)
(Time reported by LRGS)
System Status: Running
LRGS Version: 9.2 Opensource 4.5 BDD (Jul 30, 2018)

Archive Statistics

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<th>Oldest Msg Time</th>
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<td>657987</td>
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Hourly Data Collection Statistics

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<th>07-09</th>
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<th>13-15</th>
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<th>17-19</th>
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<tr>
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<tr>
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<td>0</td>
<td>0</td>
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<td>0</td>
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<td>5716 / 1343</td>
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<td>5989 / 1584</td>
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<td>49013 / 1790</td>
<td>53909 / 1740</td>
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<td>LRT (Good/ParErr)</td>
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<td>35771 / 114</td>
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Downlink Statistics

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<th>Link Status</th>
<th>Link Purpose</th>
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<td>Real-Time</td>
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<td>08:31 17:44:33</td>
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<td>Ready</td>
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<td>Primary</td>
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RCKI2 - 08/31/2018 00:09:00.2 (UTC)
Mississippi River at L&D 15 - MET Station

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<th>Value</th>
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<td>Signal Strength</td>
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<td>GOES Channel</td>
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<td>DRGC code</td>
<td>RE</td>
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<td>Carrier StartUTC</td>
<td>00:09:00.2</td>
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<tr>
<td>Quality Codes</td>
<td>G</td>
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<td>Frequency Offset</td>
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<tr>
<td>Battery</td>
<td>13.6 (volts)</td>
</tr>
<tr>
<td>Carrier StopUTC</td>
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Raw Data:

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<td>18.83</td>
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</table>
GOES DCS Hydro-Met Integration

- Inland Navigation and Water Resource Management
- Operational Decision Support
- Water Quality (TDG, DO, Chlorophyll, PH, turbidity, conductivity….)
- Water Quantity (stage, discharge, storage, snow water equivalent….)
- Flood and Drought Management/Response
- Water Resource Management
- Meteorological (relative humidity, solar radiance, wind vector, air temp….)
- Wildfire Response (RAWS behavior and prediction, BAER post-fire precip gages)
- Agriculture (soil moisture, pan evaporation, soil temperature….)
- Academia
- Private Industry/Economic Impacts
- Alerts/Warnings and Information
US Bureau of Reclamation River Levels, Reservoir Capacity and Snow Water Equivalence

- USBR is the largest wholesale water supplier in the United States
  - Supplies 31 million people (10 trillion gal/year)
- Second largest supplier of hydro-power ($1B+/year, 3.5M homes)
- Operates 600+ Water Management Projects in the Western United States
  - Flood control
  - Recreation (280+ recreation sites)
  - Fishing
  - Wildlife benefits
  - Irrigation (10 million acres: 60% of US vegetables, 25% of nuts)
CBT - EAST SLOPE

Data as of 08/28/2018
National Ocean Service Tides and Currents
PORTS Program

- **Physical Oceanographic Real-Time System**
  - Network of U.S. coastal hydro-met stations located in seaports
    - Measure and disseminate real-time current data, storm forecasts/warnings, water quantity/quality, hydro-met, etc.
    - Proven reliability providing data during extreme storm events
  - Supports safe and efficient coastal navigation
    - Provides mariners with accurate oceanographic data
      - Safety: Reduces collisions and groundings by 60%
      - Maximize cargo load/draft generating increased revenue (as much as $290K add’l profit/ft of draft)
      - Minimize maritime passage times
      - Protect coastal resources and habitat: ~$7B annual revenue from saltwater fishing
      - Customizable PORTS composite plots
  - Customized for local requirements
    - Station instrumentation consists of as many as 50 sensors
  - PUFFF – Ports Uniform Flat File Format
    - Enables automated access to PORTS data via well-defined ASCII flat-file exchange specification
**NOAA HAB-OFS Conditions Report**

**Gulf of Mexico Harmful Algal Bloom Bulletin**

**Region: Southwest Florida**

**Conditions Report**

Not present to high concentrations of *Karenia brevis* (commonly known as red tide) are present along- and offshore portions of southwestern Florida, and not present in the Florida Keys. *K. brevis* concentrations are patchy in nature and levels of respiratory irritation will vary locally based upon hourly bloom concentrations, ocean currents, and wind speed and direction.

**Recently Reported Impacts (Listed by County):**

- Respiratory irritation: Monroe, Sarasota, Lee, Collier
- Dead fish: Pinellas, Manatee, Sarasota, Charlotte, Lee, Collier

**Definition of respiratory irritation levels:**

<table>
<thead>
<tr>
<th>RESPIRATORY IRRITATION LEVEL</th>
<th>NONE</th>
<th>LOW</th>
<th>MILD</th>
<th>MODERATE TO HIGH</th>
</tr>
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<tbody>
<tr>
<td>APPLIED POPULATION</td>
<td>0</td>
<td>&lt;1</td>
<td>1-9</td>
<td>&gt;9</td>
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</tbody>
</table>

**Additional Resources**

- **Health Information:**
  - Other resources: [https://go.usa.gov/xCN9p](https://go.usa.gov/xCN9p)
- **Recent Local Observations and Data:**
  - [National Marine Laboratory Daily Beach Conditions:](http://www.fws.gov/Florida/Conservation/)
  - [Florida Department of Environmental Conservation Commission:](http://myfwc.com/middlestatus)

<table>
<thead>
<tr>
<th>County Region</th>
<th>Mon 08-27-18</th>
<th>Tue 08-28-18</th>
<th>Wed 08-29-18</th>
<th>Thu 08-30-18</th>
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<tbody>
<tr>
<td>Northern PINELLS County-Gulf Coast</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Northern PINELLS County-Bay Regions</td>
<td>none</td>
<td>none</td>
<td>none</td>
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<tr>
<td>Southern PINELLS County-Gulf Coast</td>
<td>very low</td>
<td>very low</td>
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<tr>
<td>Southern PINELLS County-Bay Regions</td>
<td>very low</td>
<td>very low</td>
<td>very low</td>
<td>very low</td>
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</tbody>
</table>
USACE Effective Flood Control and Navigation Project Operation Benefits

► Real-time GOES data collection, acquisition, archival, decision support and dissemination
  • Daily/upward reporting, studies, analysis, hydraulic forecasts, operational instructions, etc.
  • Flood Inundation Mapping, Flood Impact Analysis
► Corps Water Management System (CWMS) Modeling and Analysis
  • Flood Impact Analysis
  • Flood Inundation Mapping
  • Flood Impact Assessments/Calculate Damages
► Provide daily operational forecasts/reports
► Daily Lock and dam operation for safe in-land navigation (~$250B annual benefit)
  • ~200 USACE-owned Navigation Projects
► Daily Reservoir discharge operations
  • ~400 USACE-owned Flood Control Projects
  • Flood control, hydro-power, recreation, water supply, irrigation, etc.
► Provide data to the public, private industry, academia and other agencies
Two basic facts about inland navigation drive this analysis: (1) More than one-half billion tons of freight move an average of 450 miles each year by barge, and (2) There are no better ways to move, store, and otherwise manage this freight. If there were, shippers would choose them. This simple reality forms the basis for the work that follows.
USACE Modeling Mapping and Consequences Production Center creates inundation maps by incorporating real-time GOES hydro-met observations. FIM is combined with economic, land use and other information for analysis to estimate consequences/losses; fatality rates, critical infrastructure, real-estate, etc.
NOTICE: All data contained herein is preliminary in nature and therefore subject to change. The data is for general information purposes ONLY and SHALL NOT be used in technical applications such as, but not limited to, studies or designs. All critical data should be obtained from and verified by the United States Army Corps of Engineers. The United States Government assumes no liability for the completeness or accuracy of the data contained herein and any use of such data inconsistent with this disclaimer shall be solely at the risk of the user.

EXTERNAL LINK DISCLAIMER: Solely for ease of reference to related data, this site contains hyperlinks to a number of external web sites and/or information created and maintained by other public or private entities. The US Army Corps of Engineers neither controls nor guarantees the accuracy, relevance, timeliness, or completeness of any external sites or information, and the agency expresses no discretion to establish or remove external links from the server at any time. Further, the inclusion of links to particular external sites is not intended to reflect their importance or to endorse any views expressed, products or services offered on those sites, or the organizations sponsoring the sites.
RiverGages WaterML webservice allows users to query and retrieve data from the RiverGages database for use in their automated information systems. Based on the CUAHSI WaterML model, this information is immediately available for ingest by WaterML enabled automated systems.
Lock and Dam 15 – Mississippi River

- Navigation project operated by Rock Island District
- Constructed in 1934
  - Worlds longest roller dam at 1,203 ft
    - 9 gates: 100 ft long x 14.3 ft diameter
    - 2 gates: 100 ft long x 16.2 ft diameter
  - Creates Pool 15 along Upper Mississippi River
  - $3 billion in commodity transportation savings/$246 million to operate
    - (1 barge = 58 semi-trailers or 15 rail cars)
- Stats
  - Capacity: 100,000 ac-ft
  - Catchment: 88,500 sq mi
  - Chamber length: Two 600 ft lock chambers at 100 ft wide
  - Transit Time: 30 mins
  - Average Annual Tonnage: 20 Million Tons
Bonneville Lock and Dam – Columbia River

- Constructed in 1934 (first powerhouse) and 1974 (second powerhouse)
- Multi-purpose Project
  - Navigation
  - Power generation (1.2GW for 500,000 customers using Kaplan adjustable turbines)
  - Fish ladder for spawning Salmon, Trout, Shad and Lamprey
  - Recreation
    - Fishing, boating, camping, hiking, hunting, camping, etc.
- Stats
  - 537,000 ac-ft
  - Catchment: 240,000 sq mi
  - Length: 2,690 ft, Height: 197 ft, Base Width: 132 ft
  - Lock Chamber Dimensions: 675 ft long x 85 ft wide (25 to min fill and empty)
  - Transit Time: 30 mins
  - 18 Gates (1,450 ft spillway): 1.6 million cu ft/s
  - Tonnage: 8.6 million tons
Red Rock Dam – Des Moines River

- Flood control project operated by USACE, Rock Island District
  - Operated in conjunction with Saylorville Dam
- Constructed 1960 - 1969
  - Multi-purpose Project
    - Flood control
    - Water supply
    - Recreation: camping, fishing, hunting, etc.
    - Hydro-power (2018)
  - Creates Lake Red Rock in Central Iowa
  - DCP’s monitor aiding seasonal conservation pool and drought/flood mitigation operation
- Stats
  - Max discharge: 144,000 cfs
  - Catchment: 12,320 sq mi
  - Length: 5,676 ft, Height: 95 ft, Width: 13.4 ft
  - Surface area: 15,250 acres
  - Power generation (2018): 36.4 MW, (179,000 MWh annually for 18,000 homes)
Saylorville Lake (upper left) and Red Rock Lake (lower right) are operated together during flood events.
FIGURE 1
Flood Damage Reduction

Billions of Dollars

Fiscal Year


10-Yr Average = 67.3

Flood Damages Prevented in the U.S.A. by the U.S. Army Corps of Engineers

FIGURE 2
Potential Flood Damages

Billions of Dollars

Fiscal Year


Damages Suffered 10-Yr Avg = 10.1

BUILDING STRONG®
FIGURE 6

Benefits of Federal Projects (Damages Prevented)
Accumulative Corps Expenditures (Principle plus O&M)
Adjusted to 2000 Using Construction Cost Index EM 1110-2-1304 (Mar 2018 revision)

Flood Damage Reduction
BENEFITS TO COST
$9.96 in Benefits for every $1.00 Invested
Water Quality Mission

- Dissolved Oxygen
- Total Dissolved Gas
- Turbidity
- Conductivity
- Chlorophyll
- Phycocyanin
- Suspended Solids
- Water Temperature
- pH

Real-time Water Quality data provides mission critical information to operate projects within mandated constraints codified in the Water Quality Management Plan unique to each project.

Fish, wildlife, public health, safety and interest are among the chief tenets for responsible project operation.
Detroit Dam - Williamette Basin - Salem, OR

- Multi-purpose project
  - Flood Risk Management (operated in conjunction with Big Cliff Dam)
  - Hydro-power generation (2 generators producing 100 MW)
  - Water Quality improvement (fish passage improvements)
  - Songbird and waterfowl habitat
  - Recreation
  - Irrigation

- Stats
  - Length: 1,523.5 ft, Height: 463 ft
  - Capacity: 3,500 ac-ft
  - Shoreline: 32 mi, Lake Length: 9 mi
4. Bonneville Forebay TDG Monitoring Station (BON)

Cage Elevation: Fixed
Latitude: 45° 38' 44.4" N
Longitude: 121° 56' 24.3" W
Datum: NAD 83
River: Columbia
River Mile: 146.1
USGS ID: 453845131562000
Owner: U.S. Army Corps of Engineers
Gauge Type: Hydroxide
Data Transmission: GOES Satellite
Dates of Operation: Year-round
Years of Operation: 1986 – Present
River Conditions: Forebay Monitor
Location: This gauge is located in the forebay of Bonneville Dam on the northern side of the spillway channel on Cascade Island just upstream of spillway #1.
Detroit Dam & Lake Downstream Passage Project

The U.S. Army Corps of Engineers is conducting an environmental review to aid in developing a project that will provide downstream juvenile fish passage for Upper Willamette River Chinook and temperature control at Detroit Dam. The Detroit Dam and Lake spans the Linn County-Marion County border in the Oregon Cascades on the North Santiam River near the city of Detroit. Read an article about this project here.

Background

The Corps operates and maintains 13 multipurpose dams and reservoirs (including Detroit Dam and Lake) in the Willamette River Basin in Oregon, collectively referred to as the Willamette Project.

The listing of several species under the Endangered Species Act (ESA) requires the Corps to perform an assessment of the Willamette Project and its operations’ impact on listed species. Based on this assessment, the National Marine Fisheries Service (NOAA Fisheries) released a Biological Opinion (BiOp) in 2008 which identified the required actions to avoid jeopardizing the existence of ESA listed fish in the Willamette basin. These include downstream fish passage at Detroit Dam and the minimization of water quality effects, temperature in particular, associated with operations of Detroit and Big Cliff dams, by making structure modifications or major operational changes.

If feasible and more efficient to achieve both purposes through one construction project, the BiOp allows for this.

Upcoming Public Meetings

The Corps will host three public information meetings to provide an overview of alternatives assessed to date to meet the project’s purpose. View the alternatives analysis report here. This is NOT a formal comment forum.

- August 7, 2018, 5:30-7:30 p.m., Stayton Community Center, 409 W Virginia Street, Stayton, OR 97338
- August 22, 2018, 5:30-7:30 p.m., Gates Fire Hall, 140 E Sorbin Street, Gates, OR 97346
- August 23, 2018, 5:30-7:30 p.m., Oregon Department of Fish and Wildlife Commission Room, 4034 Fairview Industrial Drive SE, Salem, OR 97302
Pittsburgh District Water Quality Monitoring Network

- Funds the USGS to build, maintain and store data for a network of GOES Water Quality stations
  - Provides valuable real-time data to evaluate health of lake projects
- Employs buoyed stations for continuous monitoring
  - Operate spring-fall each year
  - Turbidity, total dissolved gas, water temperature, dissolved oxygen, pH, conductivity, etc.

The United States Geological Survey (USGS) is funded by the U.S. Army Corps of Engineers (USACE) to build, operate and store data for water quality monitoring stations throughout the Pittsburgh District. Diagrams of these monitoring stations can be seen below and more information can be found at: http://pubs.usgs.gov/tm/2006/tm1D3/

Figure 2. Ramapo River at Pompton Lakes, New Jersey, and schematic of flow-through water-quality monitoring station.

Figure 3. Delaware River and Ararat Canal feeder at Raven Rock, New Jersey, and schematic of internal-loging water-quality monitoring sensor and recording system.
Continuous Data

Visitors can view real time continuous data for the 12 water temperature buoys at Pittsburgh District reservoirs (when in operation from the spring through fall) and the 35 USGS water quality stations that are funded in part by the US Army Corps of Engineers below.


The Pittsburgh District utilizes a network of water temperature buoys to measure lake temperature at 12 reservoirs and other water quality parameters, primarily pH, specific conductivity, dissolved oxygen and turbidity, at 4 reservoirs. Data are recorded hourly every day from spring to fall each year. Water temperature and quality readings are taken on the lake, near the dam, by an automated buoy that has a temperature string, and in some cases a water quality sonde.

Fondriest Environmental is the company contracted by the Pittsburgh District to provide services for the water temperature buoy network. For more details on the platform, see the following document.

US Army Corps of Engineers
Pittsburgh District Reservoir Temperature Monitoring Network

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Surface Sonde Depth (ft)</td>
<td>1.41</td>
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<tr>
<td>Surface pH</td>
<td>7.66</td>
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<tr>
<td>Surface pH mV</td>
<td>-38.4</td>
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<tr>
<td>Surface ORP (mV)</td>
<td>1.46</td>
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<tr>
<td>Surface Turbidity (NTU)</td>
<td>1.43</td>
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<tr>
<td>Surface Chlorophyll (ug/L)</td>
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<tr>
<td>Surface BGA-Phycocyanin (ug/L)</td>
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<td>Surface BGA-Phycocyanin RFU (RFU)</td>
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<tr>
<td>Surface ODOSat (%)</td>
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<tr>
<td>Surface ODO (mg/L)</td>
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<tr>
<td>13ft Temperature (°C)</td>
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<tr>
<td>13ft Sp Cond (g/L/cm)</td>
<td>37.5</td>
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</tbody>
</table>

**Graphs:**
- Berlin Surface Chlorophyll
- Berlin Surface pH
- Berlin Surface BGA-Phycocyanin
- Berlin 13ft Temperature
- Berlin 13ft Sp Cond

**Other Data Points:**
- 13ft Depth (ft): 9.833
- 13ft pH: 9.63
- 13ft mV: -135.1
- 13ft ORP (mV): 219
- 13ft Turbidity (NTU): 173.36
- 13ft Chlorophyll (ug/L): 23.1
- 13ft Chlorophyll RFU (RFU): 5.7
- 13ft BGA-Phycocyanin (ug/L): 1.270
- 13ft BGA-Phycocyanin RFU (RFU): 1.3
- 13ft ODOSat (%): 134.3
National Weather Service, Interagency Fire Center and Forest Service

- Rapid deployed and permanent GOES transmitting stations
- Provide real-time data for monitoring fire danger
  - Weather Service Remote Automated Weather Stations (RAWS – behavior/predictive)
    - Average 5.8MM acres burned/year from ~51K fire events/year (2008 – 2017)
  - Forest Service Burned Area Emergency Response (BAER – post fire)
  - National Interagency Fire Center (NIFC) – Boise, ID
    - Fire and Aviation Management software for fire weather and fuel modeling
  - Western Regional Climate Center – WRCC Reno, NV
- Provide real-time post-fire precipitation readings
  - Monitor for floods and landslides
- Interagency fire coordination and response
Remote Automated Weather Stations (RAWS)

Note: We have moved to a new RAWS website (https://raws.nifc.gov/). Please update your links.

There are nearly 2,200 Interagency Remote Automatic Weather Stations (RAWS) strategically located throughout the United States. These stations monitor the weather and provide weather data that assist land management agencies with a variety of projects such as monitoring air quality, rating fire danger, and providing information for research applications.

Fire managers use this data to predict fire behavior and monitor fuels; resource managers use the data to monitor environmental conditions. Locations of RAWS stations can be searched online courtesy of the Western Regional Climate Center.

News and Information

January 27, 2017

FTS FOR ANTHA

All RAWS customers are advised that the manufacturer design of the FTS EnGo Antenna may limit the RT145/4095 ability to make any repairs to this item.

Due to this maintenance limitation if an EnGo antenna appears to fail in the field the following maintenance options apply:

- RTS/TVS Transmitter Upgrade
- Replacement RT145 Antenna
- Replacement RT4095 Antenna
- Replacement Complete Antenna

Burned Area Emergency Response - BAER

Background | Wildland Fire Leadership Council

While many wildfires cause little damage to the land and pose few threats to fish, wildlife and people downstream, some fires create situations that require special efforts to prevent further problems after the fire. Loss of vegetation exposes soil to erosion; runoff may increase and cause flooding, sediments may move downstream and damage houses or fill reservoirs, and put endangered species and community water supplies at risk. The Forest Service Burned Area Emergency Response (BAER) program addresses these situations on Forest Service lands with the goal of guarding the safety of Forest visitors and employees and protecting Federal property, water quality, and critical natural or cultural resources from further damage after the fire is out. Information collected by the Forest Service BAER teams is shared with other Federal, State and local emergency response agencies so they can provide assistance to communities and private landowners who may also be affected by potential post-fire damage.

National DACR & Watershed Improvement Program Leader: Penny Luecke

References

2017 BAER Intern Director: doc 170 KB
USDA Forest Service BAER, Soil & Water Engineering Publications
policy and will enter into an agreement to install and maintain equipment only when other agencies have agreed to provide the 24-hour monitoring and take emergency action based on the data. The NWS and La Plata County Office of Emergency Preparedness agreed to these roles for the Missionary Ridge Fire. The NWS interprets the data and formulates hazard watches and warnings as required. The Office of Emergency Preparedness provides assignment of emergency response resources and coordinates response activities. Each party continues operating in their respective mission-specific roles.

Butch Knowlton, La Plata County Emergency Manager, commented, “The network has been invaluable to emergency service personnel. By monitoring the network they know when and where to effectively commit manpower and resources. Information from the network assists water-system operators in determining basins affected by runoff allowing them time to close critical intakes. Even road crews and contract personnel monitor the system for safety. We don’t know how we could have handled this situation without it.”

A similar operational model to the model described for the Missionary Ridge Fire has been in use for almost 7 years in the Rapid Creek drainage above Rapid City, South Dakota, and recently (2002) similar models have been used following the Grizzly Gulch and Battle Creek Fires in South Dakota (table 1). The rapid-deployment network has been effective in providing warning to residents of Deadwood, South Dakota, where mudslides have resulted from precipitation in the burned areas of the a series of field sensors, GOES/DOMSAT satellite transmitters, ground-readout delivery systems, and solar-power modules.

Examples of equipment used in the satellite-telemetered early-warning networks for the Missionary Ridge, Grizzly Gulch, and Battle Creek Fires are shown in figure 3 in burned areas. The field sensors collect data for a variety of hydrologic measurements selected by the BAER team to meet specific needs. Precipitation and stream stage are the most frequently acquired measurements, but other water-quality and quantity data can be collected. The data from the sensors are processed in a field data-collection platform (DCP) and transmitted to the GOES weather satellite. The processed GOES data are transmitted for local use to ground-readout stations by way of the DOMSAT satellite. The steps involved in deploying a network of this type are as follows:

1. Field sensor packages must be assembled according to the data needs of the BAER team and deployed at specified locations;
2. Satellite window assignments must be made at National Environmental Satellite Data and Information Service (NESSIS) for each field sensor station for data acquisition and delivery;
3. Data decoding must be completed for interpretation of the satellite data;
4. Responsibility for data monitoring and network maintenance must be assigned to the various support and interpretive personnel and agencies; and
5. Protocols defining required actions for specific data users must be developed based on data interpre-

Figure 3. Examples of equipment used in rapid-deployment networks in burned areas at the Missionary Ridge, Grizzly Gulch, and Battle Creek Fires.
Post Wildfire Debris Flows, 2009 Station Fire, CA (USGS)

Fire Personnel Watch Wildfire at a Permanent RAWS Station (NIFC)
Spectrum Preservation

- GOES downlink operates between 1675 – 1695 MHz (DCS channelized at 1679.7 – 1680.1 MHz)
  - Autonomous collection insulates from terrestrial encumbrances
  - Reliable during storms and other Earth-events
  - Cost effective medium for distributed hydro-met network
- Desirable spectrum for terrestrial cellular network manufacturers; upper end auctioned
  - GOES HRIT @ 1694.1 while 1695 – 1710 reallocated for internet mobile radio
  - Commercial proposal to develop network within GOES spectrum @ 1680 MHz
    - Cross-country terrestrial cell-tower LTE network infrastructure
    - Tower signal strength is billions of times more powerful than downlink signal “earth” strength
    - RF interference detected at various receive sites within exclusion zones
  - Impacts mission of aforementioned Federal, State, Local and private agencies and organization with hydro-met interests; includes Earth and Space weather products/imagery
  - Disrupted terrestrial GPS systems; proposing move to GOES allocation
  - Industry proposed GOES direct receive alternative: commercial terrestrial content delivery network
- Engaging users, Congress, agencies, etc. on RFI’s adverse impacts on protecting life, property, critical infrastructure, habitats and economy
  - Whitepapers, briefings, symposia facilitated by STIWG, American Meteorological Society, National Hydrologic Warning Council, et. al.
Figure 2 Depiction of the GOES communication spectrum. The downlink graph (top) shows the 1675 – 1695 MHz band used by satellites to relay data to Earth receive ground stations and the close proximity of the recently auctioned spectrum for wireless broadband (1695 – 1710 MHz) to the HRIT/EMWIN frequency at 1694.1 MHz.
*GOES-R now transmits at 1679.7 – 1680.4
*GOES HRIT rebroadcast transmits at 1694.1 MHz
Simulated GRB GOES-R Imager Full Disk (Mode 4, Band 1) Without Noise

Simulated GRB GOES-R Imager Full Disk (Mode 4, Band 1) with noise injected at random point. Immediate catastrophic failure of the DVB-S2 signal occurred.
GOES vs Terrestrial Storm Event Performance Synopsis

- Performance during Natural Disasters
  - NOS primarily uses Iridium and GOES to ingest data
    - Also employ IP modems and phone lines
  - Working to upgrade their data status reports to reflect where their data is coming from
  - Large decrease in data coming from terrestrial connections immediately before, during and after hurricanes
  - Large increase in GOES messages received during storm events
  - GOES messages continued when IP modems and other terrestrial infrastructure dependent methods failed
    - GOES message count decreased as batteries failed; no electricity and/or damaged solar panels
  - Intends to use the statistics collected for further outreach to stress the need for essential data collection systems
  - Important to estimate impact had there been no data during storm events
By combining various wavelengths in Advanced Baseline Imager products with the lightning flash detection from the Geostationary Lightning Mapper, GOES-R can provide a “radar-like” substitute over ocean areas for aviation use.

When Hurricane Maria destroyed the radar used for weather in Puerto Rico, GOES-16’s data and OPC were used to temporarily substitute for the lack of ground radar coverage in Puerto Rico.
Distributed GOES Transmitter Failure

- 21-OCT-2018: Platforms equipped with pre-2014 Xylem H-2221 GOES transmitters stopped reporting: ~2,000+ units affected
- Determined to be a firmware bug causing transmitter date to reset to the base year
  - No transmit without GPS sync safeguarded against rogue transmitters
  - Data continued to log internally
- YSI developed a field deployable firmware fix to resolve the issue
  - Target release date pending transmitter recertification with NOAA
- Underscored the importance of real-time data for mission execution and public dissemination
- Generated discussion on importance of preserving GOES capability and redundancy at critical sites
Spectrum Preservation Path Forward

- Interagency Effort to investigate current systems’ status
  - On-site RF analysis
  - Determine baseline of existing receive systems
  - Determine viability of spectrum sharing
  - Develop and implement mitigation, monitoring and reporting measures
  - Investigate viable/reasonable RFI protection
  - Report findings and provide impact assessment
References

• "Consequence Assessment for Dam Failure Simulations" Kurt Buchanan, CFM, USACE
• "USACE Modeling, Mapping and Consequences Production Center - Inundation Mapping Standards" Alexandra Ubben, USACE
• GOES Uses and Users and Benefits for Users and Their Constituents Dave Lubar, 2018
• http://acwi.gov/hydrology/stiwg/
• http://acwi.gov/hydrology/stiwg/Meetings/20180322/co-ops_goes_presentation_stiwg2017.pdf
• http://co-ops.nos.noaa.gov/map/index.shtml?region=Florida
• http://co-ops.nos.noaa.gov/stationhome.html?id=8720625
• http://famit.nwcg.gov/applications/RAWS
• http://lightning.umd.edu/Apps/GoesCesium/
• http://pubs.usgs.gov/fs/fs03603/fs03603_files/fs036-03.pdf
• http://tidesandcurrents.noaa.gov/portions.html
• http://wqdatalive.com/public/15
• http://www.hec.usace.army.mil/
• http://www.hydrodb.net/
• http://www.mvr.usace.army.mil/Missions/Navigation/
• http://www.ncdc.noaa.gov/societal-impacts/wildfires/
• http://www.ndbc.noaa.gov/
• http://www.nwd-wc.usace.army.mil/nwp/wm/wq_reports.html
• http://www.nwp.usace.army.mil/Missions/Water-Management/Dams/
• http://www.nwp.usace.army.mil/mount-st-helens/
• http://www.nwp.usace.army.mil/Portals/24/docs/locations/bonneville/Bonneville_FS.pdf
• http://www.redrockhydroproject.com/
• http://www.usbr.gov
• http://www.weather.gov
• https://www.fs.fed.us/naturalresources/watershed/burnedareas.shtml
• https://www.nwcg.gov/
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