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

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Chair, CWMS Users Representative Group (CURG)

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

US Army Corps of Engineers
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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

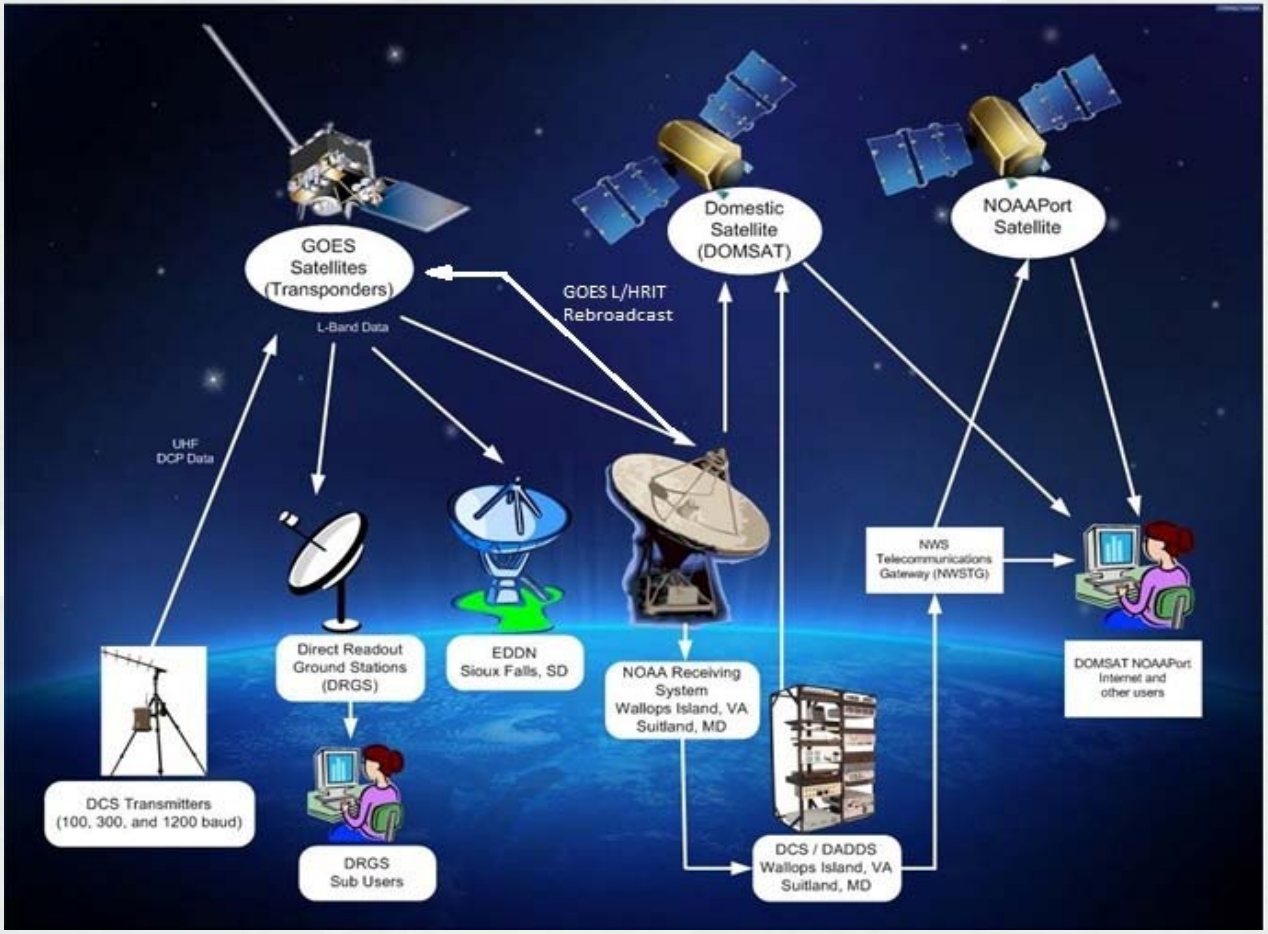
- DCS Preservation
  - Tasked with addressing issues pertaining to matters that impact the viability, availability and integrity of GOES DCS data from the GOES satellites.

- 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.

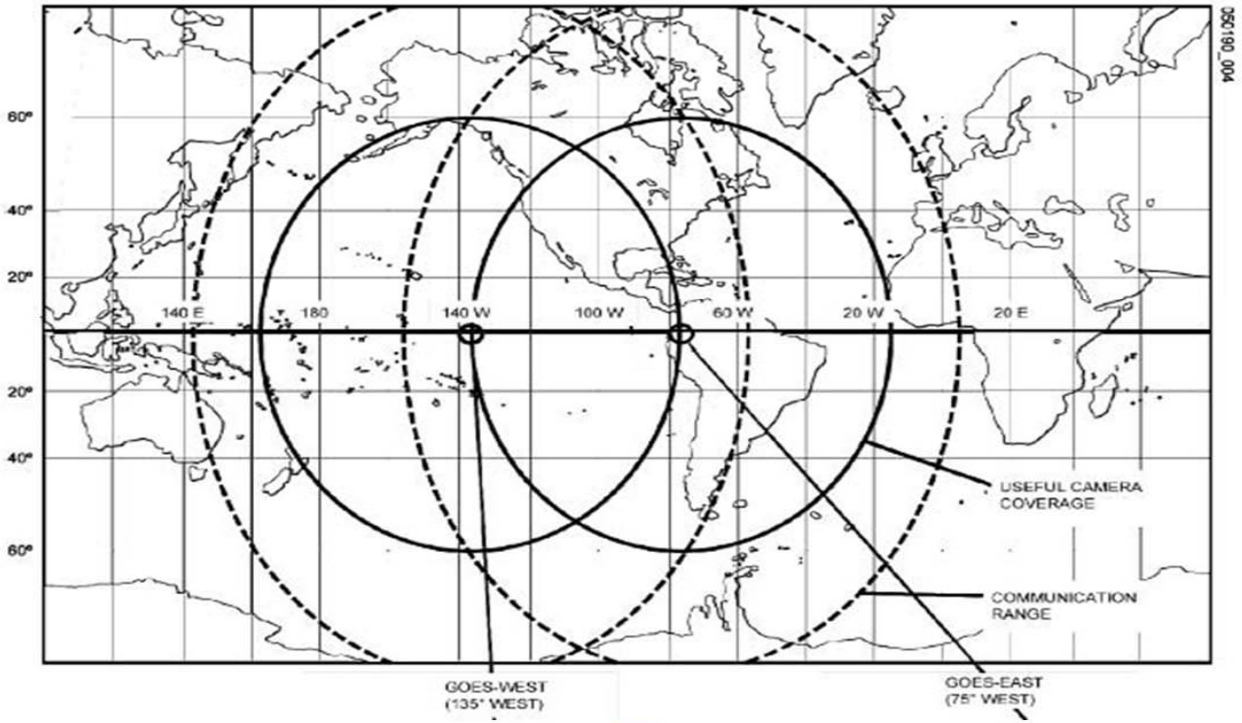
What is GOES DCS

- 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.

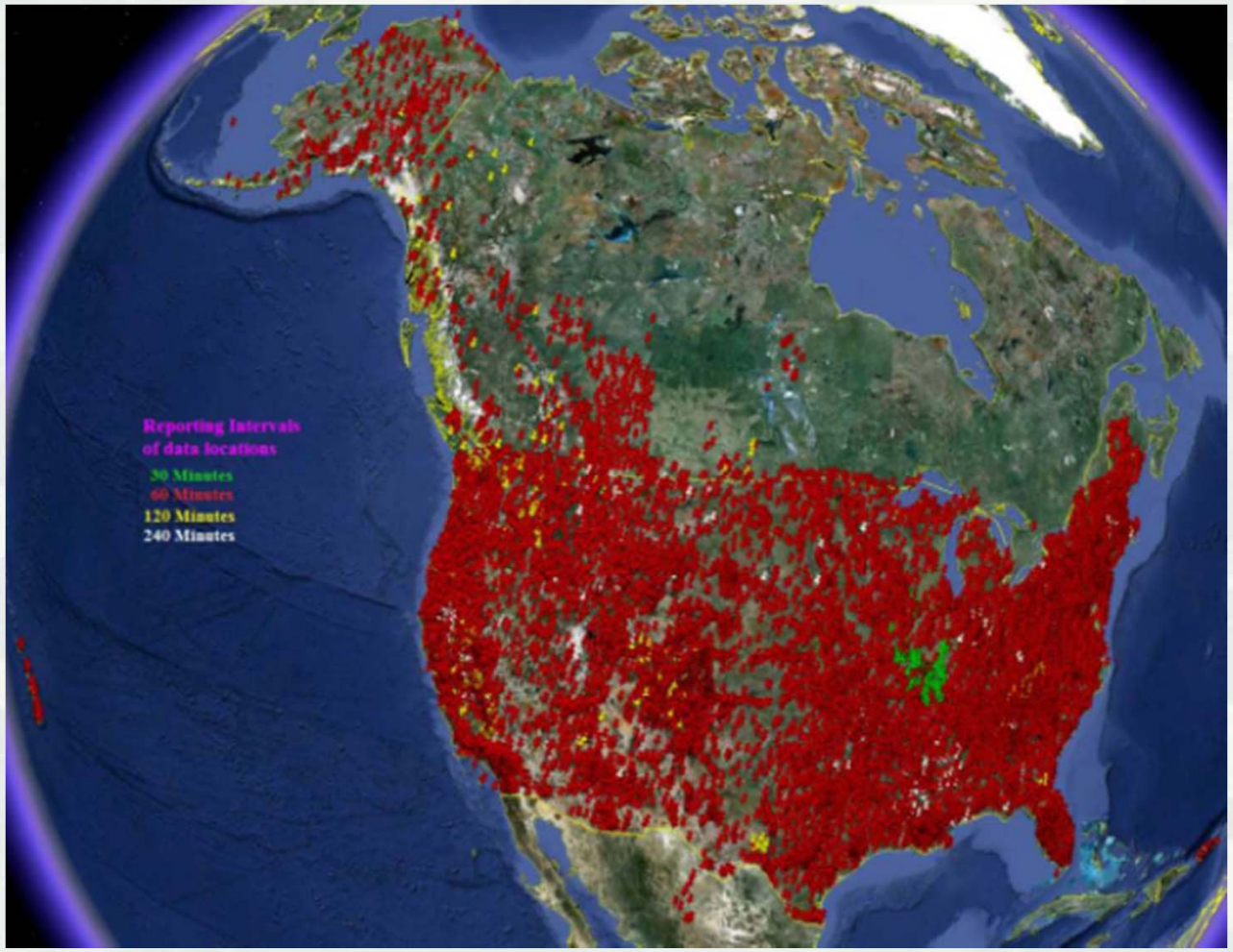
GOES DCS Operation



GOES Footprint



NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)



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 Databse (HDB)
      - Postgres OpenTSDB
      - And others

DECODES Database Editor

File Help

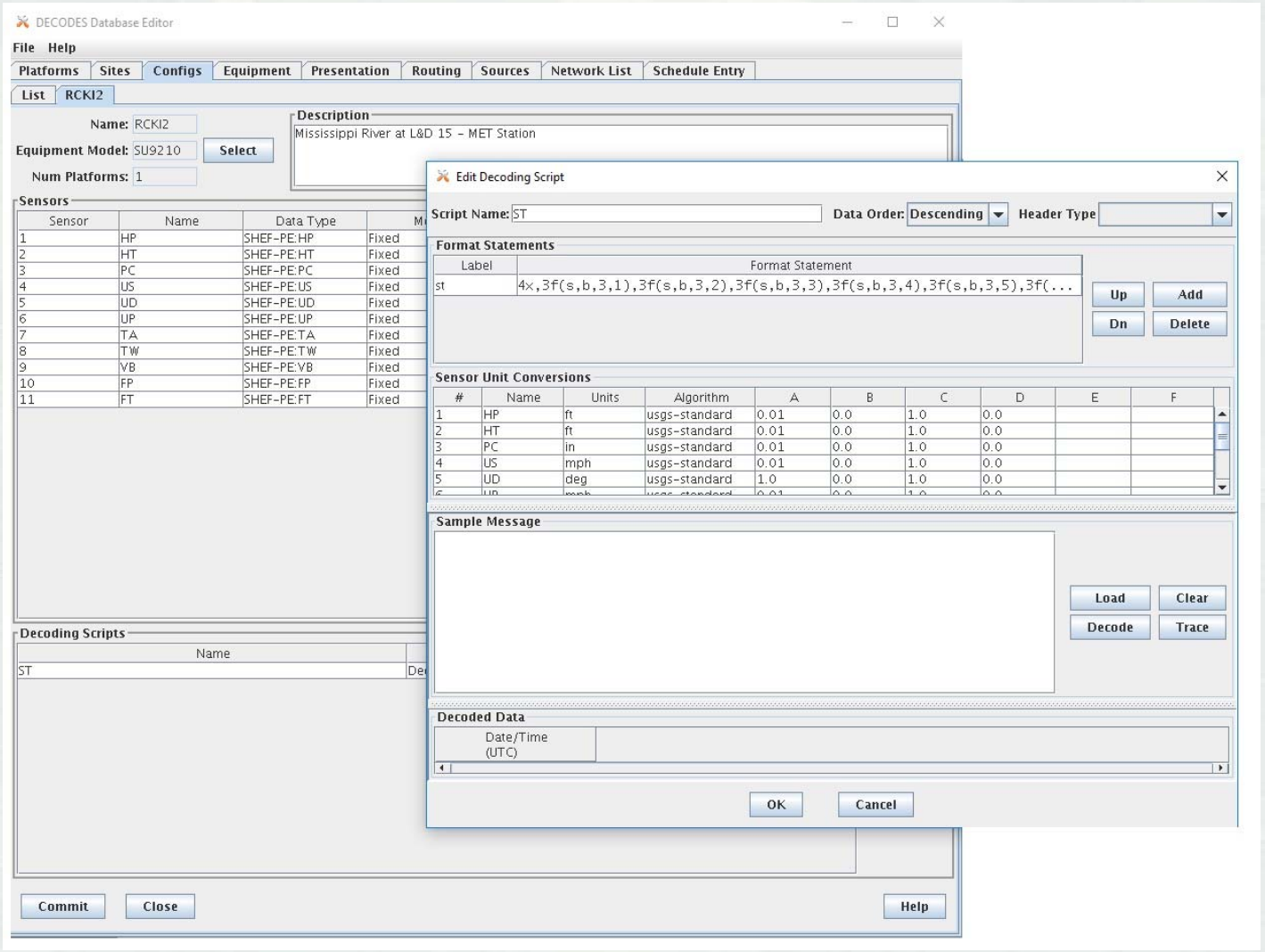
Platforms | Sites | Configs | Equipment | Presentation | Routing | Sources | Network List | Schedule Entry

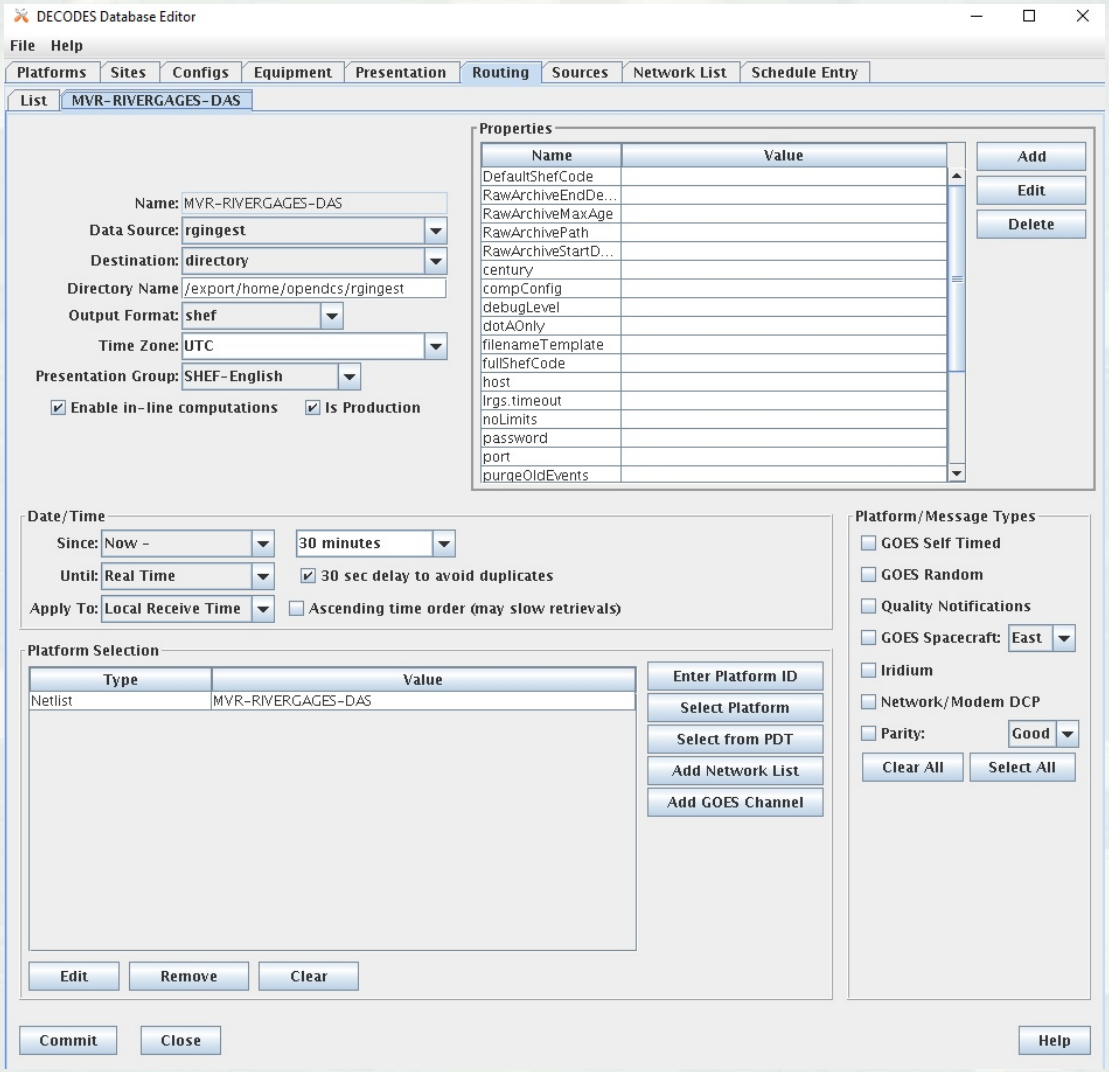
List

Platforms Defined in the Database

Platform	Agen...	Transport-ID	Config	Expiration	Description
01080	MVN	CE7F948E	MVN_Format_KnoxLanding		Miss River at Knox Landing
01120	MVN	CE411082	MVN_Format_21		Miss River at Red River Landing
01143	MVN	CE658FE6	MVN_Format_ACM_Castin...		Corps ACM Casting Yard nr St. Francisville 0...
01145	MVN	CE5F1374	MVN_Format_St_Francisville		Miss River at St.Francisville-South
01220	MVN	CE65C23E	SUTRON-MVN-Donaldson...		Miss River at Donaldsonville
01260	MVN	CE41C6EA	MVN_Format_MissR_Rese...		Miss River at Reserve
01275	MVN	CE45705E	SUTRON-MVN-WestBank		Miss River at Bonnet Carre North of Spillway
01280	MVN	CE41EED4	MVN_Format_3		Miss River at Bonnet Carre
01300	MVN	CE412518	MVN_Format_10		Miss River at New Orleans (Carrollton Gage)
01320	MVN	CE96F2BE	SUTRON-MVN-LOCKS1		Harvey Lock - River/Cham/Canal (01320/7...
01340	MVN	CE9700C0	SUTRON-MVN-LOCKS1		IHNC Lock - Canal/Cham/River (76160/761...
01380	MVN	CE9674AA	SUTRON-MVN-LOCKS1		Algiers Lock - Canal/Cham/River (76240/7...
01390	MVN	CE3D6222	SUTRON-MVN-Alliance		Mississippi River at Alliance
01400	MVN	CE965246	SUTRON-MVN-003		Miss Riv West Pointe a la Hache
01440	MVN	CE9667DC	SUTRON-MVN-004		Miss Riv at Empire
01480	MVN	CE41F370	MVN-DCP-Format27		Mississippi River at Venice
01515	MVN	CE964130	MVN_Format_26		Mississippi River at West Bay
01516	MVN	CE61E1E8	MVN_Format_25		West Bay Receiving Area - Outflow
01545	MVN	CE65A90A	SUTRON-MVN-HEAD_OF_...		Miss River at Head of Passes
01575	MVN	CE65B4AE	SUTRON-MVN-SW_PASS_...		Miss River/Southwest Pass mile 7.5
01670	MVN	CE410D26	SUTRON-MVN-SW_PASS		Miss River SouthWest Pass - East Jetty
01850	MVN	CE97262C	MVN_Format_HG-TW		Mississippi River South Pass at Port Eads
02200	MVN	CE7FF168	MVN_Format_6		Old River Aux Inflow/Outflow (02200/02210)
02570	MVN	173EF176	USGS_OldRiver_Hydropower		Old River Outflow below Confluence of Hydr...
03060	MVN	CE41C838	MVN_Format_Melville		Atchafalaya River at Melville
03075	MVN	CE4CD6FA	SUTRON-MVN-Krotz_Spri...		Atchafalaya River at Krotz Springs
03120	MVN	1728C3BC	BLRL1		Atchafalaya River at Butte Rose
03210	MVN	CE1157CA	MVN_Format_HG-VB		Bayou la Rompe at lake Long
03235000	LRL	CE6B4E90	CAE01		CAESAR CREEK LK TW
03240	MVN	CE11215A	MVN_Format_HG-VB		Whiskey Bay Pilot Channel
03242050	LRL	CE22C3D6	LLMO1		SPRING VALLEY
03245500	LRL	CE559AE0	MLGO1		MILFORD
03247041	LRL	CE6B3800	HA560D-OH-023		Harsha Lake TW, OH
03247500	LRL	CE559432	HA560D-OH-005		Perintown, Oh
03248300	LRL	1784940A	03248300		SALYERSVILLE (SLVL), KY on LICKING RIVER K...
03250500	LRL	DD48E338	HA560-BLUELICK		BlueLickSprings
03251500	LRL	DDAB024E	HA570D-KY-2000		MCKINNEYSBURG
03255500	LRL	1664E6B2	03255500		Reading (READ) OH on Mill CreekOHGS
03260706	LRL	DD65B1CC	03260706		Degraff
03261950	LRL	DD65C75C	03261950		Newport-NPTO1
03262000	LRL	DD65D42A	03262000		LOCKINGTON-LOCO1
03263000	LRL	DD6707B6	03263000		TAYLORSVILLE-TAYO1
03264000	LRL	DD65F2C6	03264000		BRADFORD-BRDO1
03265000	LRL	DD66054C	03265000		PleasantHill-PLLO1
03266000	LRL	DD66163A	03266000		Eaglewood-ENGO1
03267000	LRL	DD6623A0	03267000		Urbana-URNO1

Open | New | Copy | Delete | Refresh


DECODES Database Editor
File Help
Platforms Sites Configs Equipment Presentation Routing Sources Network List Schedule Entry
List RCKI2
Name: RCKI2
Equipment Model: SU9210
Select
Num Platforms: 1
Description
Mississippi River at L&D 15 - MET Station
Sensors
Sensor Name Data Type
1 HP SHEF-PE:HP Fixed
2 HT SHEF-PE:HT Fixed
3 PC SHEF-PE:PC Fixed
4 US SHEF-PE:US Fixed
5 UD SHEF-PE:UD Fixed
6 UP SHEF-PE:UP Fixed
7 TA SHEF-PE:TA Fixed
8 TW SHEF-PE:TW Fixed
9 VB SHEF-PE:VB Fixed
10 FP SHEF-PE:FP Fixed
11 FT SHEF-PE:FT Fixed
Decoding Scripts
Name
ST
Commit
Close
Help
Edit Decoding Script
Script Name: ST
Data Order: Descending
Header Type
Format Statements
Label
Format Statement
st
4x,3f(s,b,3,1),3f(s,b,3,2),3f(s,b,3,3),3f(s,b,3,4),3f(s,b,3,5),3f(...
Up
Add
Dn
Delete
Sensor Unit Conversions
Name Units Algorithm A B C D E F
1 HP ft usgs-standard 0.01 0.0 1.0 0.0
2 HT ft usgs-standard 0.01 0.0 1.0 0.0
3 PC in usgs-standard 0.01 0.0 1.0 0.0
4 US mph usgs-standard 0.01 0.0 1.0 0.0
5 UD deg usgs-standard 1.0 0.0 1.0 0.0
Sample Message
Load
Clear
Decode
Trace
Decoded Data
Date/Time (UTC)
OK
Cancel


DECODES Database Editor
File Help
Platforms Sites Configs Equipment Presentation Routing Sources Network List Schedule Entry
List MVR-RIVERGAGES-DAS
Name: MVR-RIVERGAGES-DAS
Data Source: rgingest
Destination: directory
Directory Name: /export/home/opendcs/rgingest
Output Format: shef
Time Zone: UTC
Presentation Group: SHEF-English
Enable in-line computations
Is Production
Properties
Name
Value
DefaultShefCode
RawArchiveEndDe...
RawArchiveMaxAge
RawArchivePath
RawArchiveStartD...
century
compConfig
debugLevel
dotAOnly
filenameTemplate
fullShefCode
host
lrgs.timeout
noLimits
password
port
purgeOldEvents
Add
Edit
Delete
Date/Time
Since: Now -
30 minutes
Until: Real Time
30 sec delay to avoid duplicates
Apply To: Local Receive Time
Ascending time order (may slow retrievals)
Platform Selection
Type
Value
Netlist
MVR-RIVERGAGES-DAS
Enter Platform ID
Select Platform
Select from PDT
Add Network List
Add GOES Channel
Edit
Remove
Clear
Platform/Message Types
GOES Self Timed
GOES Random
Quality Notifications
GOES Spacecraft: East
Iridium
Network/Modem DCP
Parity: Good
Clear All
Select All
Commit
Close
Help

LRGS: RiverGages-WIBS

UTC: August 31, 2018 17:44:33 (Day 243)
(Time reported by LRGS)
System Status: Running
LRGS Version: 9.2.OpenDCS-6.5 RC01 (Jul 30, 2018)

Archive Statistics

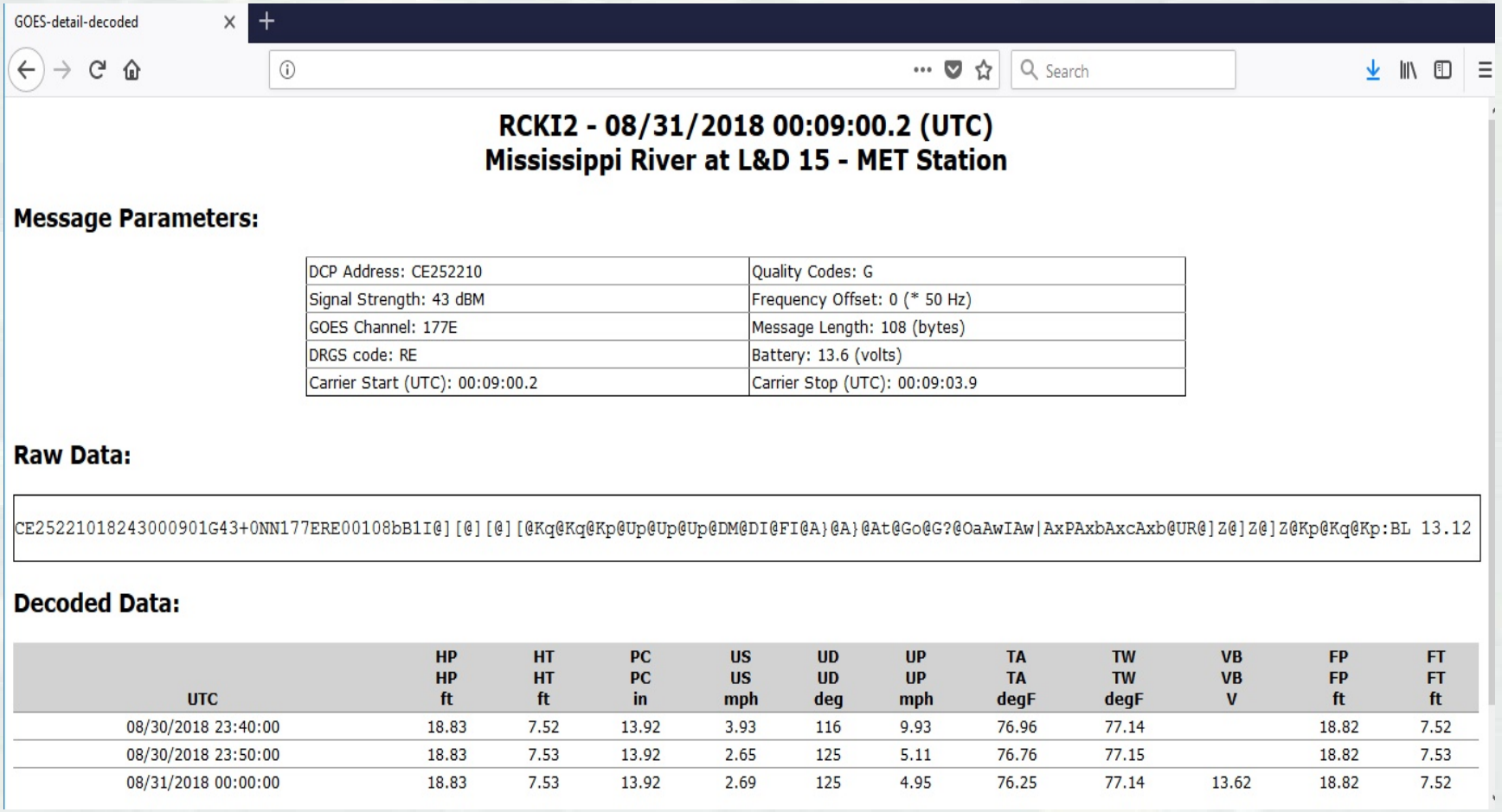
Messages In Storage: 431469920 Oldest Msg Time: 08/30 23:58:00 Next Idx #: 867678

Hourly Data Collection Statistics

Hour:	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
DOMSAT (Good/ParErr):	35455 / 120	35353 / 120	35633 / 124	35567 / 105	35580 / 125	35767 / 103	35712 / 116	27590 / 95
DOMSAT Dropped:	1	0	0	0	0	0	0	0
GOES DRGS (Good/ParErr):	5727 / 1360	5716 / 1423	5774 / 1505	5989 / 1684	5983 / 1714	6137 / 1797	6250 / 1882	4698 / 1399
DDS Recv (Good/ParErr):	43387 / 1407	44034 / 1440	47443 / 1518	49852 / 1670	48513 / 1720	53068 / 1740	48344 / 1803	33650 / 1335
LRIT (Good/ParErr):	35237 / 109	35254 / 114	35449 / 132	35381 / 118	35364 / 125	35700 / 109	35771 / 114	27556 / 97
NOAAPORT (Good/ParErr):	0	0	0	0	0	0	0	0
Archived (Good/ParErr):	35529 / 1018	35502 / 1037	35703 / 1059	35647 / 1083	35684 / 1123	35855 / 1060	35810 / 1085	27692 / 828

Downlink Statistics

Downlink Name	Last Msg Rcv Time	Last Seq Num	Link Status	Link Params
DomsatRecv	08/31 17:44:33	415	Active	
NOAAPORT-Marta	(none)	0	Disconnected	
LRIT:155.76.213.73	08/31 17:44:31	25286	Connected	
DDS:WIBS2	08/31 17:44:33	-1	Real-Time	Primary
DDS:MVR-CWMS2	08/29 19:57:42	-1	Ready	Primary
DDS:CWMS2	(none)	-1	Ready	Primary
DDS:USGS-EDDN1	(none)	-1	Ready	Primary
DDS:USGS-EDDN2	(none)	-1	Ready	Primary
DDS:CDADATA	(none)	-1	Ready	Primary
DDS:CDABACKUP	(none)	-1	Ready	Primary
DRGS:DRGS-East	08/31 17:44:33	71765	Connected	



RCKI2 - 08/31/2018 00:09:00.2 (UTC)
Mississippi River at L&D 15 - MET Station

Message Parameters:

DCP Address: CE252210	Quality Codes: G
Signal Strength: 43 dBM	Frequency Offset: 0 (* 50 Hz)
GOES Channel: 177E	Message Length: 108 (bytes)
DRGS code: RE	Battery: 13.6 (volts)
Carrier Start (UTC): 00:09:00.2	Carrier Stop (UTC): 00:09:03.9

Raw Data:

```
CE252210182430009O1G43+0NN177ERE00108bB1I@][@][@][@Kq@Kq@Kp@Up@Up@Up@DM@DI@FI@A}@A}@At@Go@G?@OaAwIAw|AxPAxbAxcAxb@UR@]Z@]Z@]Z@Kp@Kq@Kp:BL 13.12
```

Decoded Data:

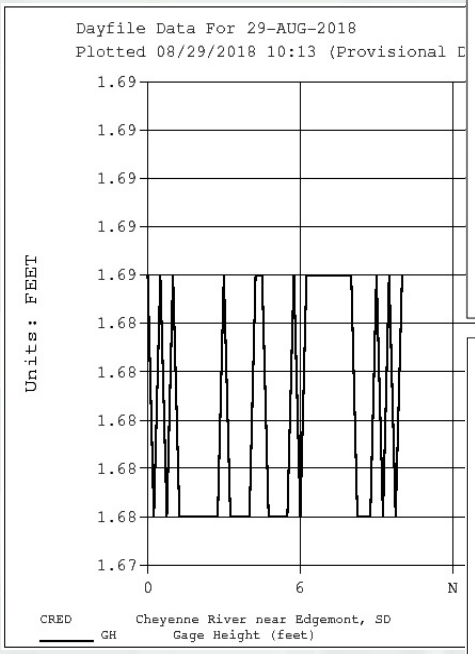
UTC	HP HP ft	HT HT ft	PC PC in	US US mph	UD UD deg	UP UP mph	TA TA degF	TW TW degF	VB VB V	FP FP ft	FT FT ft
08/30/2018 23:40:00	18.83	7.52	13.92	3.93	116	9.93	76.96	77.14		18.82	7.52
08/30/2018 23:50:00	18.83	7.53	13.92	2.65	125	5.11	76.76	77.15		18.82	7.53
08/31/2018 00:00:00	18.83	7.53	13.92	2.69	125	4.95	76.25	77.14	13.62	18.82	7.52

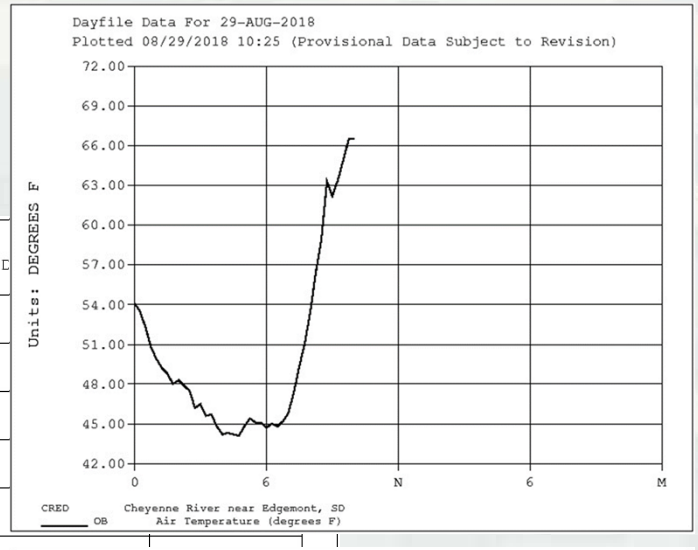
GOES DCS Hydro-Met Integration

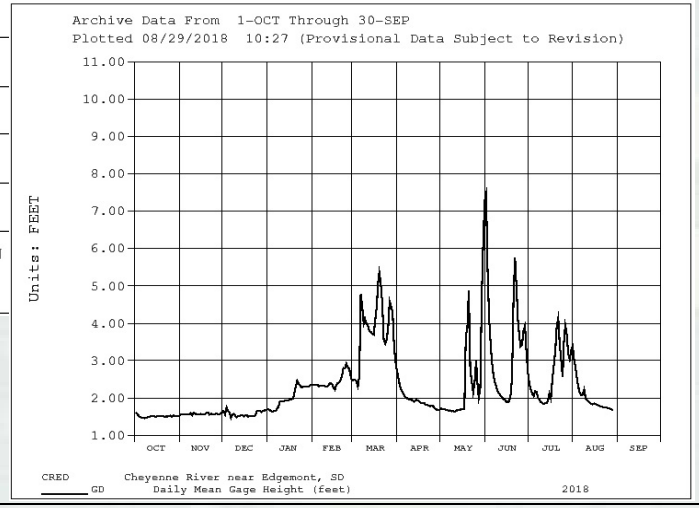
- Inland Navigation and Water Resource Management
- Operational Decision Support
- Water Quality (TDG, DO, Chlorophyll, PH, turbidity, conductivity….)
- Water Quantity (stage, discharge, storage, snow water equivalent….)
- Flood and Drought Management/Response
- Water Resource Management
- Meteorological (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

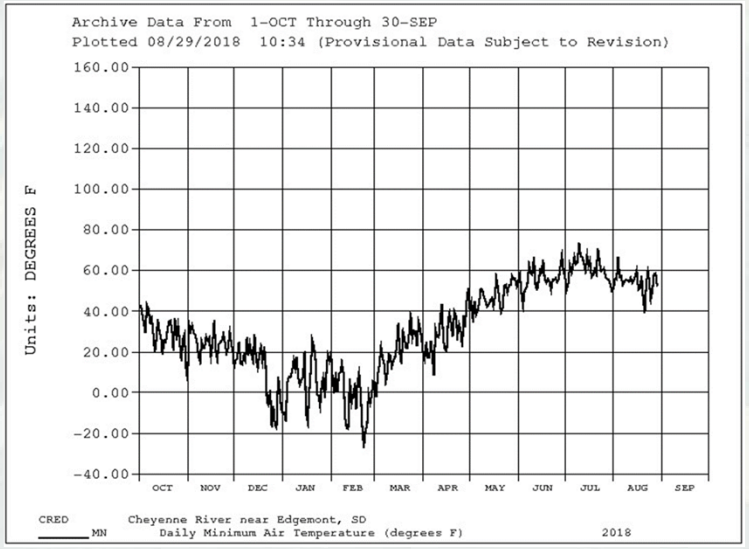
US Bureau of Reclamation River Levels, Reservoir Capacity and Snow Water Equivalence

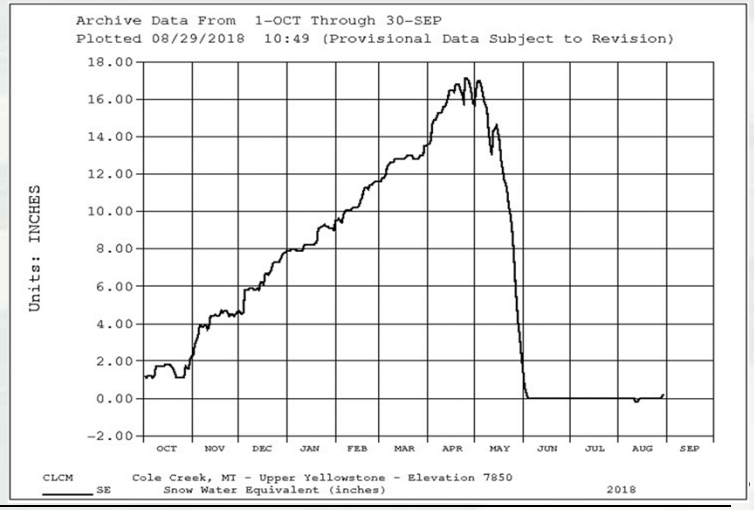
- USBR is the largest wholesale water supplier in the United States
  - Supplies 31 million people (10 trillion gal/year)
- Second largest supplier of hydro-power ($1B+/year, 3.5M homes)
- Operates 600+ Water Management Projects in the Western United States
  - Flood control
  - Recreation (280+ recreation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

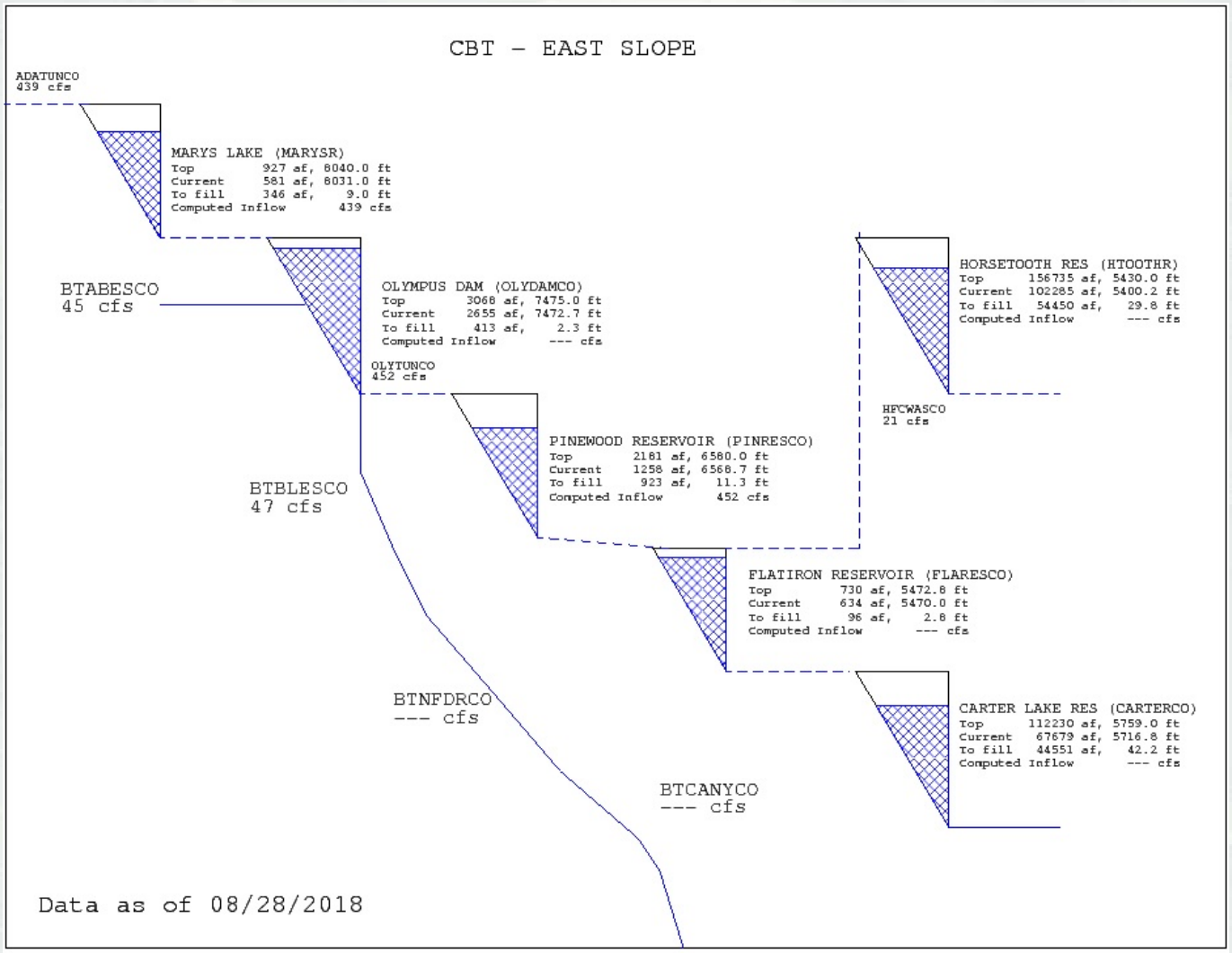

Dayfile Data For 29-AUG-2018
Plotted 08/29/2018 10:13 (Provisional D
Units: FEET
1.69
1.69
1.69
1.69
1.69
1.68
1.68
1.68
1.68
1.68
1.67
0
6
N
CRED
GH
Cheyenne River near Edgemont, SD
Gage Height (feet)

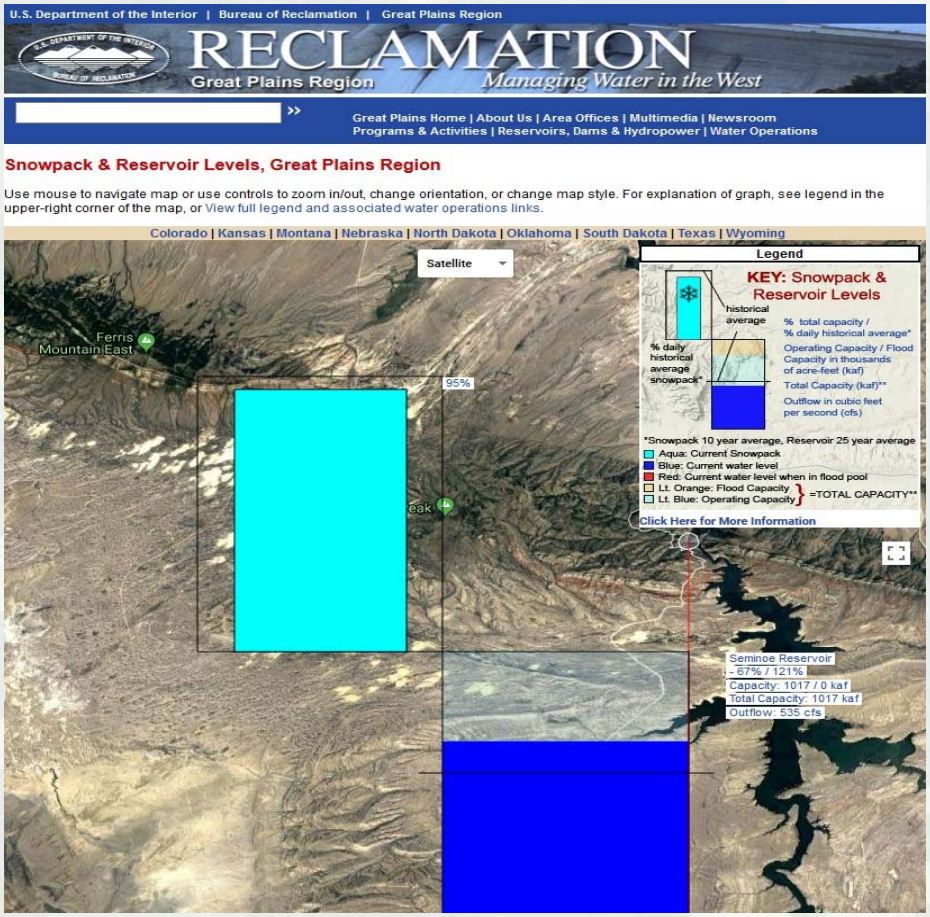

Dayfile Data For 29-AUG-2018
Plotted 08/29/2018 10:25 (Provisional Data Subject to Revision)
Units: DEGREES F
72.00
69.00
66.00
63.00
60.00
57.00
54.00
51.00
48.00
45.00
42.00
0
6
N
6
M
CRED
OB
Cheyenne River near Edgemont, SD
Air Temperature (degrees F)

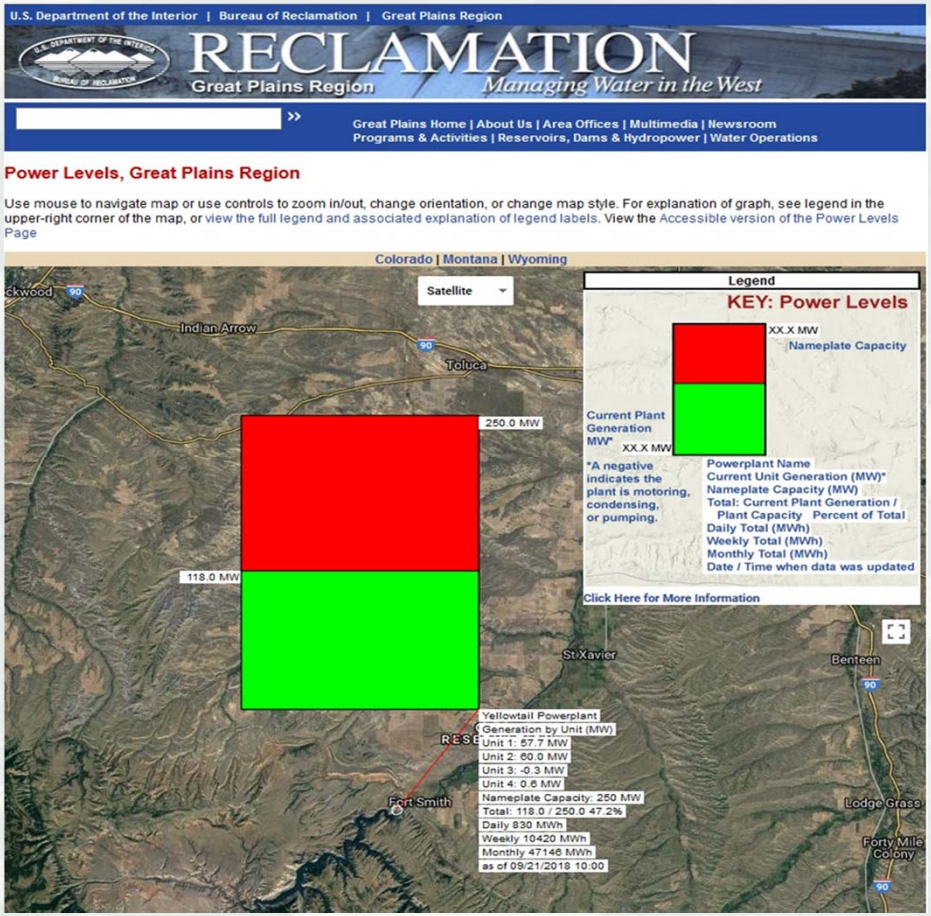

Archive Data From 1-OCT Through 30-SEP
Plotted 08/29/2018 10:27 (Provisional Data Subject to Revision)
Units: FEET
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
CRED
GD
Cheyenne River near Edgemont, SD
Daily Mean Gage Height (feet)
2018


Archive Data From 1-OCT Through 30-SEP
Plotted 08/29/2018 10:34 (Provisional Data Subject to Revision)
Units: DEGREES F
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-20.00
-40.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
CRED
MN
Cheyenne River near Edgemont, SD
Daily Minimum Air Temperature (degrees F)
2018


Archive Data From 1-OCT Through 30-SEP
Plotted 08/29/2018 10:49 (Provisional Data Subject to Revision)
Units: INCHES
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
CLCM
SE
Cole Creek, MT - Upper Yellowstone - Elevation 7850
Snow Water Equivalent (inches)
2018


CBT – EAST SLOPE
ADATUNCO
439 cfs
MARYS LAKE (MARYSR)
Top 927 af, 8040.0 ft
Current 581 af, 8031.0 ft
To fill 346 af, 9.0 ft
Computed Inflow 439 cfs
BTABESCO
45 cfs
OLYMPUS DAM (OLYDAMCO)
Top 3068 af, 7475.0 ft
Current 2655 af, 7472.7 ft
To fill 413 af, 2.3 ft
Computed Inflow --- cfs
OLYTUNCO
452 cfs
HORSETOOTH RES (HTOOTHR)
Top 156735 af, 5430.0 ft
Current 102285 af, 5400.2 ft
To fill 54450 af, 29.8 ft
Computed Inflow --- cfs
HFCWASCO
21 cfs
PINEWOOD RESERVOIR (PINRESCO)
Top 2181 af, 6580.0 ft
Current 1258 af, 6568.7 ft
To fill 923 af, 11.3 ft
Computed Inflow 452 cfs
BTBLESCO
47 cfs
FLATIRON RESERVOIR (FLARESCO)
Top 730 af, 5472.8 ft
Current 634 af, 5470.0 ft
To fill 96 af, 2.8 ft
Computed Inflow --- cfs
BTNFDRCO
--- cfs
CARTER LAKE RES (CARTERCO)
Top 112230 af, 5759.0 ft
Current 67679 af, 5716.8 ft
To fill 44551 af, 42.2 ft
Computed Inflow --- cfs
BTCANYCO
--- cfs
Data as of 08/28/2018


U.S. Department of the Interior | Bureau of Reclamation | Great Plains Region
RECLAMATION
Great Plains Region
Managing Water in the West
Great Plains Home | About Us | Area Offices | Multimedia | Newsroom
Programs & Activities | Reservoirs, Dams & Hydropower | Water Operations
Snowpack & Reservoir Levels, Great Plains Region
Use mouse to navigate map or use controls to zoom in/out, change orientation, or change map style. For explanation of graph, see legend in the upper-right corner of the map, or View full legend and associated water operations links.
Colorado | Kansas | Montana | Nebraska | North Dakota | Oklahoma | South Dakota | Texas | Wyoming
Satellite
Ferris Mountain East
95%
Legend
KEY: Snowpack & Reservoir Levels
historical average
% daily historical average snowpack*
% total capacity / % daily historical average*
Operating Capacity / Flood Capacity in thousands of acre-feet (kaf)
Total Capacity (kaf)**
Outflow in cubic feet per second (cfs)
*Snowpack 10 year average, Reservoir 25 year average
Aqua: Current Snowpack
Blue: Current water level
Red: Current water level when in flood pool
Lt. Orange: Flood Capacity
Lt. Blue: Operating Capacity
=TOTAL CAPACITY**
Click Here for More Information
Seminoe Reservoir
- 67% / 121%
Capacity: 1017 / 0 kaf
Total Capacity: 1017 kaf
Outflow: 535 cfs


U.S. Department of the Interior | Bureau of Reclamation | Great Plains Region
RECLAMATION
Great Plains Region
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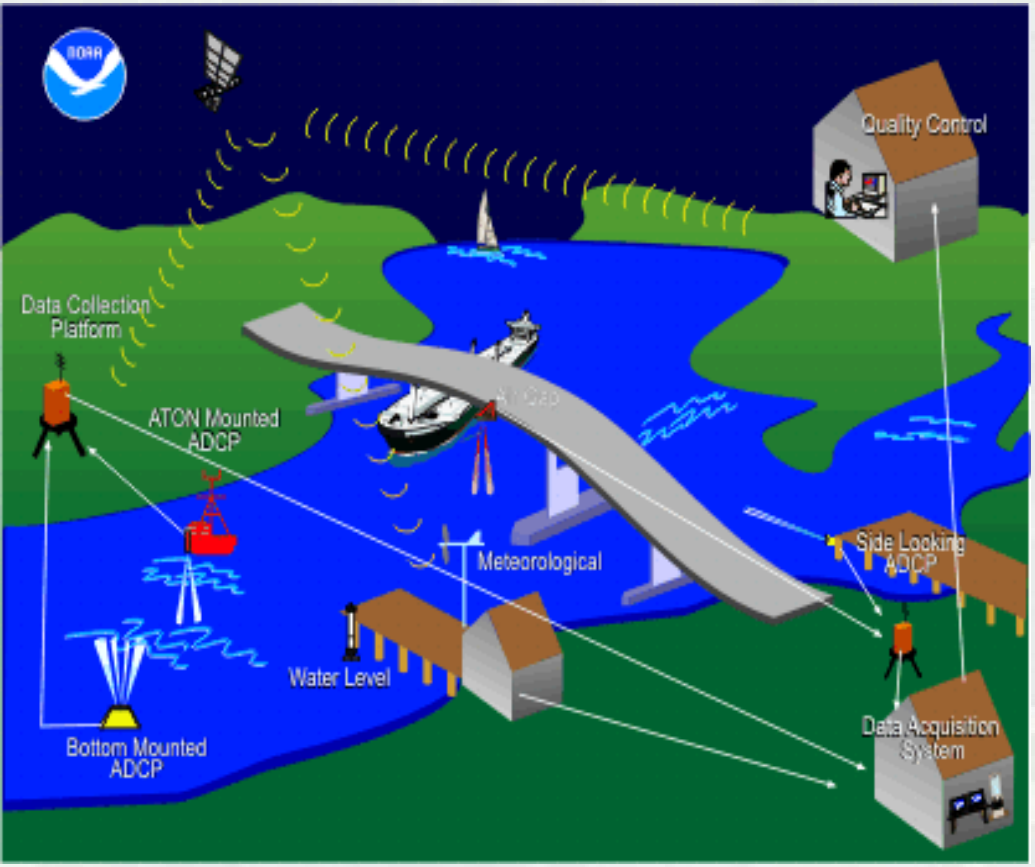
Power Levels, Great Plains Region
Use mouse to navigate map or use controls to zoom in/out, change orientation, or change map style. For explanation of graph, see legend in the upper-right corner of the map, or view the full legend and associated explanation of legend labels. View the Accessible version of the Power Levels Page
Colorado | Montana | Wyoming
Satellite
Indian Arrow
Toluca
250.0 MW
118.0 MW
Legend
KEY: Power Levels
XX.X MW
Nameplate Capacity
Current Plant Generation MW*
XX.X MW
*A negative indicates the plant is motoring, condensing, or pumping.
Powerplant Name
Current Unit Generation (MW)*
Nameplate Capacity (MW)
Total: Current Plant Generation / Plant Capacity Percent of Total
Daily Total (MWh)
Weekly Total (MWh)
Monthly Total (MWh)
Date / Time when data was updated
Click Here for More Information
St Xavier
Benteen
Yellowtail Powerplant
Generation by Unit (MW)
Unit 1: 57.7 MW
Unit 2: 60.0 MW
Unit 3: -0.3 MW
Unit 4: 0.6 MW
Nameplate Capacity: 250 MW
Total: 118.0 / 250.0 47.2%
Daily 830 MWh
Weekly 10420 MWh
Monthly 47146 MWh
as of 09/21/2018 10:00
Fort Smith
Lodge Grass
Forty Mile Colony

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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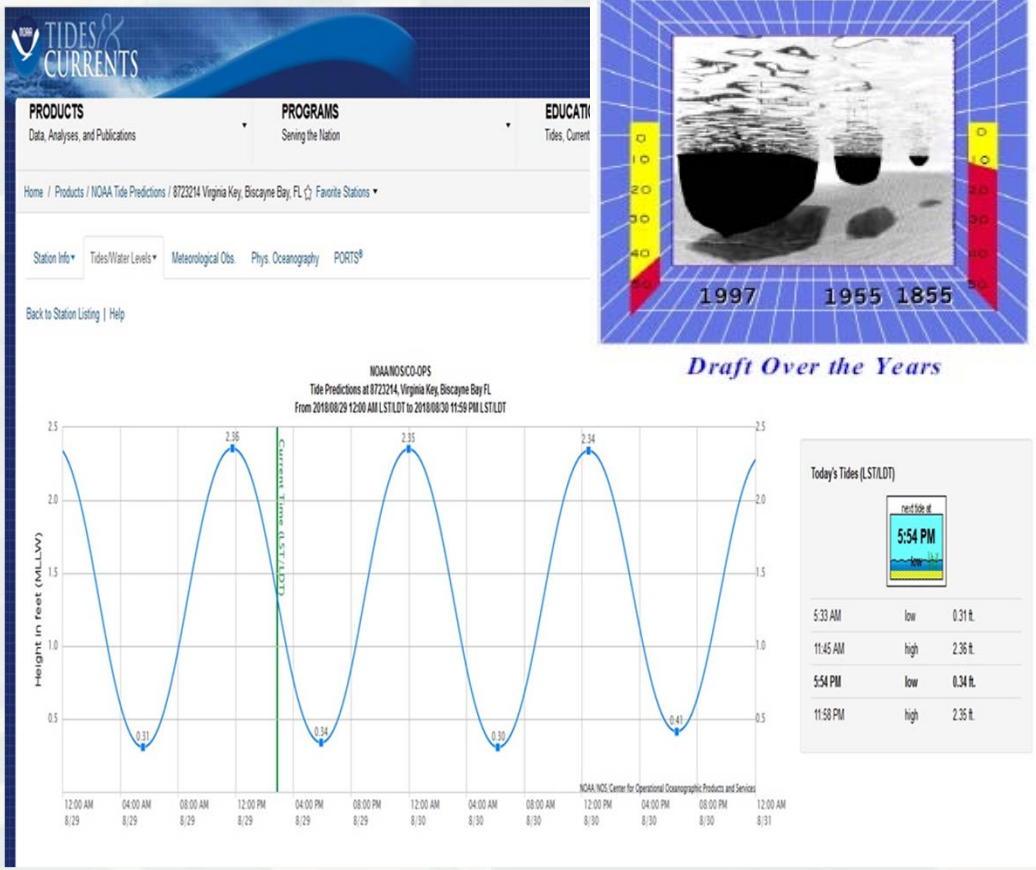
ATON Mounted ADCP
Meteorological
Side Looking ADCP
Water Level
Data Acquisition System
Bottom Mounted ADCP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Station Info
Tides/Water Levels
Meteorological Obs.
Phys. Oceanography
PORTS®
Back to Station Listing | Help
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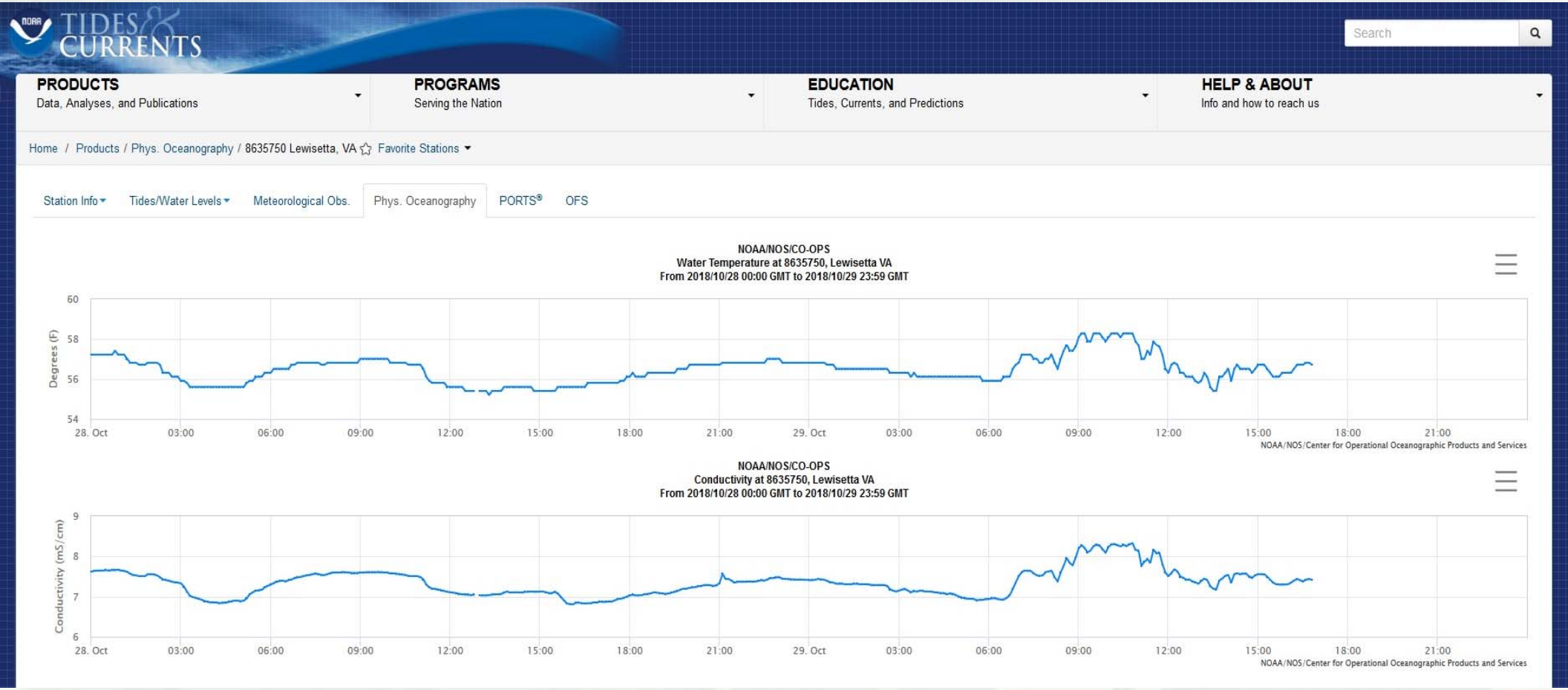
Tide Predictions at 8723214, Virginia Key, Biscayne Bay FL
From 2018/08/29 12:00 AM LST/LDT to 2018/08/30 11:59 PM LST/LDT
Height in feet (MLLW)
Today's Tides (LST/LDT)
5:54 PM
5:33 AM low 0.31 ft.
11:45 AM high 2.36 ft.
5:54 PM low 0.34 ft.
11:58 PM high 2.35 ft.

DECREASING MARGIN OF ERROR
1997
1955
1855
Draft Over the Years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Meteorological Obs.
Phys. Oceanography
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OFS
NOAA/NOS/CO-OPS
Water Temperature at 8635750, Lewisetta VA
From 2018/10/28 00:00 GMT to 2018/10/29 23:59 GMT
Degrees (F)
60
58
56
54
28. Oct
03:00
06:00
09:00
12:00
15:00
18:00
21:00
29. Oct
03:00
06:00
09:00
12:00
15:00
18:00
21:00
NOAA/NOS/Center for Operational Oceanographic Products and Services
NOAA/NOS/CO-OPS
Conductivity at 8635750, Lewisetta VA
From 2018/10/28 00:00 GMT to 2018/10/29 23:59 GMT
Conductivity (mS/cm)
9
8
7
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28. Oct
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09:00
12:00
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18:00
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29. Oct
03:00
06:00
09:00
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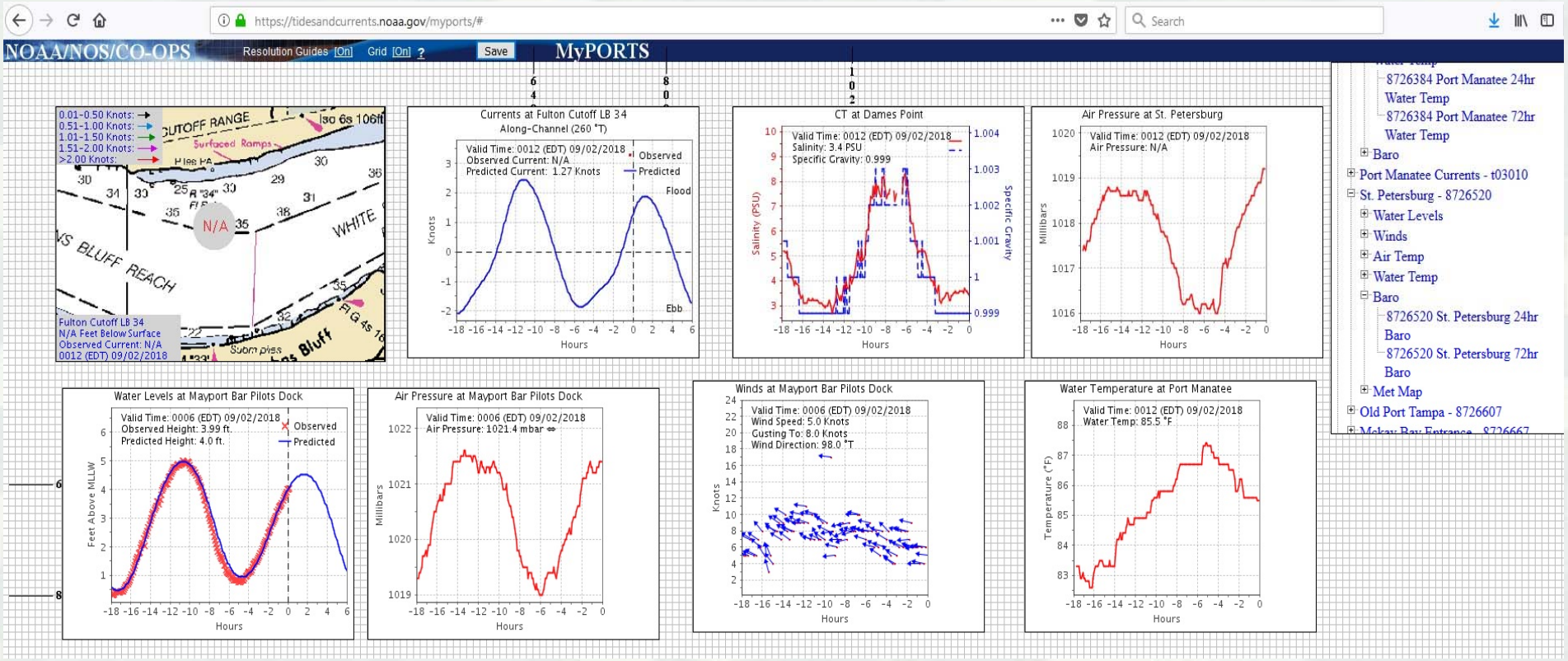
21:00
NOAA/NOS/Center for Operational Oceanographic Products and Services



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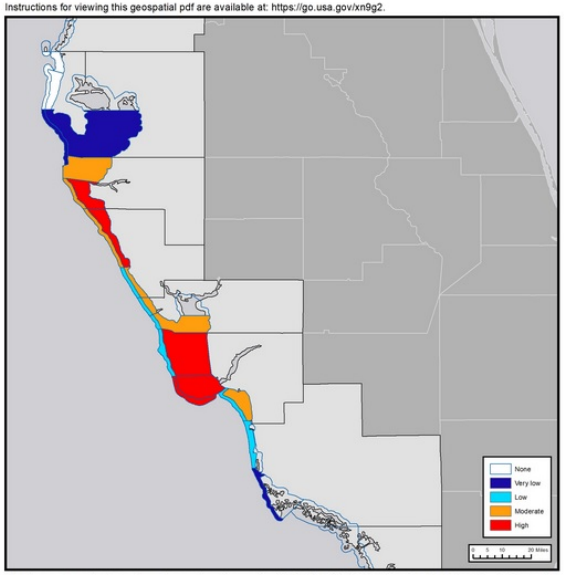
NOAA HAB-OFS Conditions Report

Click on the icon of Adobe Acrobat Reader link to download the PDF reader - Get Adobe Reader

Gulf of Mexico Harmful Algal Bloom Bulletin

Monday, August 27, 2018
NOAA National Ocean Service
NOAA Satellite and Information Service
NOAA National Weather Service

Instructions for viewing this geospatial pdf are available at: https://go.usa.gov/xn9g2.



The image above is the top layer in a series of maps for 08-27-18 to 08-30-18 displaying the highest level of potential respiratory irritation forecasts in each region.

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 southwest 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 nearby bloom concentrations, ocean currents, and wind speed and direction.

Recently Reported Impacts (Listed by County):

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

Definition of respiratory irritation levels.

	AFFECTED POPULATION				
RESPIRATORY IRRITATION LEVEL	NONE	CHRONIC RESPIRATORY CONDITION	SENSITIVE TO RED TIDE	GENERAL PUBLIC (MILD SYMPTOMS)	GENERAL PUBLIC (INTENSE SYMPTOMS)
None	x				
Very low		x			
Low		x	x		
Moderate		x	x	x	
High		x	x	x	x

Additional Resources

Health Information:

Florida Department of Health:
http://www.floridahealth.gov/environmental-health/aquatic-toxins/red-tide.html
Other resources: https://go.usa.gov/xQNWp

Recent, Local Observations and Data:

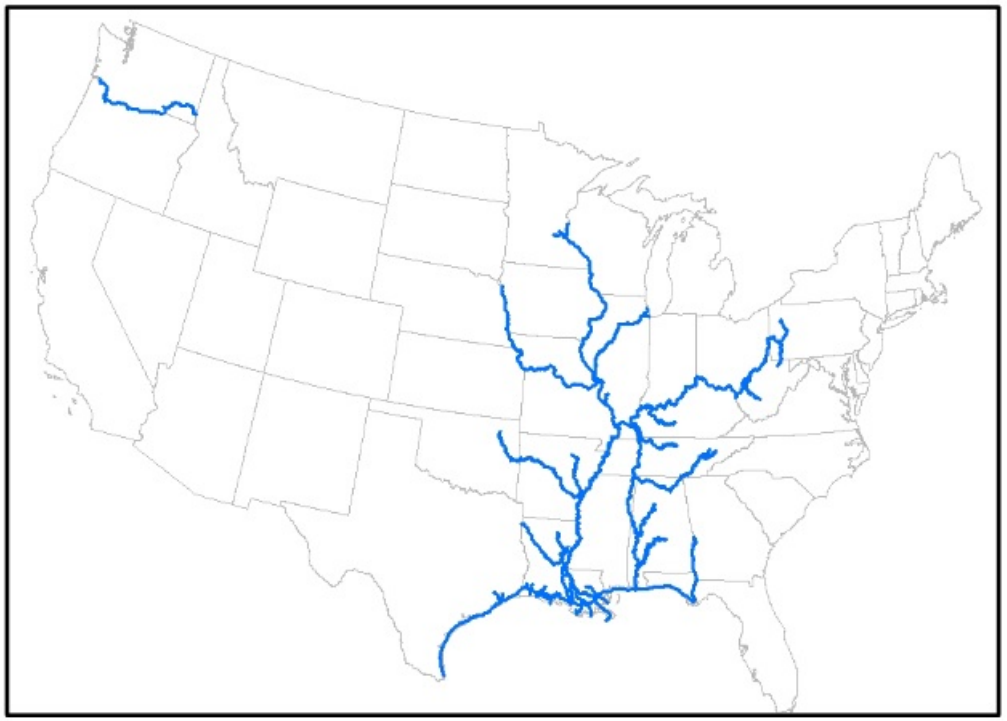
Mote Marine Laboratory Daily Beach Conditions:
http://visitbeaches.org
Florida Fish and Wildlife Conservation Commission:
http://myfwc.com/redtidestatus

County Region	Mon 08-27-18	Tue 08-28-18	Wed 08-29-18	Thu 08-30-18
Northern PINELLAS County-Gulf Coast	none	none	none	none
Northern PINELLAS County-Bay Regions	none	none	none	none
Southern PINELLAS County-Gulf Coast	very low	very low	very low	very low
Southern PINELLAS County-Bay Regions	very low	very low	very low	very low

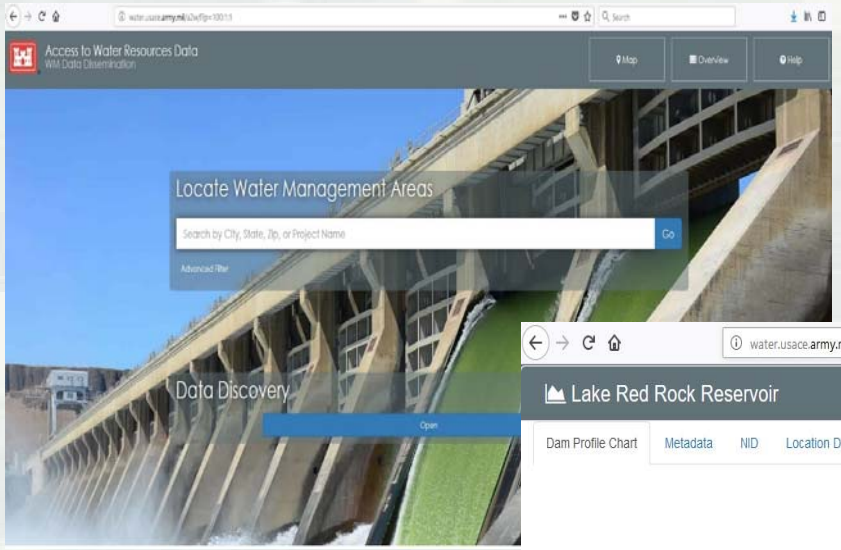
USACE Effective Flood Control and Navigation Project Operation Benefits

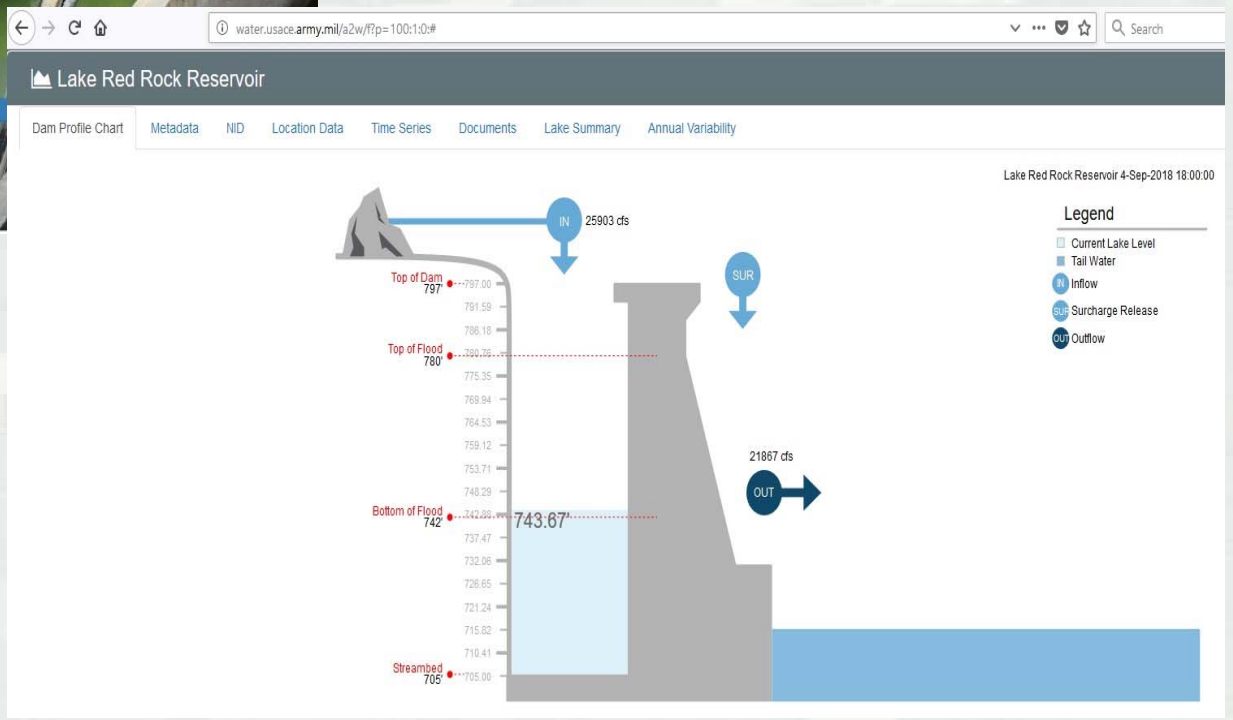
- Real-time GOES data collection, acquisition, archival, decision support and dissemination
  - Daily/upward reporting, studies, analysis, hydraulic forecasts, operational instructions, etc.
  - Flood Inundation Mapping, Flood Impact Analysis
- Corps Water Management System (CWMS) Modeling and Analysis
  - 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

Figure 1.1 – The Inland Navigation System



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.


Access to Water Resources Data
WM Data Dissemination
Map
Overview
Help
Locate Water Management Areas
Search by City, State, Zip, or Project Name
Go
Advanced Filter
Data Discovery
Open


water.usace.army.mil/a2w/f?p=100:1:0:#
Search
Lake Red Rock Reservoir
Dam Profile Chart
Metadata
NID
Location Data
Time Series
Documents
Lake Summary
Annual Variability
Lake Red Rock Reservoir 4-Sep-2018 18:00:00
Legend
Current Lake Level
Tail Water
Inflow
Surcharge Release
Outflow
IN
25903 cfs
SUR
OUT
21867 cfs
Top of Dam
797'
Top of Flood
780'
Bottom of Flood
742'
Streambed
705'
743.67'
797.00
791.59
786.18
780.76
775.35
769.94
764.53
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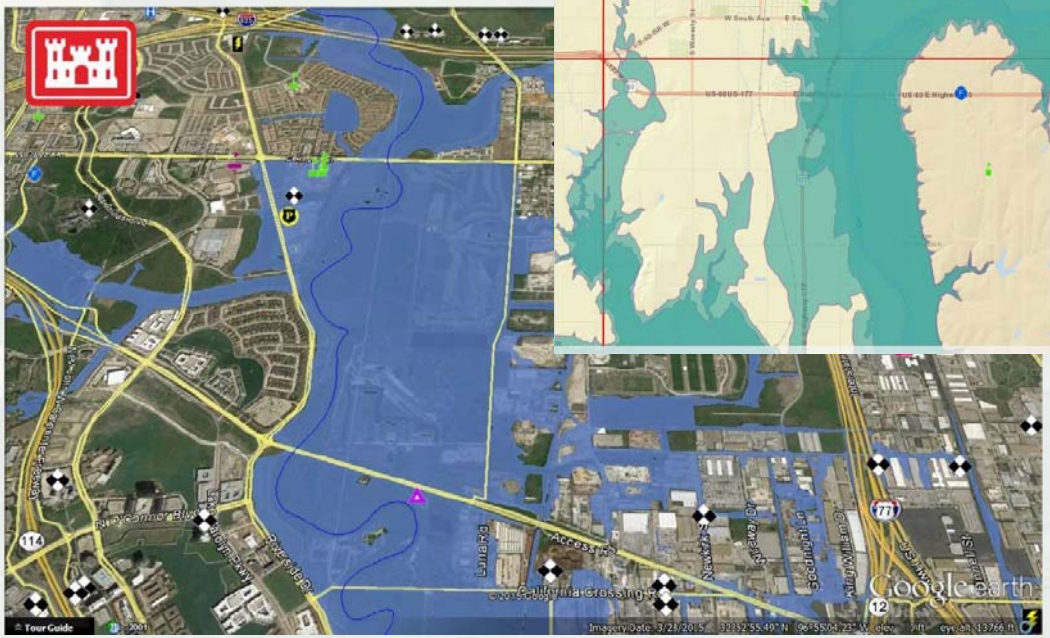

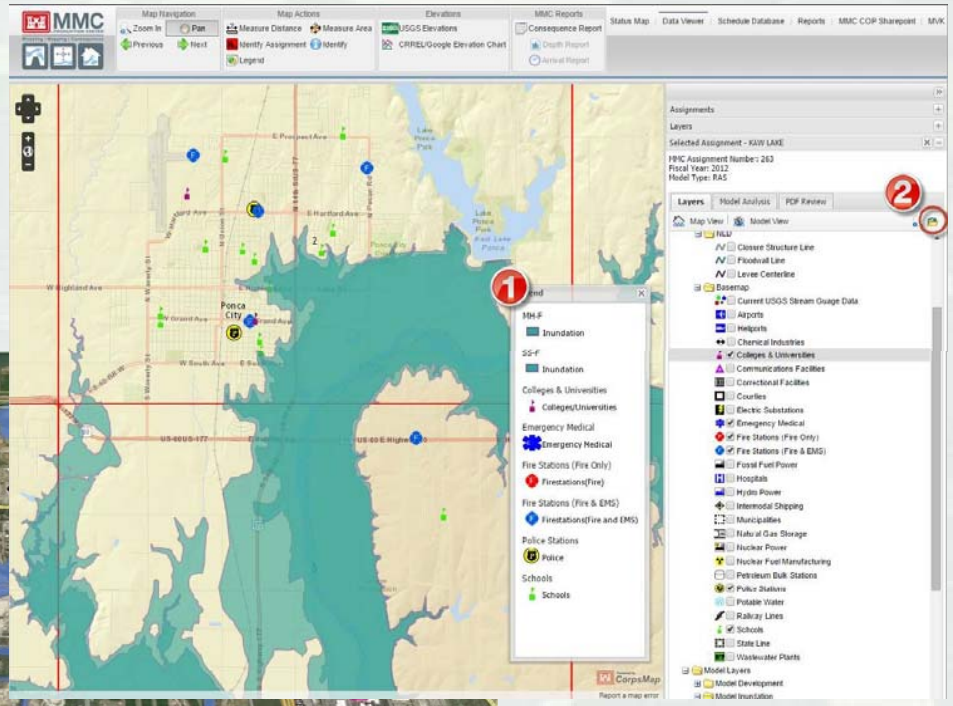

USACE Modeling Mapping and Consequences Production Center creates inundation maps by incorporating real-time GOES hydro-met observations. FIM is combined with economic, land use and other information for analysis to estimate consequences/losses; fatality rates, critical infrastructure, real-estate, etc.

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Water Levels of Rivers and Lakes

US Army Corps of Engineers

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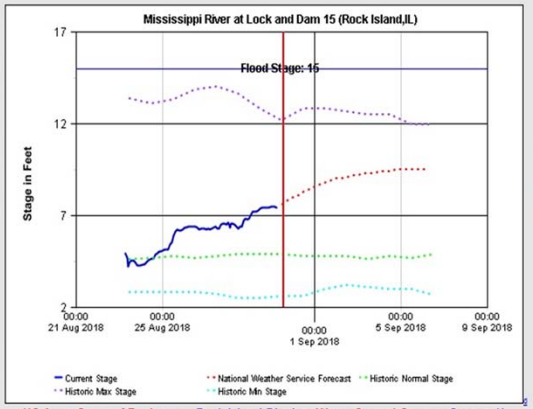
Mississippi River at Lock and Dam 15 (Rock Island,IL) - National Weather Service Forecast
(Central Time Zone)



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US Army Corps of Engineers

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National Weather Service Products

Bookmark

View Real-Time Stations In This Basin | View All Stations In This Basin
View All Values In Stage | View All Values In Elevation

STATION * Currently Forecasted Station	RECORD STAGE	FLOOD STAGE	LATEST LEVEL	24 Hr CHANGE	24 Hr PRECIP
Cedar River at Lansing,MN as of 10:00	23.44 09/15/2004	18.00	9.31	-0.07	M
Dobbins Creek at Austin,MN as of 10:00	19.18 07/10/2000	11.50	6.68	-0.04	0.00
Turtle Creek at Austin,MN as of 10:00	14.77 09/16/2004	10.50	2.04	-0.11	0.00
Cedar River near Austin,MN as of 10:00	25.00 08/16/2004	15.00	3.22	-0.07	0.01
* Turkey River at Spillville, IA as of 10:00	20.25 08/24/2016	16.00	4.89	-0.31	0.00
Turkey River near Eldorado, IA as of 10:00	21.46 06/09/2008	12.00	9.31	-1.39	
* Turkey River above French Hollow Creek at Elkader, IA as of 09:00	27.77 06/10/2008	12.00	9.50	+ 1.28	0.00
Volga River at Littleport, IA as of 09:00	25.36 05/17/1999	12.00	4.25	-0.11	0.00
Turkey River at Garber, IA as of 10:00	32.80 05/23/2004	17.00	11.06	+ 3.25	0.08
North Raccoon River near Sac City, IA as of 10:00	20.14 06/17/1990	13.00	9.51	-0.65	0.00
North Raccoon River near Lanesboro, IA as of 10:00	20.84 12/16/2015	15.00	13.30	+ 0.30	0.00
North Raccoon River near Jefferson, IA as of 10:00	22.30 06/23/1947	19.00	9.76	+ 1.38	0.00
Buttrick Creek near Grand Junction, IA as of 10:00		12.00	8.53	+ 0.31	0.00
North Raccoon River near Perry, IA as of 10:00	23.00 07/10/1993	15.00	10.75	+ 1.66	0.00

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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

BUILDING STRONG®

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

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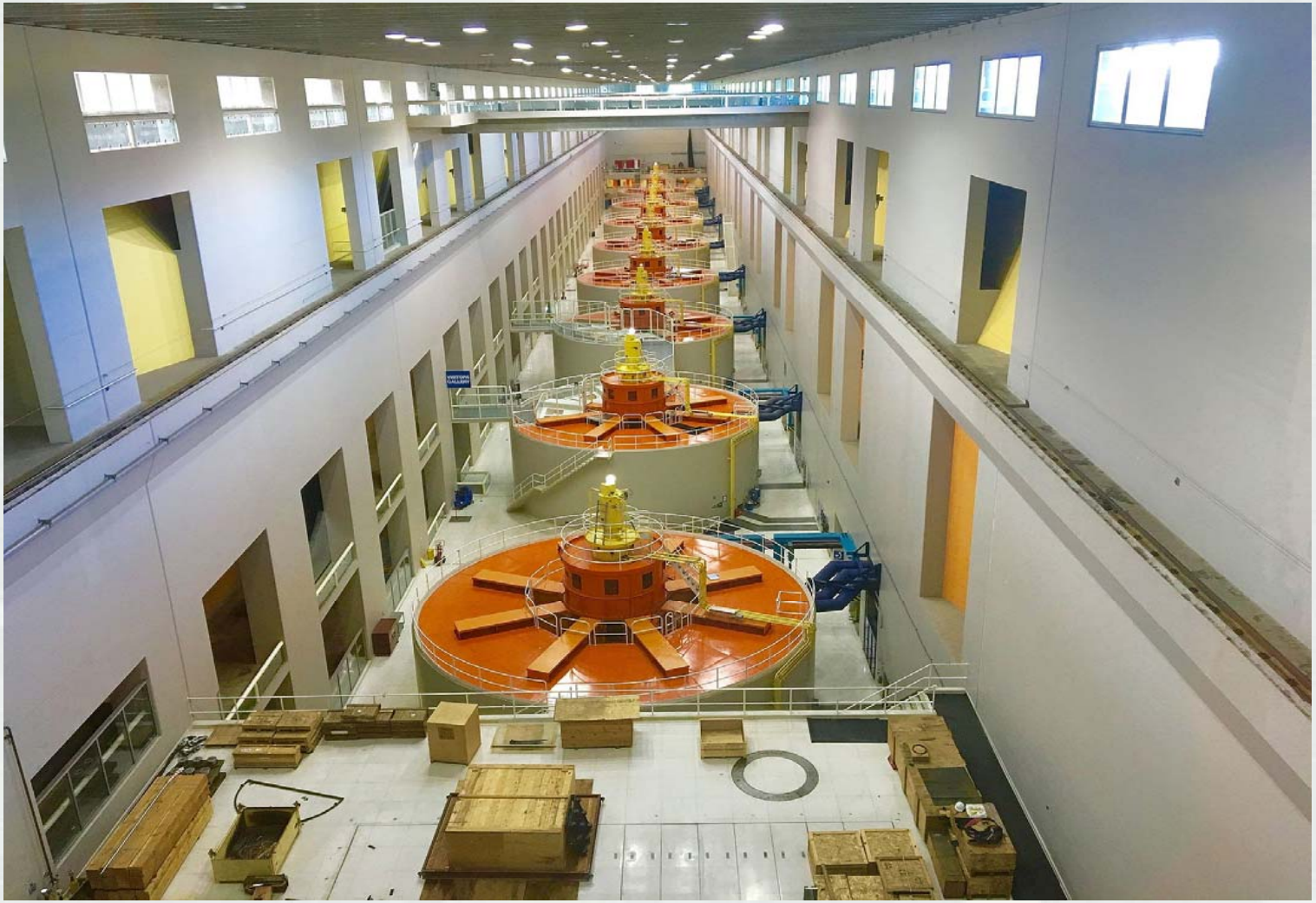
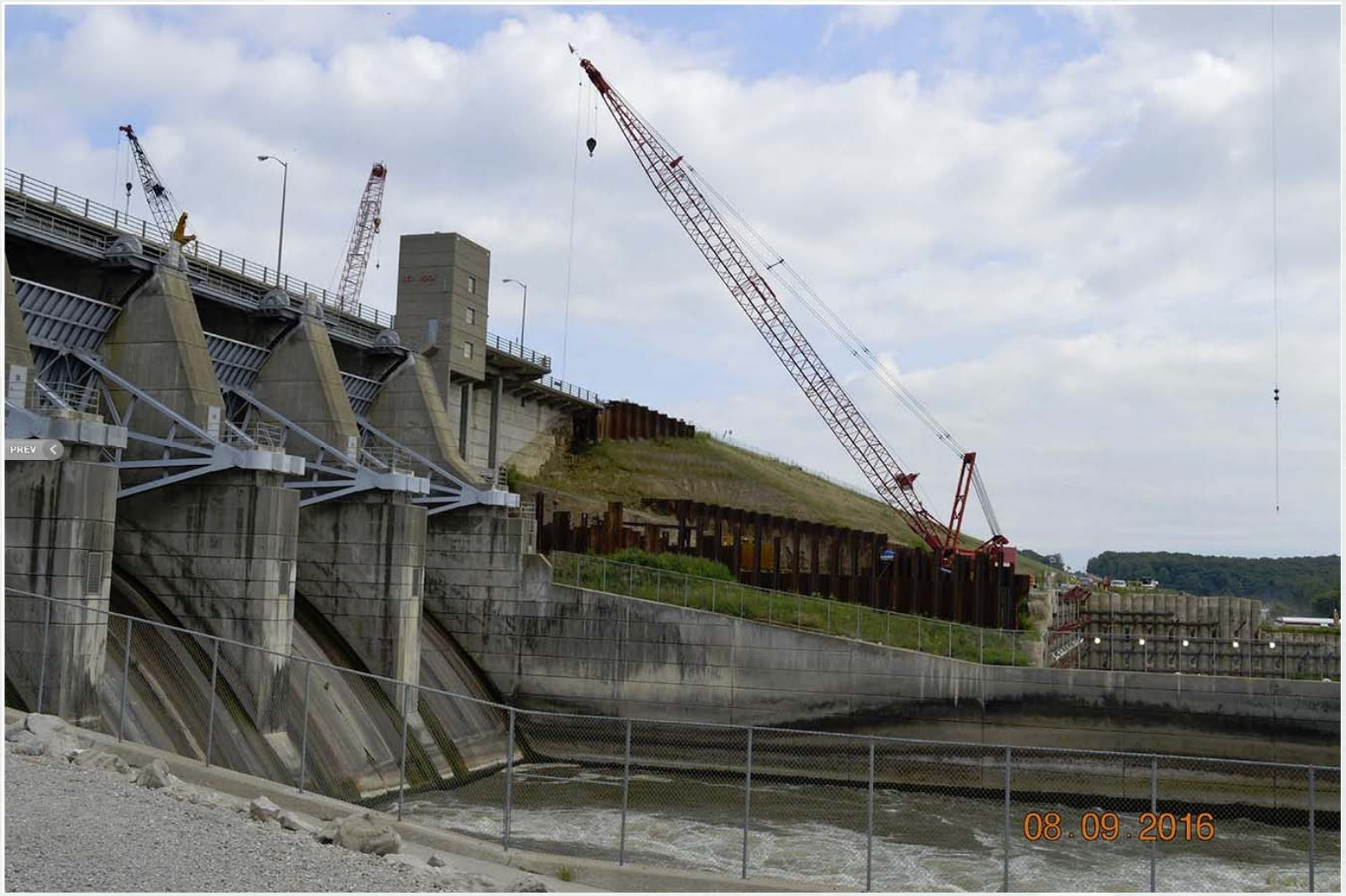
Cascades Island
Bonneville Da
Bradford Island
Robins Island
© 2018 Google



Red Rock Dam – Des Moines River

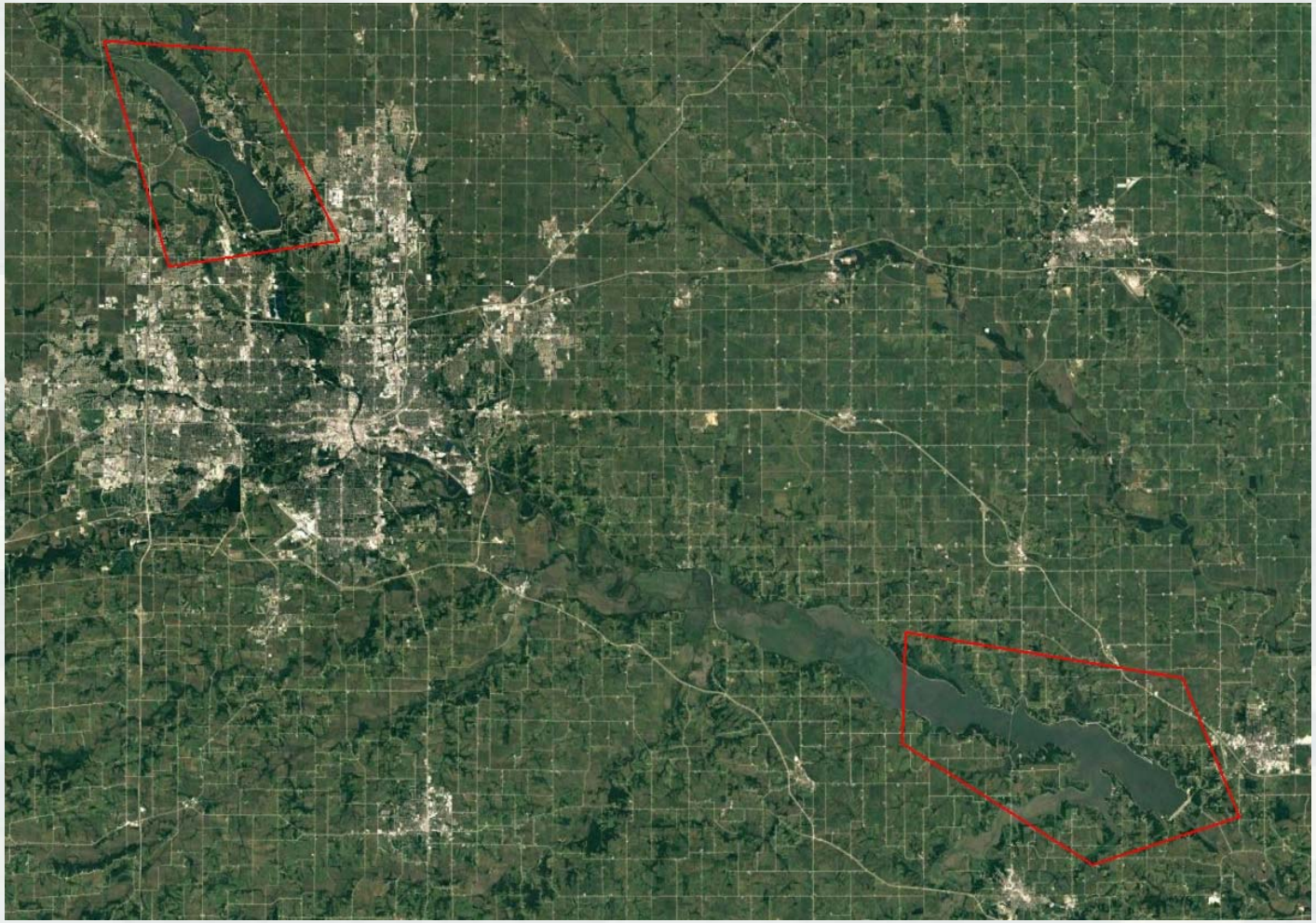
- Flood control project operated by USACE, Rock Island District
  - Operated in conjunction with Saylorville Dam
- Constructed 1960 - 1969
  - Multi-purpose Project
    - Flood control
    - Water supply
    - Recreation: camping, fishing, hunting, etc.
    - Hydro-power (2018)
  - Creates Lake Red Rock 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)


05.25.2016


PREV
08.09.2016


08.09.2016

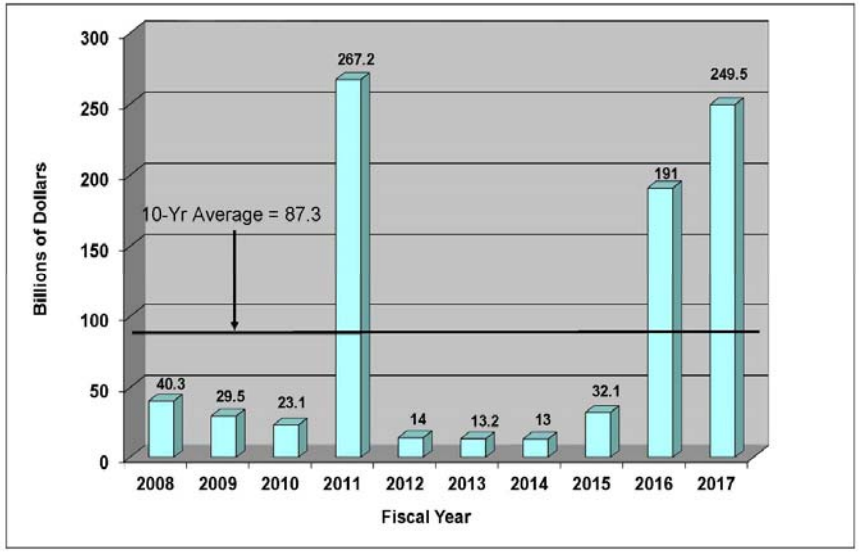

Red Rock Dam



Saylorville Lake (upper left) and Red Rock Lake (lower right) are operated together during flood events.

FIGURE 1

Flood Damage Reduction



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

FIGURE 2

Potential Flood Damages

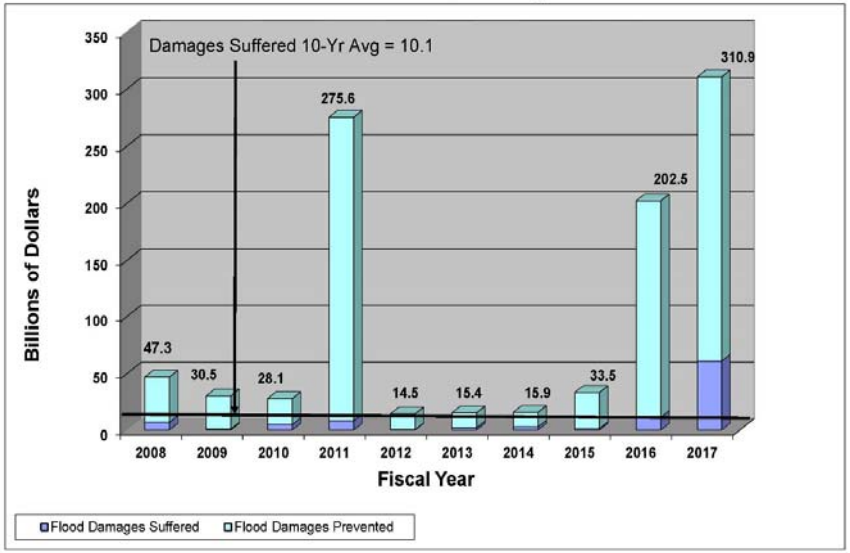
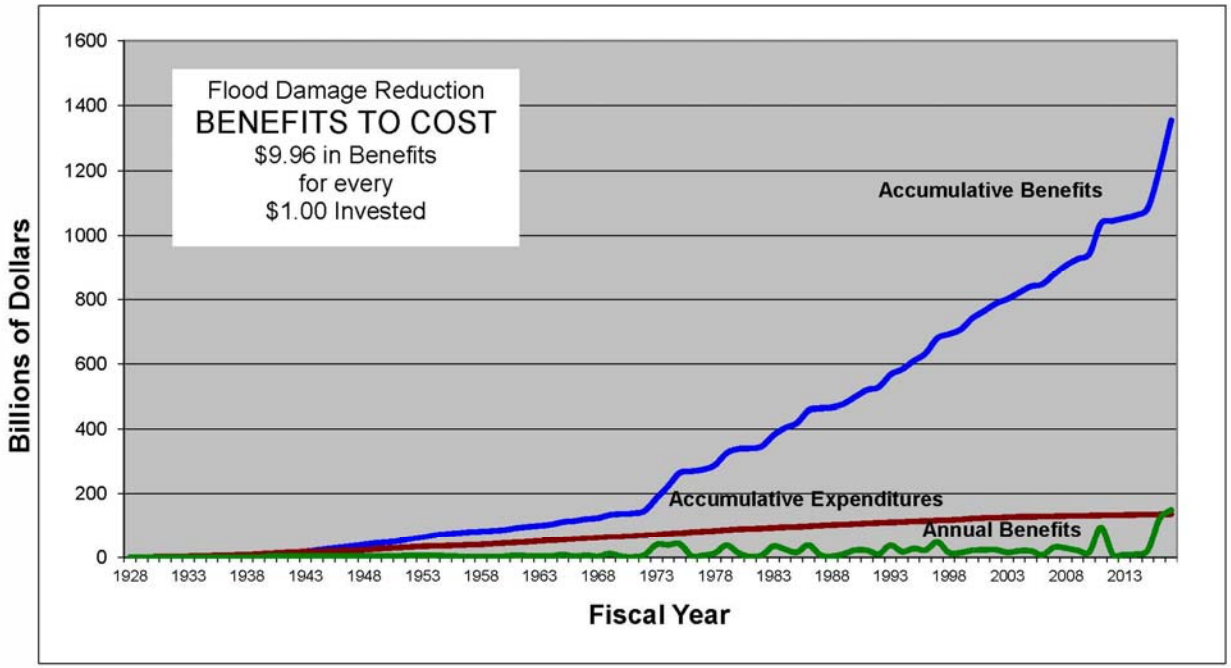


FIGURE 5

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)



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.

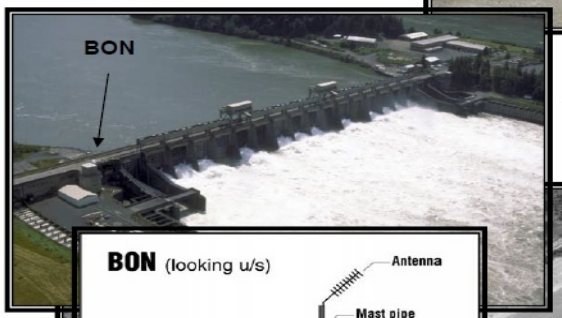
Fish, wildlife, public health, safety and interest are among the chief tenets for responsible project operation.

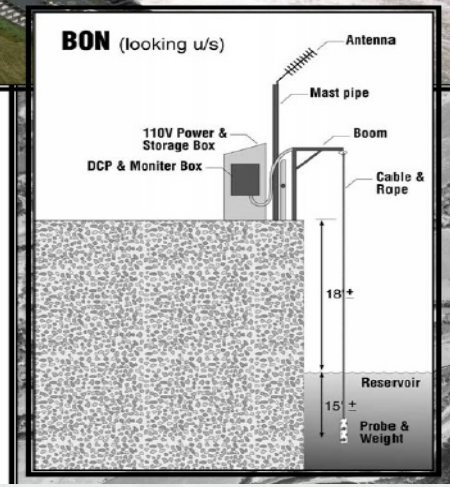
Detroit Dam - Williamette Basin - Salem, OR

- 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)

Gage 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: 453845121562000
Owner: U.S. Army Corps of Engineers
Gauge Type: Hydrosonde
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 spillbay #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.

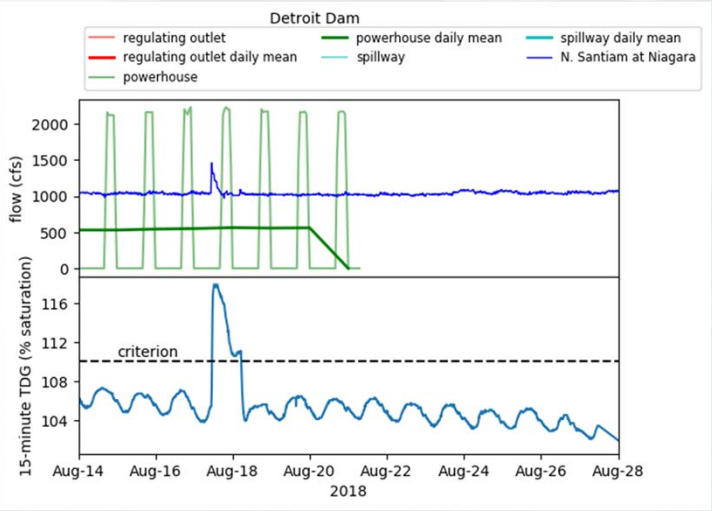
Detroit Dam, southeast of Salem, Ore., on the North Santiam River, provides a variety of functions including flood risk management and power production. However, it also blocks fish passage and the U.S. Army Corps of Engineers is in the process of building temperature control and fish passage at this site.

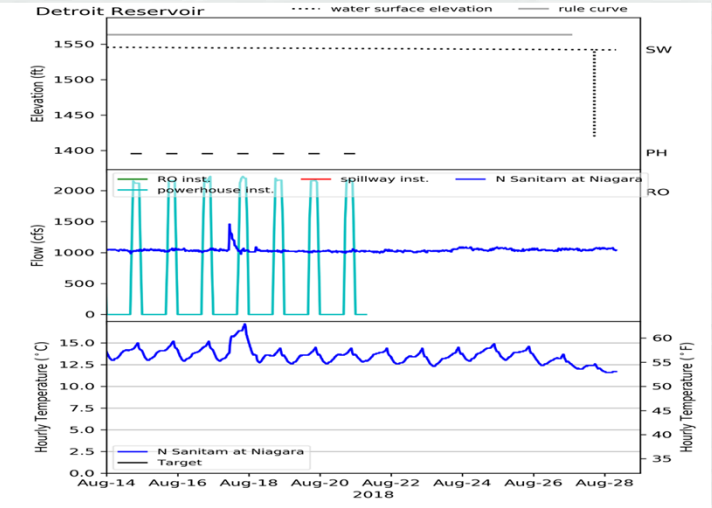
If feasible and more efficient to achieve both purposes through one construction project, the BiOp allows for this.

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: 400 W Virginia Street, Stayton, OR 97383
- 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





BUILDING STRONG®

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.

USGS Water Quality Monitoring Stations - http://waterdata.usgs.gov/nwis/current/?type=quality&group_key=NONE

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/

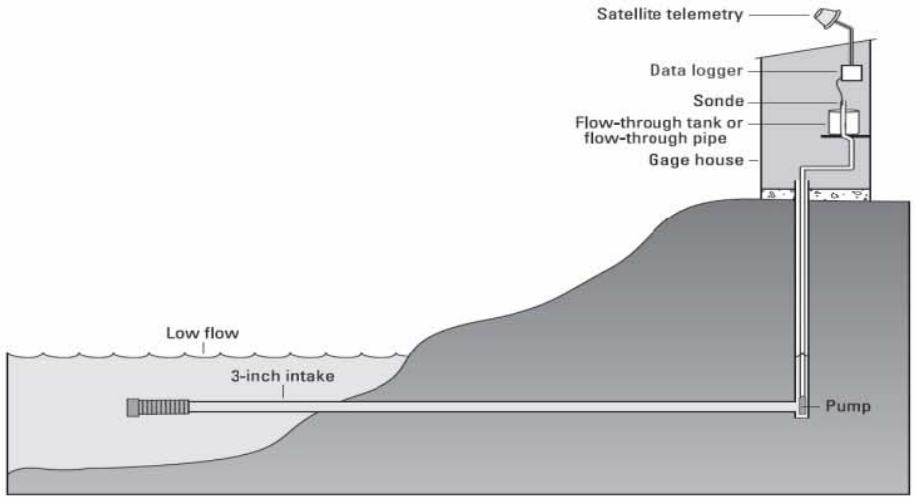


Figure 2. Ramapo River at Pompton Lakes, New Jersey, and schematic of flow-through water-quality monitoring station.

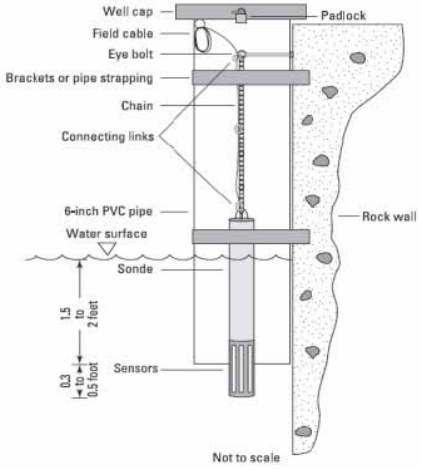


Figure 3. Delaware River and Araitan Canal feeder at Raven Rock, New Jersey, and schematic of internal-logging water-quality monitoring sensor and recording system.

Continuous Data

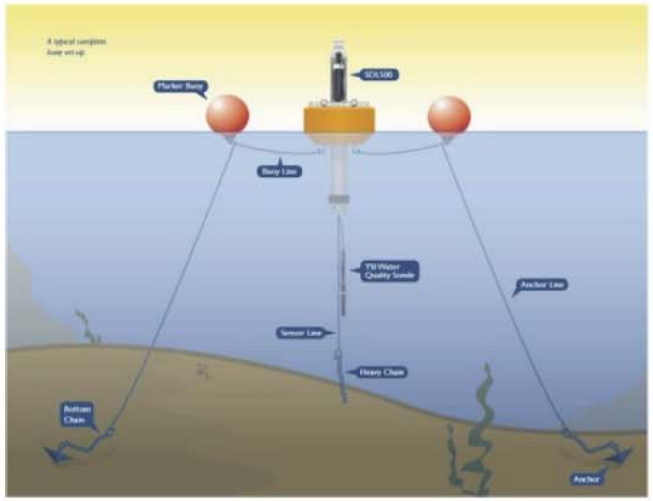
Visitors can view real time continuous data for the 12 water temperature buoys at Pittsburgh District reservoirs (when in operation from the spring through fall) and the 35 USGS water quality stations that are funded in part by the US Army Corps of Engineers below.

Water Temperature Buoys - https://www.wqdatalive.com/public/15

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.

http://www.fondriest.com/pdf/fondriest_wq_guide.pdf

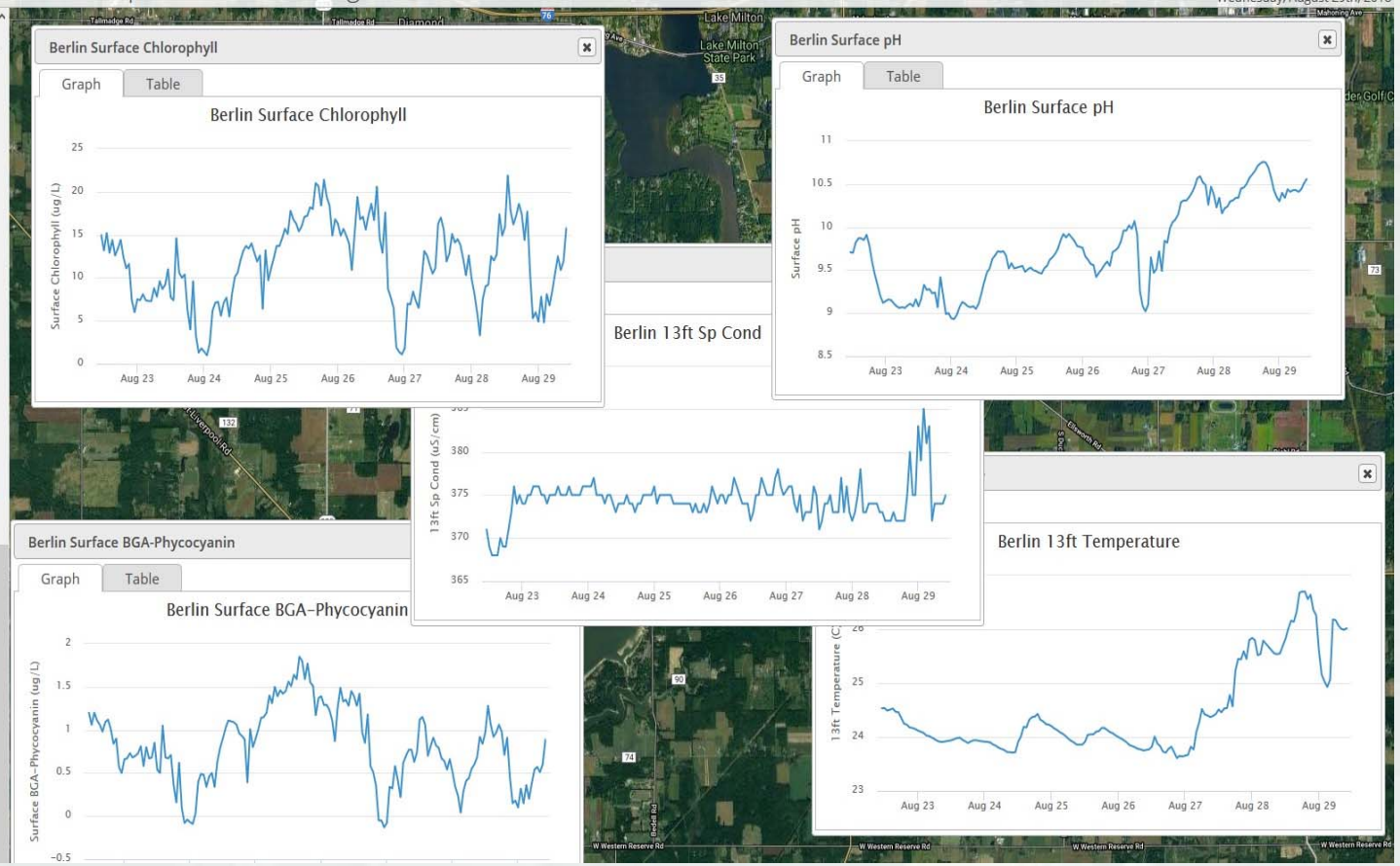


US Army Corps of Engineers

Pittsburgh District Reservoir Temperature Monitoring Network

Wednesday, August 29th, 2018

Surface Sonde Depth (ft)	1.46
Surface pH	10.56
Surface pH mV	-242.8
Surface ORP (mV)	146
Surface Turbidity (NTU)	4.29
Surface Chlorophyll (ug/L)	15.8
Surface Chlorophyll RFU (RFU)	3.9
Surface BGA-Phycocyanin (ug/L)	0.890
Surface BGA-Phycocyanin RFU (RFU)	0.9
Surface ODOSat (%)	121.3
Surface ODO (mg/L)	9.63
13ft Temperature (C)	26.02
13ft Sp Cond (uS/cm)	375
13ft Depth (ft)	9.833
13ft pH	9.03
13ft pH 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



BUILDING STRONG®

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
  - Weather information Management System – Nat'l Wildfire Coord. Grp.
    - 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
  - Forest Service, Natural Resources Conservation Service, Fish and Wildlife, Bureau of Land Management, U.S. Geological Survey and National Weather Service

FAM-IT PORTAL

menu

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 assists land management agencies with a variety of projects such as monitoring air quality, rating fire danger, and providing information for research applications.

Most of the stations owned by the wildland fire agencies are placed in locations where they can monitor fire danger. RAWS units collect, store, and forward data to a computer system at the National Interagency Fire Center (NIFC) in Boise, Idaho, via the Geostationary Operational Environmental Satellite (GOES). The GOES is operated by the National Oceanic and Atmospheric Administration (NOAA). The data is automatically forwarded to several other computer systems including the Weather Information Management System (WIMS) and the Western Regional Climate Center (WRCC) in Reno, Nevada.

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

- FTS Datalogger
- G4 FTS Transmitter
- RSFWSU STATEMENT OF SERVICES CHANGE
- CHANGE TO THE SMOKE MONITOR PROGRAM
- CS-2 TRANSMITTER UPGRADES

News and Information

January 27, 2017

FTS EON ANTENNA

All RAWS customers are advised that the manufacturer design of the FTS Eon GOES Antenna may limit the RSFWSU Depot ability to make any repairs to this item.

Due to this maintenance limitation if an Eon GOES antenna appears to fail in the field the following maintenance policy applies

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Caring for the land and serving people

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FOREST SERVICE HOME » WWW.FS.FED.US » NATURALRESOURCES » WATERSHED » WO STAFF PROGRAM - BURNED AREA EMERGENCY RESPONSE BAER

Watershed

- Overview
- Focus Areas & Initiatives
- Program Leaders
- Documents & Publications
- Tools
- Water Education
- Watershed Related Links

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 land owners who may also be affected by potential post-fire damage.

National BAER & Watershed Improvement Program Leader: Penny Luehring

References

2017 BAER Interim Directive: doc 170 KB

USDA Forest Service RMRS, Soil & Water Engineering Publications

Contact Us

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Contact Us

National Headquarters

- Office of the Chief
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- Business Operations
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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 to deploy 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 (NESDIS) 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-

A. Precipitation gage (instrument detail) used in burned area at Missionary Ridge Complex Fire.

B. Precipitation gage used in burned area at Grizzly Gulch Fire.

C. Precipitation gage used in burned area at Battle Creek Fire.

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.

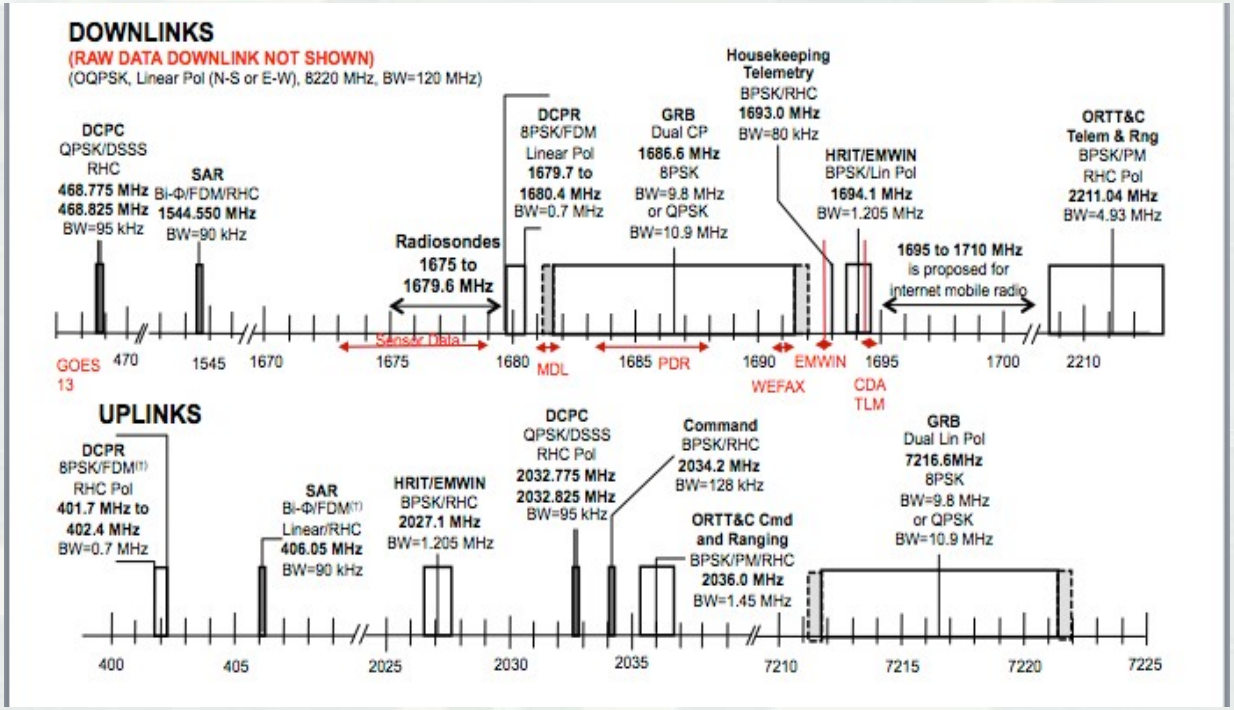
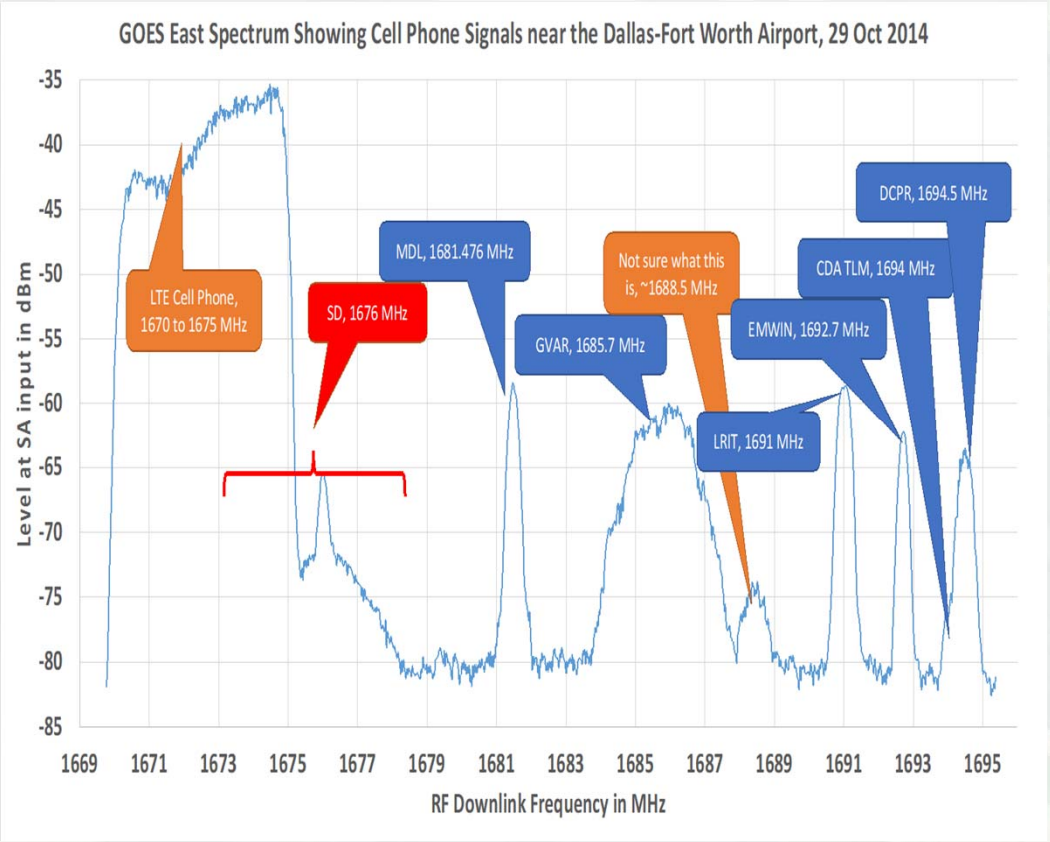
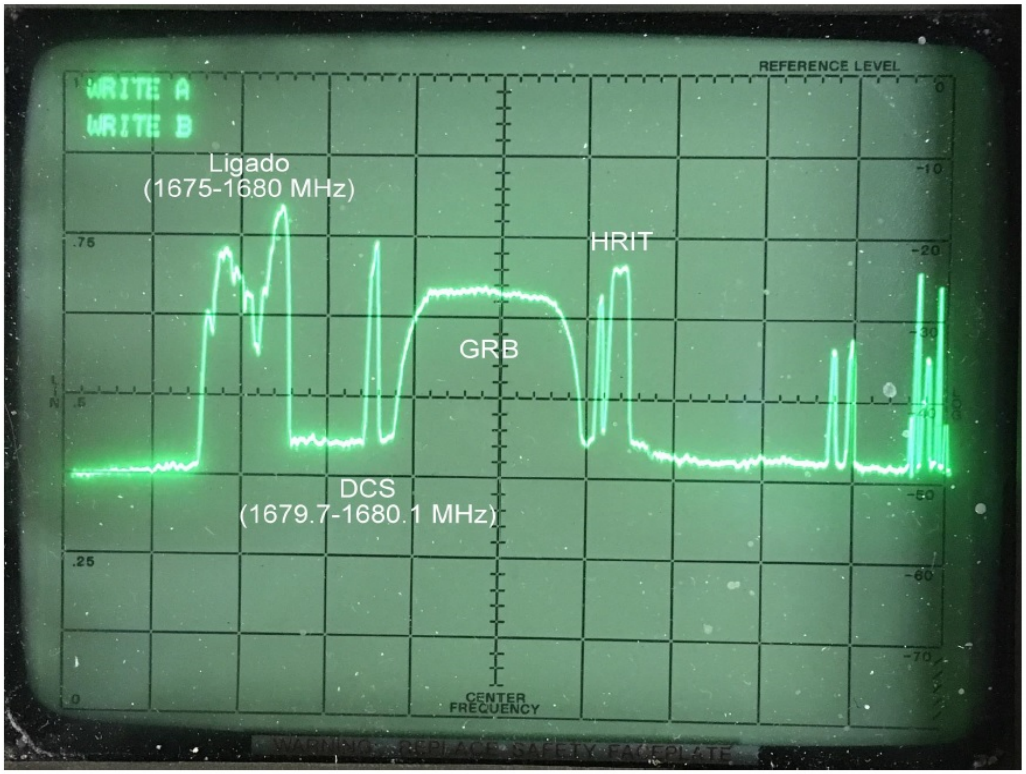


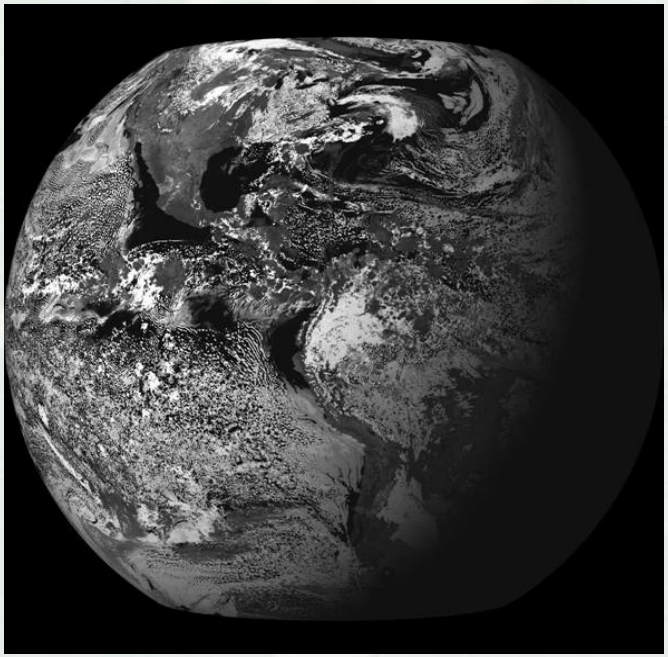
Figure 2 Depiction of the GOES communication spectrum. The downlink graph (top) shows the 1675 – 1695 MHz band used by satellites to relay data to Earth receive ground stations and the close proximity of the recently auctioned spectrum for wireless broadband (1695 – 1710 MHz) to the HRIT/EMWIN frequency at 1694.1 MHz.



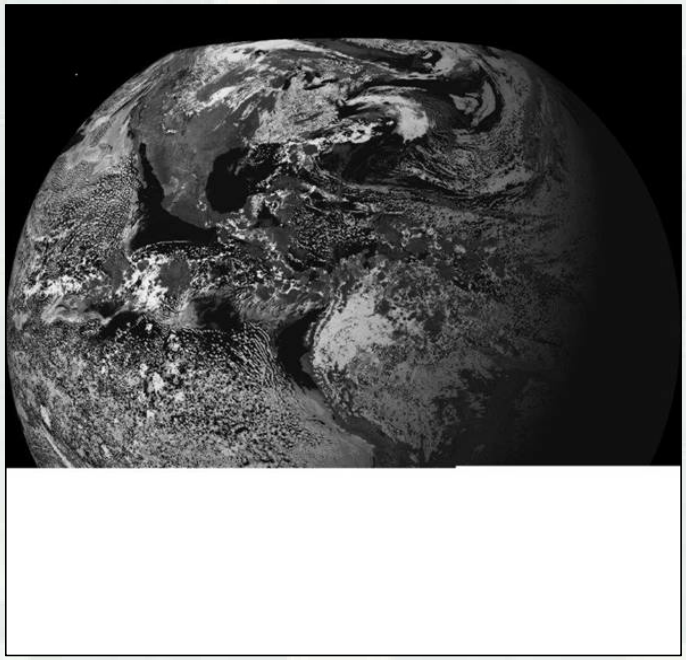
Reference Spectrum from 5M GOES-East (aka GOES-16) at DPCM



*GOES-R now transmits at 1679.7 – 1680.4
*GOES HRIT rebroadcast transmits at 1694.1 MHz



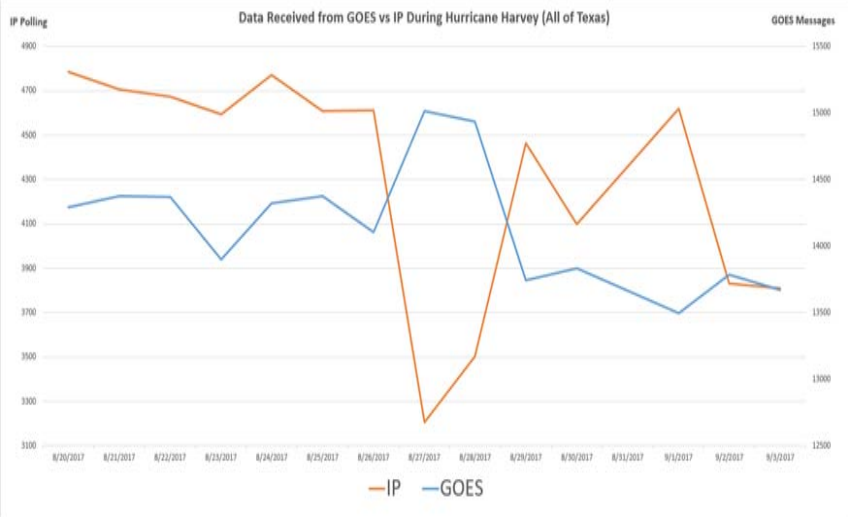
Simulated GRB GOES-R Imager Full Disk (Mode 4, Band 1) Without Noise

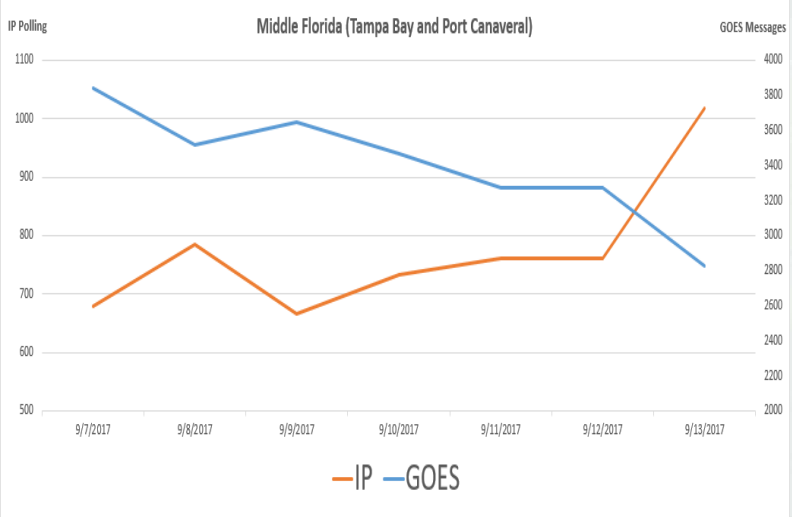


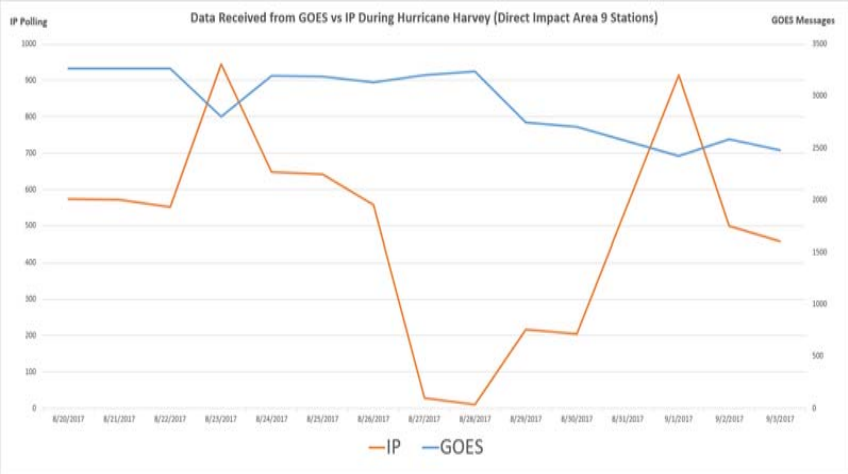
Simulated GRB GOES-R Imager Full Disk (Mode 4 Band 1) with noise injected at random point. Immediate catastrophic failure of the DVB-S2 signal occurred

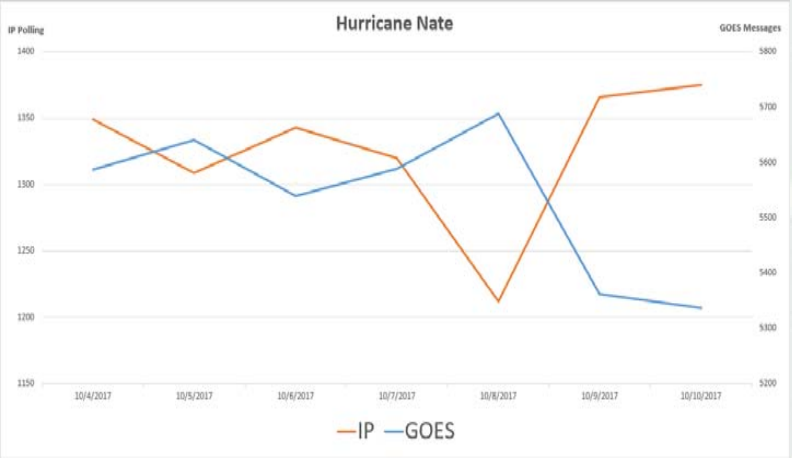
GOES vs Terrestrial Storm Event Performance Synopsis

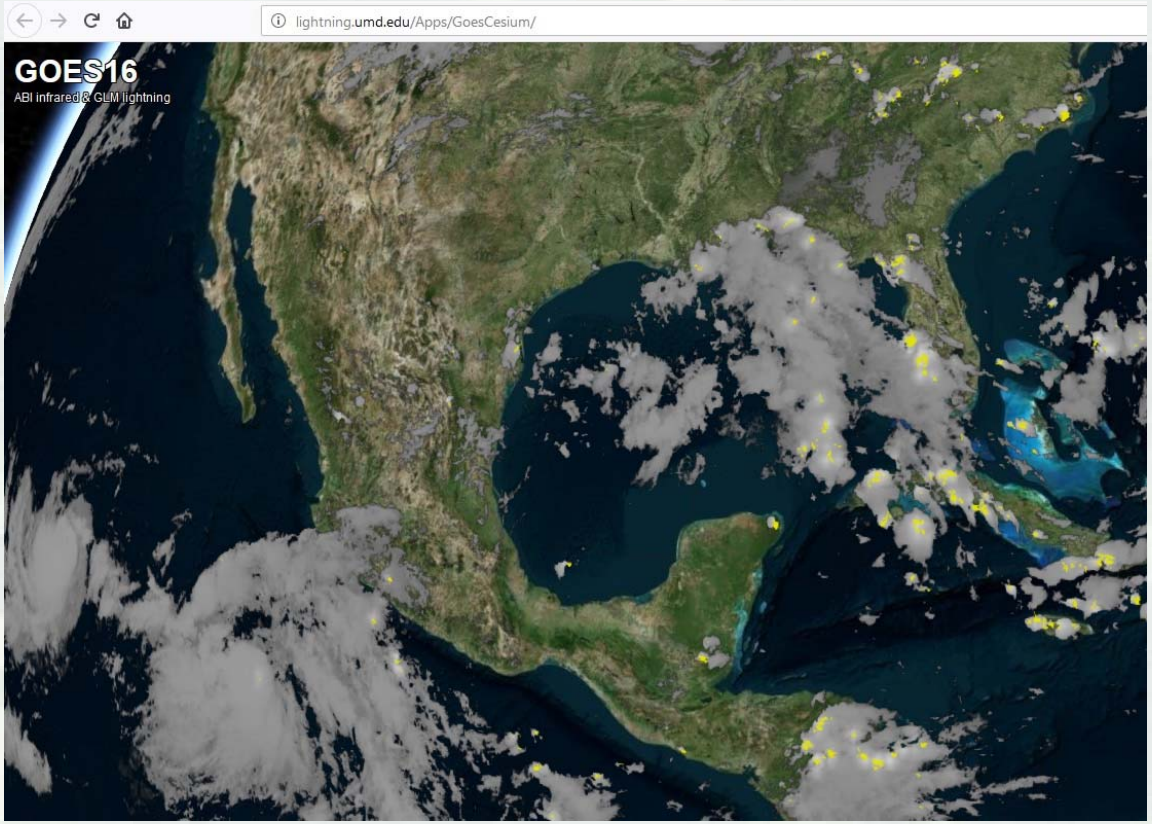
- Performance during Natural Disasters (Credit: Nathan Holcomb NOAA/NOS/COOPS)
  - NOS primarily uses Iridium and GOES to ingest data
    - Also employ IP modems and phone lines
  - Working to upgrade their data status reports to reflect where their data is coming from
  - Large decrease in data coming 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


Data Received from GOES vs IP During Hurricane Harvey (All of Texas)
IP Polling
GOES Messages
IP
GOES


Middle Florida (Tampa Bay and Port Canaveral)
IP Polling
GOES Messages
9/7/2017
9/8/2017
9/9/2017
9/10/2017
9/11/2017
9/12/2017
9/13/2017
IP
GOES

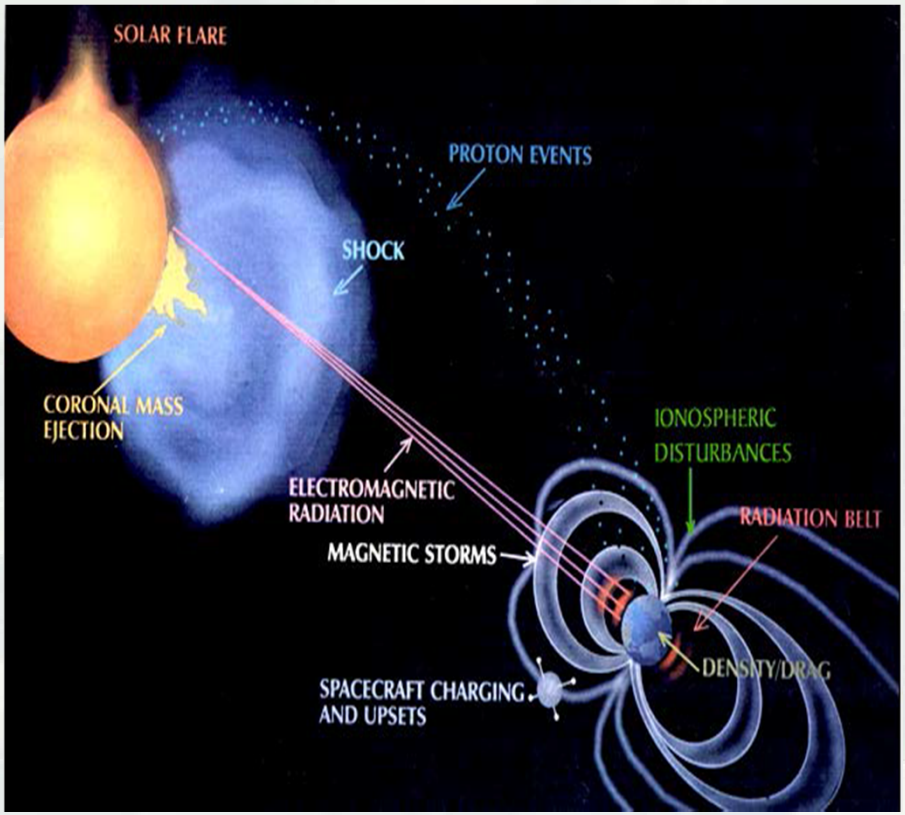

Data Received from GOES vs IP During Hurricane Harvey (Direct Impact Area 9 Stations)
IP Polling
GOES Messages
IP
GOES

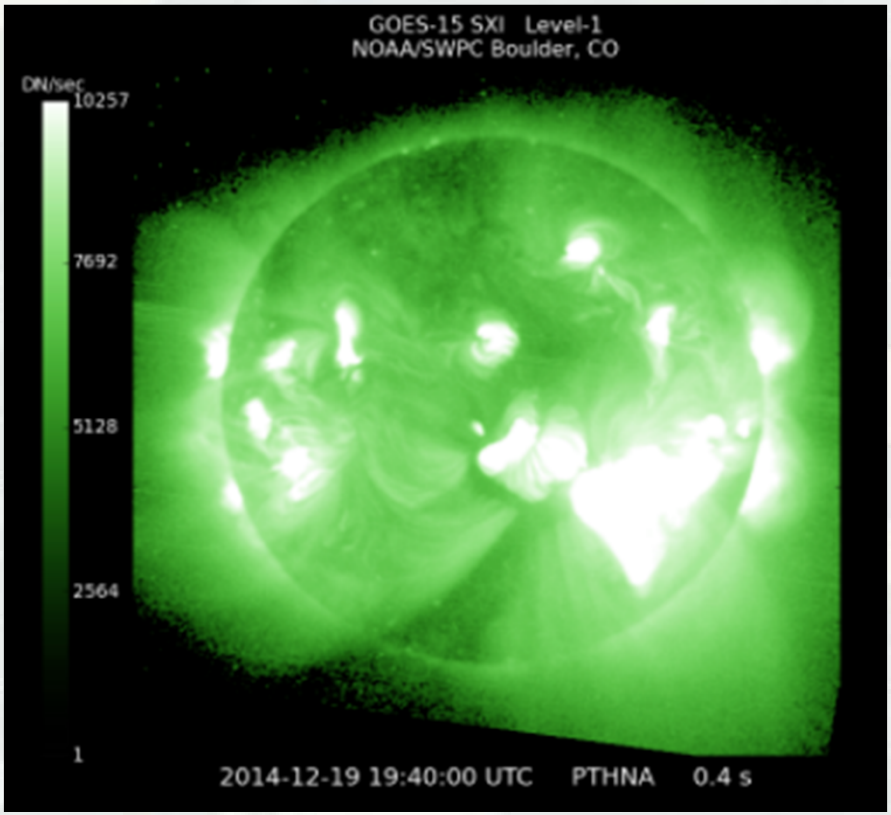

Hurricane Nate
IP Polling
GOES Messages
10/4/2017
10/5/2017
10/6/2017
10/7/2017
10/8/2017
10/9/2017
10/10/2017
IP
GOES



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.





GOES Satellites monitor Near-Earth space environment driven by solar events: GOES Electron Flux, GOES Magnetometer, GOES Proton Flux, GOES Solar X-ray Imager and GOES X-ray Flux.

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
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- 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
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End

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