

The Delaware Environmental Monitoring & Analysis Center



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Delaware Estuary Science &
Environmental Summit 2013
January 27-30, 2013



What is DEMAC?

Delaware Environmental Monitoring & Analysis Center

- NSF EPSCoR funded



Goals:

- to coordinate and collaborate on environmental monitoring efforts throughout the State of Delaware and its surrounding areas
- to provide effective analysis and visualization tools for cross-discipline research
- assist researchers in sharing their findings with K-12, decision-makers, and the general public

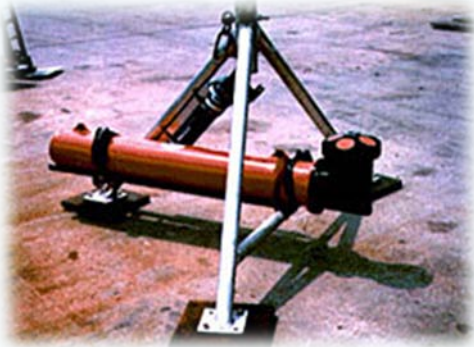
About DEMAC...

- Started in Fall 2011
- Located at the University of Delaware in the College of Earth, Ocean & Environment (CEOE)
- Work closely the Delaware State Climatologist and the Delaware Environmental Observing System (DEOS)
- Specialties in spatial data mapping & data visualization, web application development, geospatial analysis



Continuous Monitoring Efforts in the Delaware Region

- **Meteorological variables** (temp, precip, wind, atmospheric pressure, humidity, solar radiation, soil temp, soil moisture)...
DEOS/NWS/DSWA
- **Streamflow** (gage height and discharge)... **USGS**
- **Tidal Data** (tide level)... **USGS/NOAA/DNREC**
- **Ocean Buoy Data** (wave height, wave period, water temp)...
NOAA/NERR
- **Groundwater Levels**... **DGS**
- **Water Quality**... **DNREC/USGS/CIB/CMP**
- **Remote Sensing** (Satellite and Aerial Imagery)... **UDSRS**



Numerous additional environmental sensing instruments such as AUVs, ADCPs, Ocean Gliders, CODAR, and the RV Sharp are also monitoring the coastal and ocean environment.



DEMAC works with all of these groups to help them share and visualize their data.



Some of Our Current Projects

DEMAC Current Projects

- Inventory of Delaware Environmental Monitoring Efforts
- Delaware Aerial Imagery Distribution Site
- UD Satellite Receiving Station
- Development of a Comprehensive Real-Time Water Quality Monitoring Capability for the Delaware Inland Bays
- Gridded Climate Normal Products

Delaware Environmental Monitoring Sites

MAP • TABLE • LIST VIEW

469 Items

Type

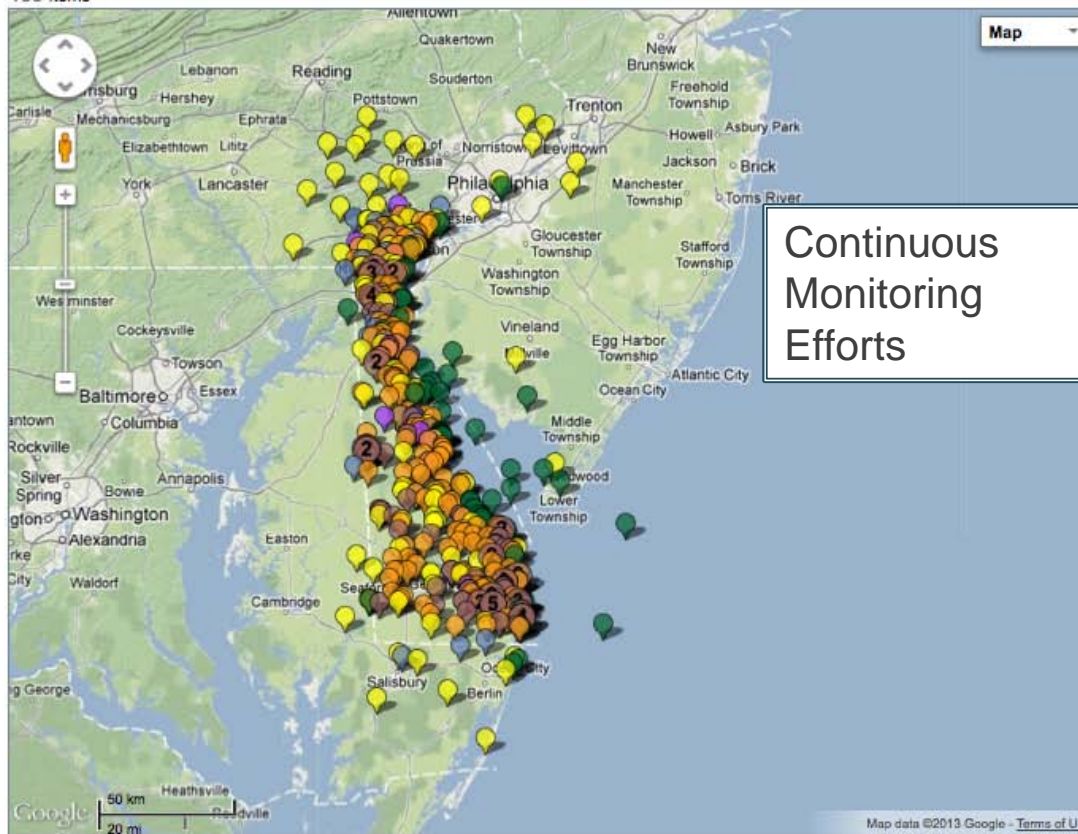
- 137 Groundwater
- 96 Meteorological
- 27 Streamflow
- 66 Tidal
- 159 Water Quality

Source

- 24 COOP/NWS
- 9 DELDOT
- 58 DEOS
- 137 DGS
- 169 DNREC
- 12 FAA/NWS
- 14 NOAA
- 2 USACE
- 44 USGS

Project

- 4 Bombay Hook
- 6 CFMS
- 24 COOP/NWS
- 2 DCMP
- 9 DELDOT
- 50 DEOS



Groundwater Meteorological Streamflow Tidal Water Quality Multiple

Text Search

Delaware Watersheds

Active?

- 71 N
- 398 Y

Realtime?

- 335 N
- 134 Y

Variables

- 108 air temperature
- 138 bacteria
- 1 cdom
- 1 ceiling height
- 1 chlorophyll
- 1 conductivity
- 1 current direction
- 1 current speed
- 74 dewpoint temperature
- 27 discharge
- 156 do
- 15 do %sat
- 4 dominant wave period
- 138 hardness
- 1 nitrate
- 146 nutrients

Page is co-maintained by the Delaware Environmental Monitoring and Analysis Center and the Delaware Geological Survey.

Delaware Environmental Monitoring Sites

MAP • TABLE • LIST VIEW

134 Items filtered from 469 originally (Reset All Filters)

Type

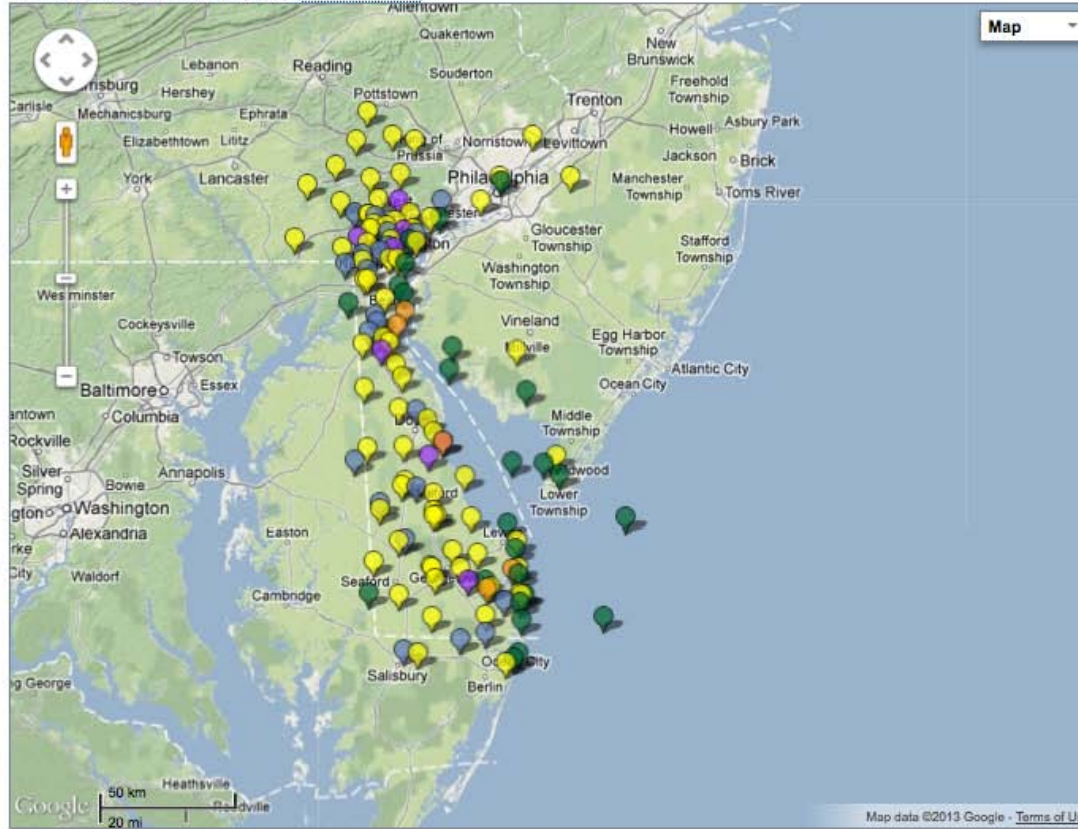
- 74 Meteorological
- 27 Streamflow
- 28 Tidal
- 13 Water Quality

Source

- 2 COOP/NWS
- 9 DELDOT
- 52 DEOS
- 1 DNREC
- 12 FAA/NWS
- 12 NOAA
- 2 USACE
- 44 USGS

Project

- 2 COOP/NWS
- 9 DELDOT
- 50 DEOS
- 1 DEOS, Inland Bays
- 12 FAA/NWS
- 1 Inland Bays



- Meteorological
- Streamflow
- Tidal
- Water Quality
- Multiple

Text Search

Delaware Watersheds

Active?

- 2 N
- 132 Y

Realtime?

- 335 N
- 134 Y

Variables

- 85 air temperature
- 1 odom
- 1 ceiling height
- 1 chlorophyll
- 1 conductivity
- 74 dewpoint temperature
- 27 discharge
- 12 do
- 9 do %sat
- 2 dominant wave period
- 1 nitrate
- 1 nutrients
- 1 o2
- 1 o2sat
- 13 ph
- 74 precipitation

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Delaware Environmental Monitoring Sites

MAP • TABLE • LIST VIEW

12 Items filtered from 469 originally (Reset All Filters)

Type

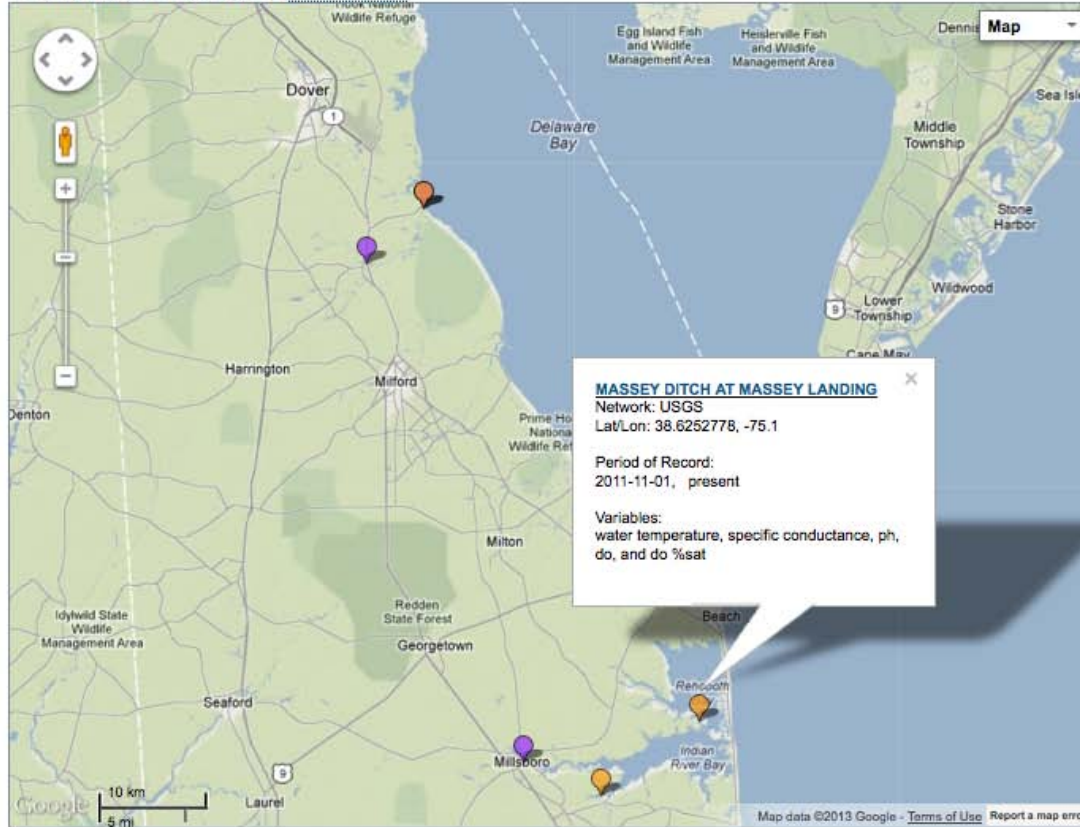
- 4 Streamflow
- 3 Tidal
- 12 Water Quality

Source

- 1 DEOS
- 1 DNREC
- 10 USGS

Project

- 1 Inland Bays
- 1 Kent County LOBO
- 4 USGS Streamgage
- 6 USGS Tidal



● Streamflow ● Tidal ● Water Quality ● Multiple

Text Search

Delaware Watersheds

Active?

- 1 N
- 11 Y

Realtime?

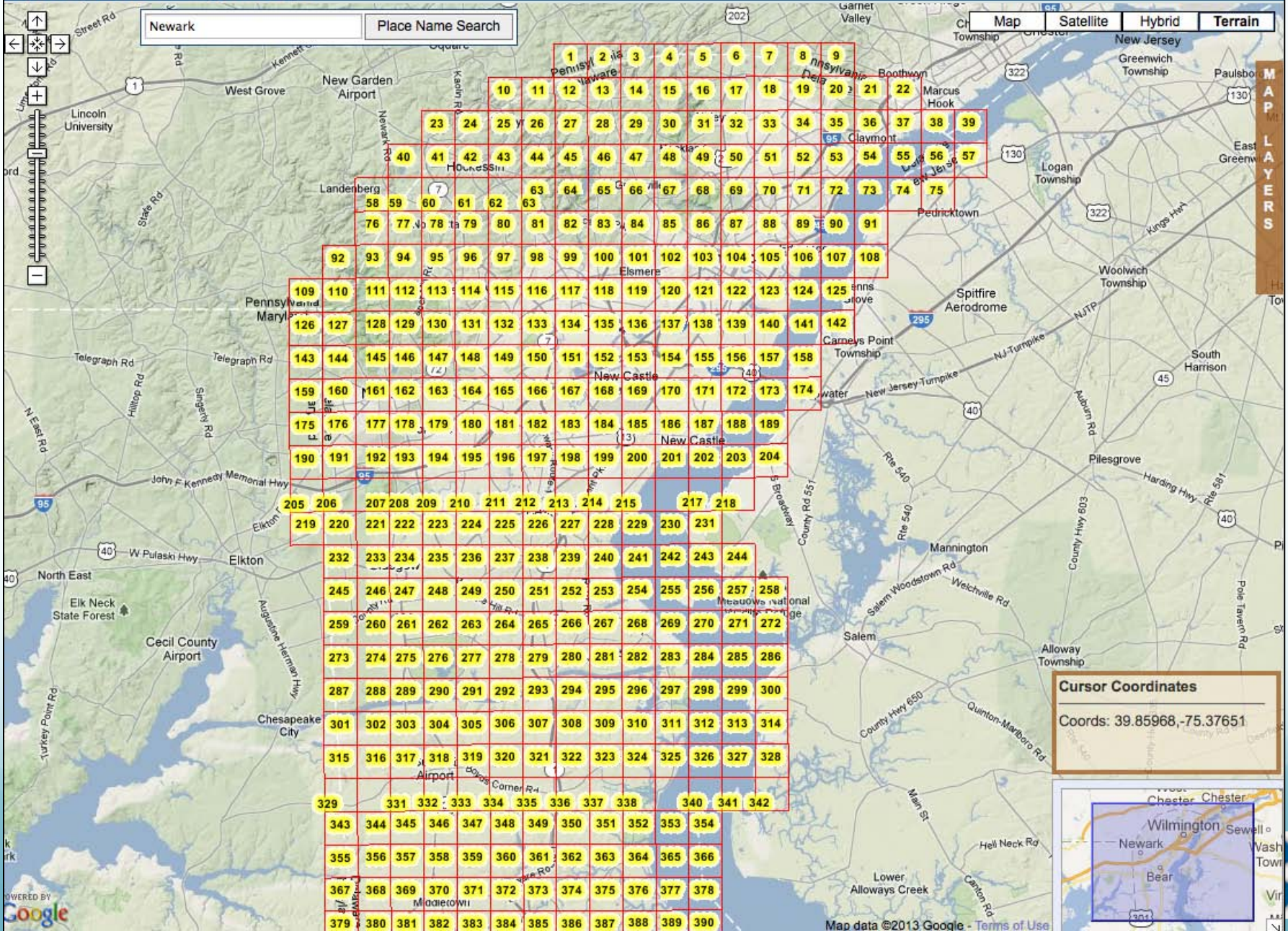
- 144 N
- 12 Y

Variables

- 85 air temperature
- 1 cdom
- 1 ceiling height
- 1 chlorophyll
- 1 conductivity
- 74 dewpoint temperature
- 27 discharge
- 12 do
- 9 do %sat
- 2 dominant wave period
- 1 nitrate
- 1 nutrients
- 1 o2
- 1 o2sat
- 13 ph
- 74 precipitation

Page is co-maintained by the Delaware Environmental Monitoring and Analysis Center and the Delaware Geological Survey.

Map Tiles | DE Ortho Inventory | Need Help?



Newark Place Name Search

Map Satellite Hybrid Terrain

MAP LAYERS

Cursor Coordinates
Coords: 39.85968, -75.37651

Map Tiles | DE Ortho Inventory | Need Help?

Newark Place Name Search

Map Satellite Hybrid Terrain

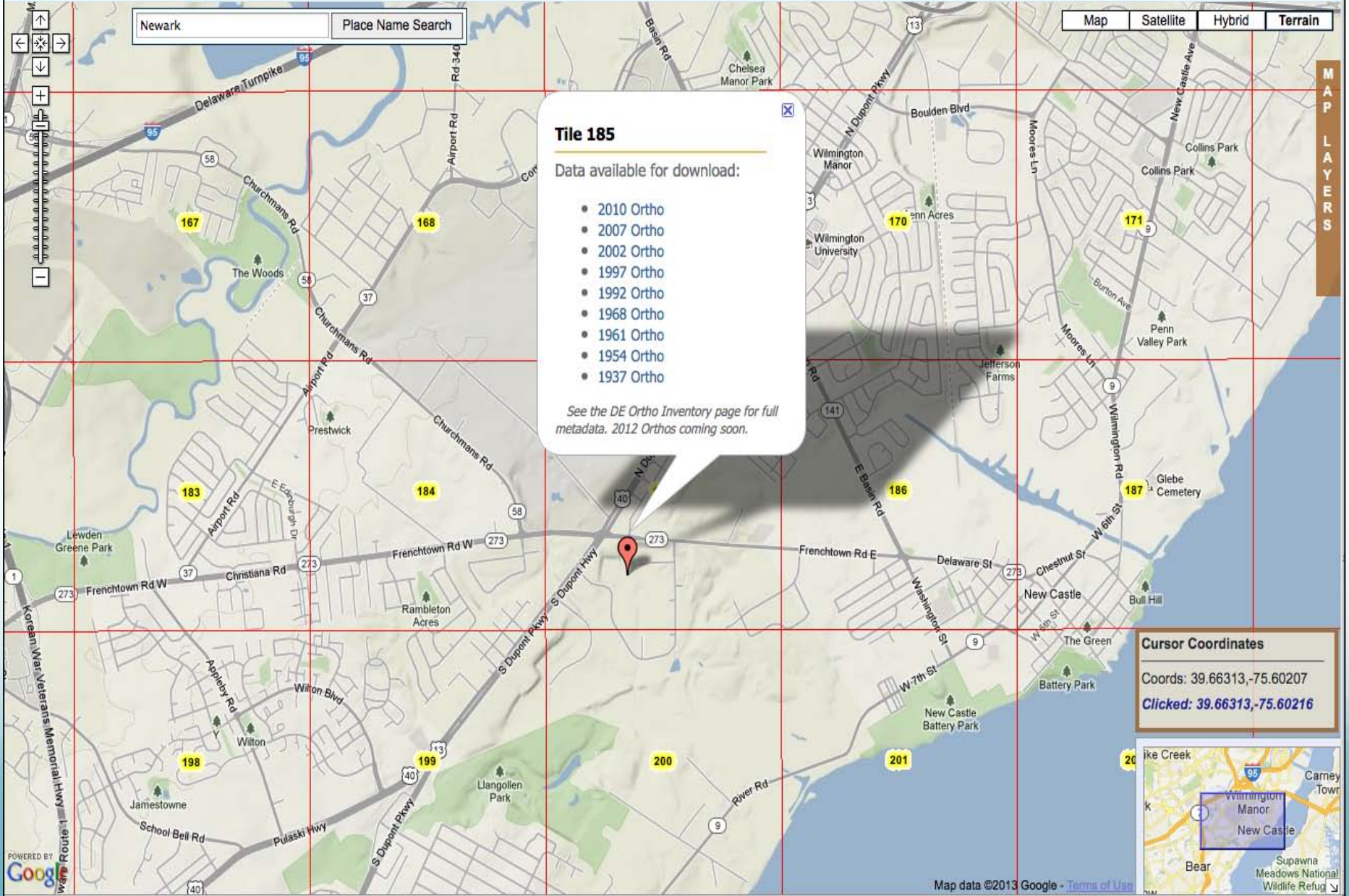
MAP LAYERS

Tile 185

Data available for download:

- 2010 Ortho
- 2007 Ortho
- 2002 Ortho
- 1997 Ortho
- 1992 Ortho
- 1968 Ortho
- 1961 Ortho
- 1954 Ortho
- 1937 Ortho

See the DE Ortho Inventory page for full metadata. 2012 Orthos coming soon.



Cursor Coordinates

Coords: 39.66313,-75.60207

Clicked: 39.66313,-75.60216





UD SATELLITE RECEIVING STATION



*polar orbiter receiving dish
(Willard Hall, UD Main Campus)*

Products vary in...

- Resolution: 250m – 4km
- Frequency: 15 min – 4x daily
- Holdings: past week - 2010

Satellites:

- GOES - East
- MODIS Terra & Aqua
- NPP/JPSS
- NOAA – 16, 18, 19
- MetOP

Products:

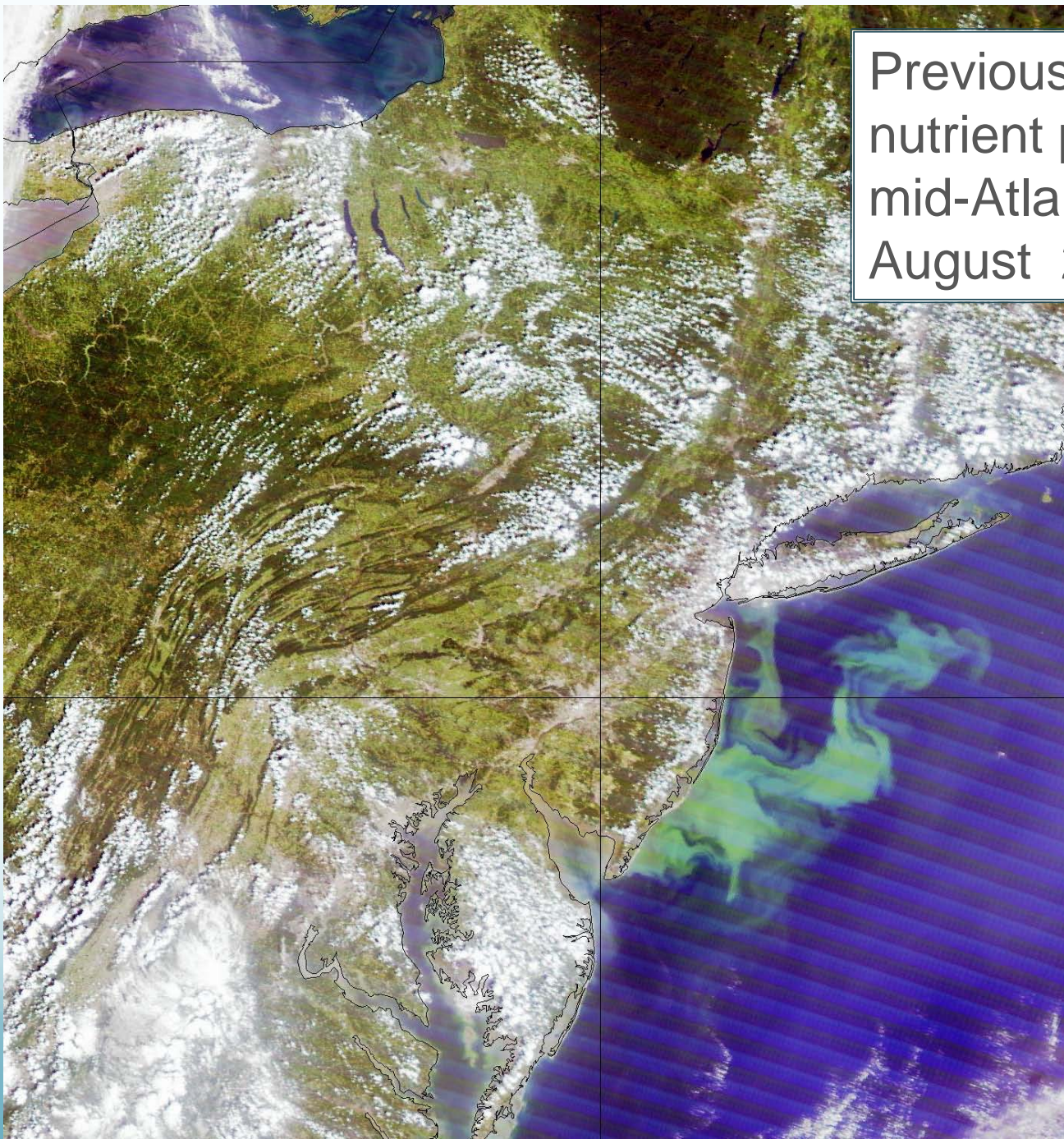
- Channel data
- SST/LST
- NDVI
- Chlorophyll
- CO₂
- Cloud Pressure
- Cloudtop Temp
- Water Vapor
- Pressure/Heights



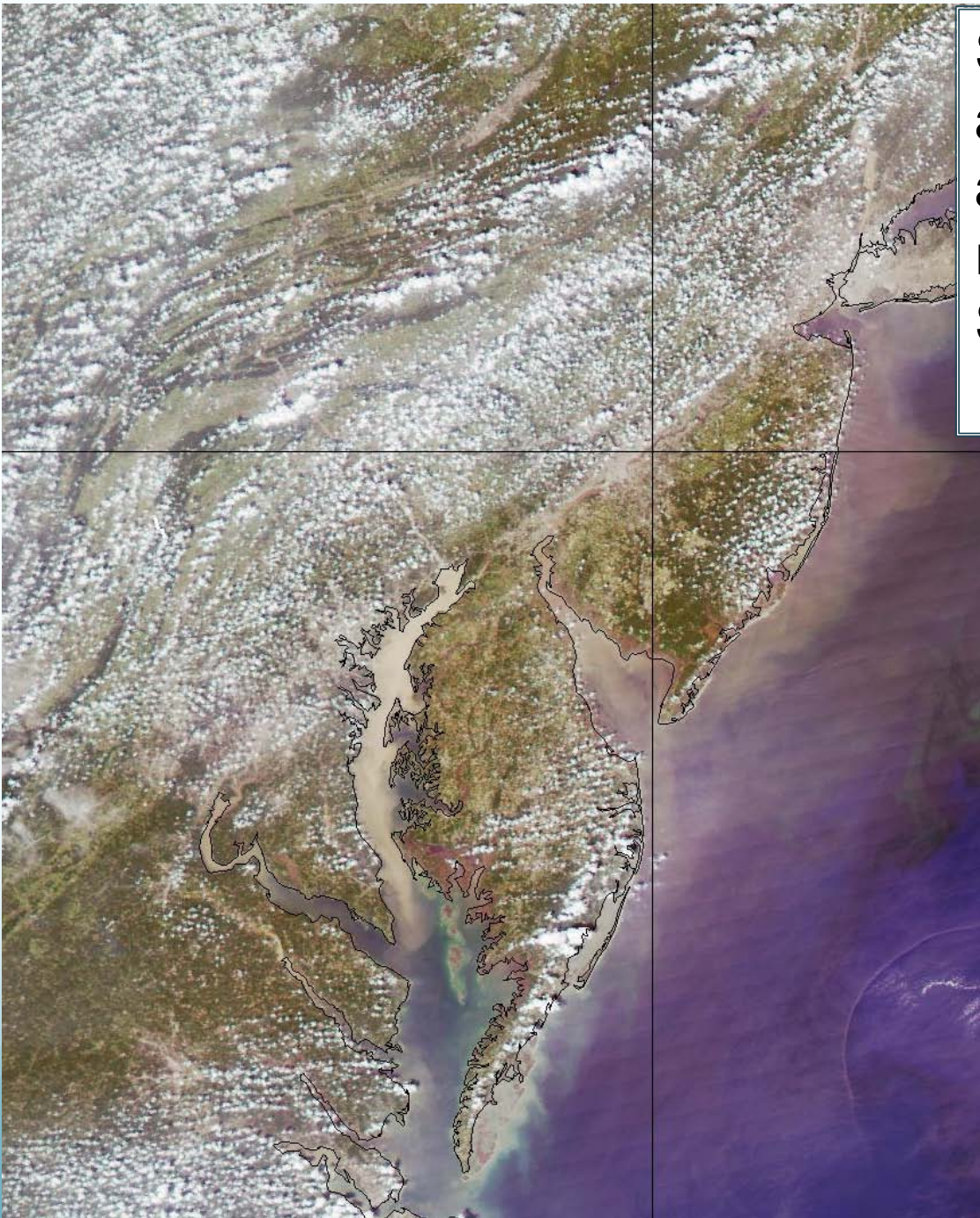
*geosynchronous receiving dish
(Willard Hall, UD Main Campus)*

<http://udsrs.udel.edu>

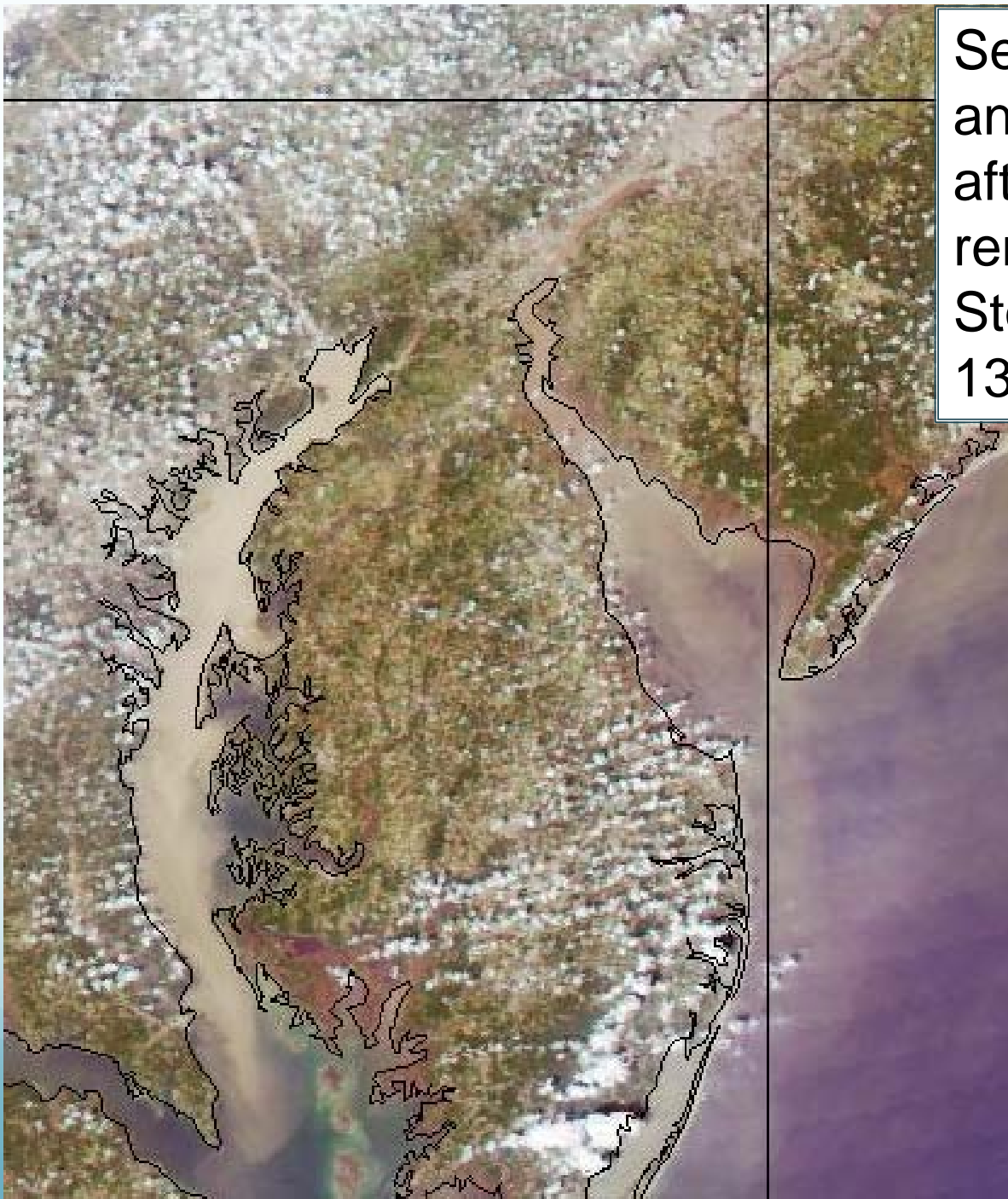
Previously unobserved
nutrient plume along
mid-Atlantic coast
August 2011.



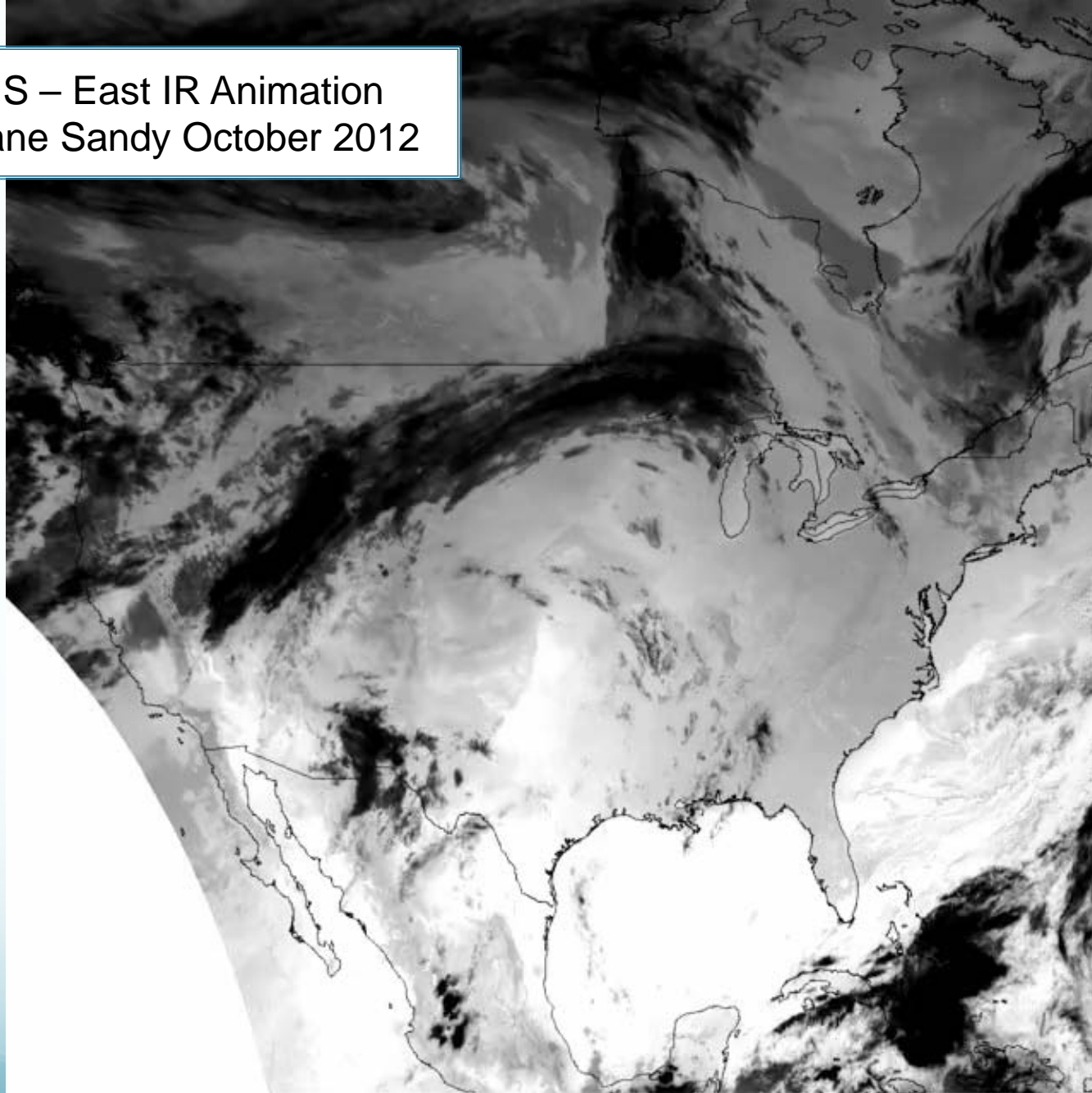
Sediment in Delaware and Chesapeake Bays after flooding from remnants of Tropical Storm Lee, September 13, 2011.



Sediment in Delaware and Chesapeake Bays after flooding from remnants of Tropical Storm Lee, September 13, 2011.

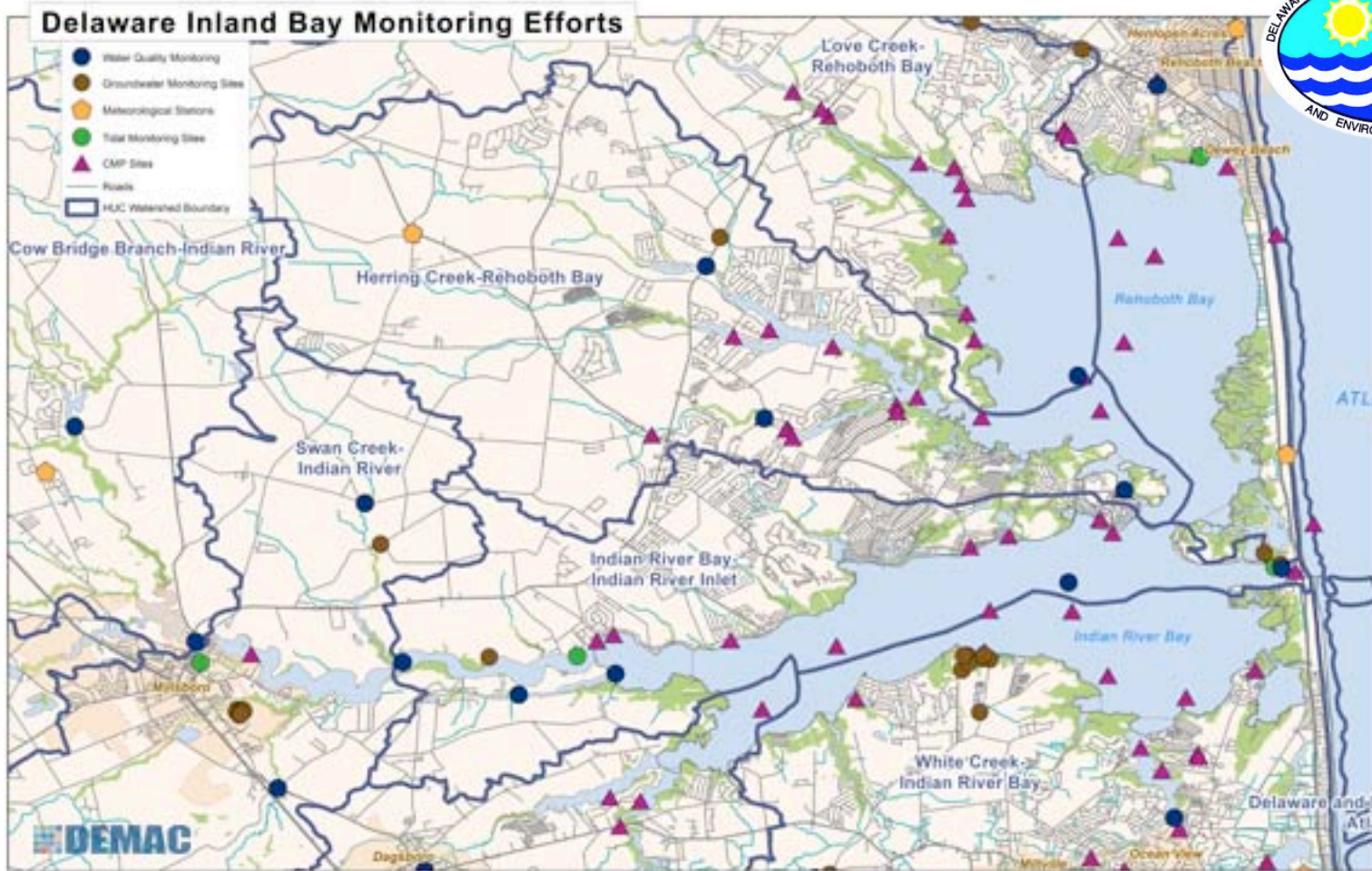


GOES – East IR Animation
Hurricane Sandy October 2012



2012-10-22 00:12 GMT

Development of a Comprehensive Real-Time Water Quality Monitoring Capability for the Delaware Inland Bays





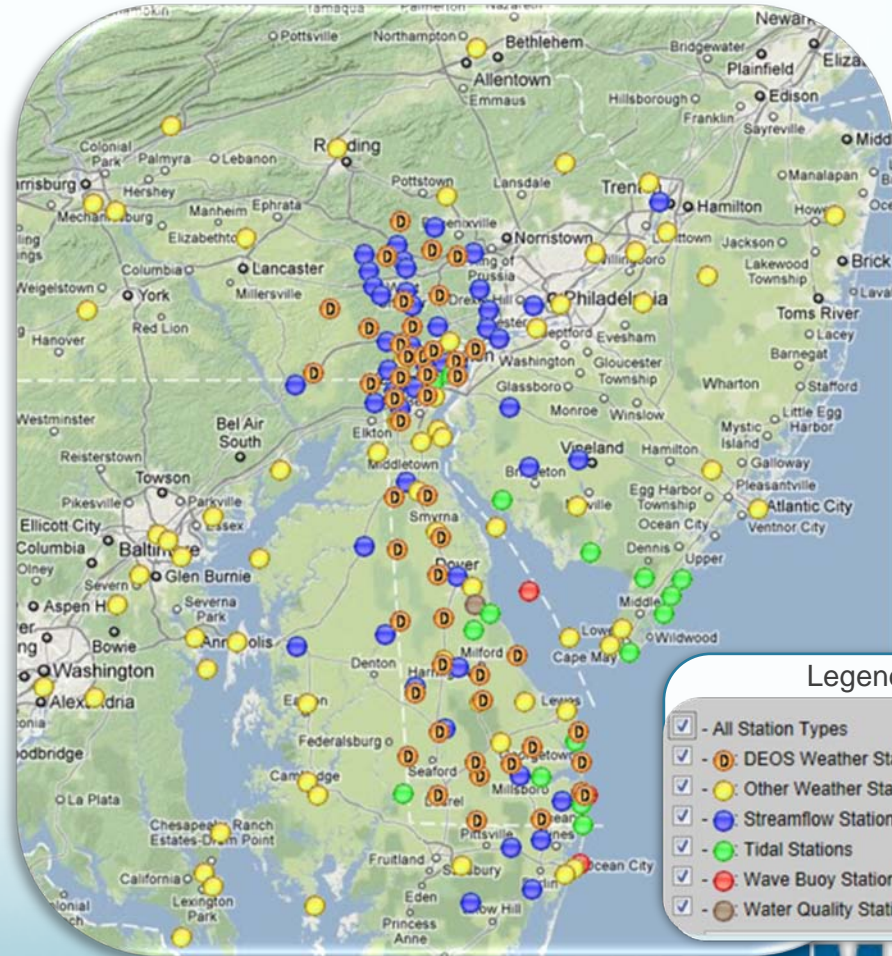
Delaware Environmental Observing System (DEOS)

Receives Real-time Data from ~250 Environmental Sensing Platforms across the Delmarva Region

- Met. Variables
- Stream Flow
- Tidal Data
- Ocean Buoy Data
- Well Levels
- Water Quality
- Snow Depth

50 Core DEOS Mesonet Stations

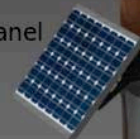
- Meteorological variables (temperature, precip, wind, atmospheric pressure, humidity, solar radiation, soil temperature, soil moisture)



Development of a Comprehensive Real-Time Water Quality Monitoring Capability for the Delaware Inland Bays



Solar Panel



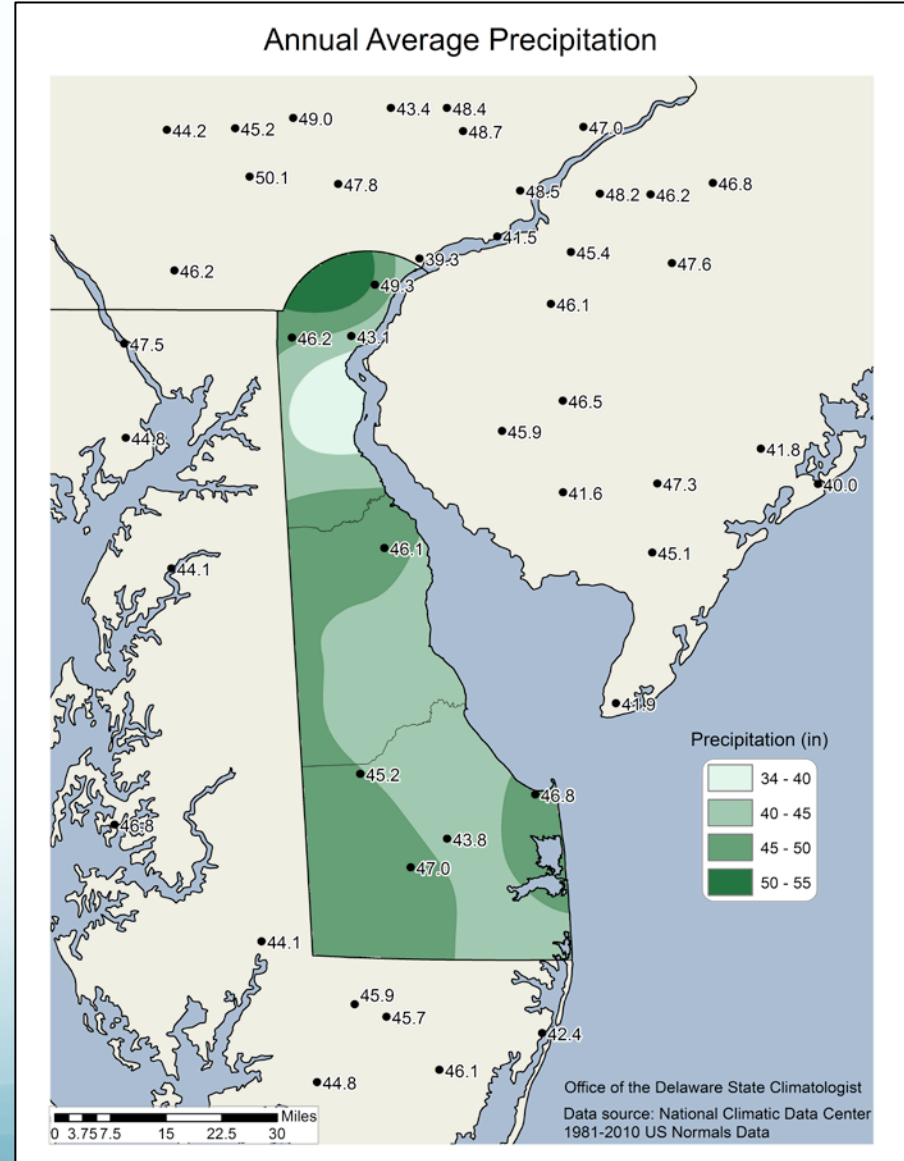
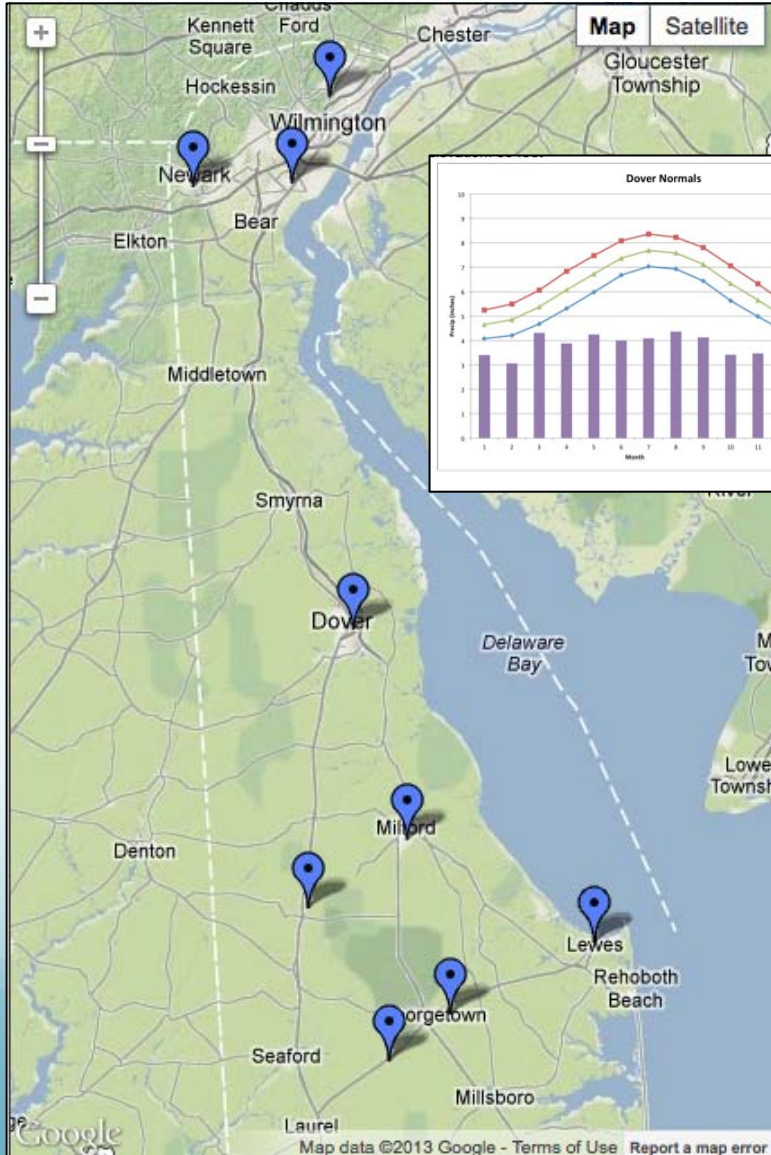
Datalogger
Battery
Communication



Water Quality



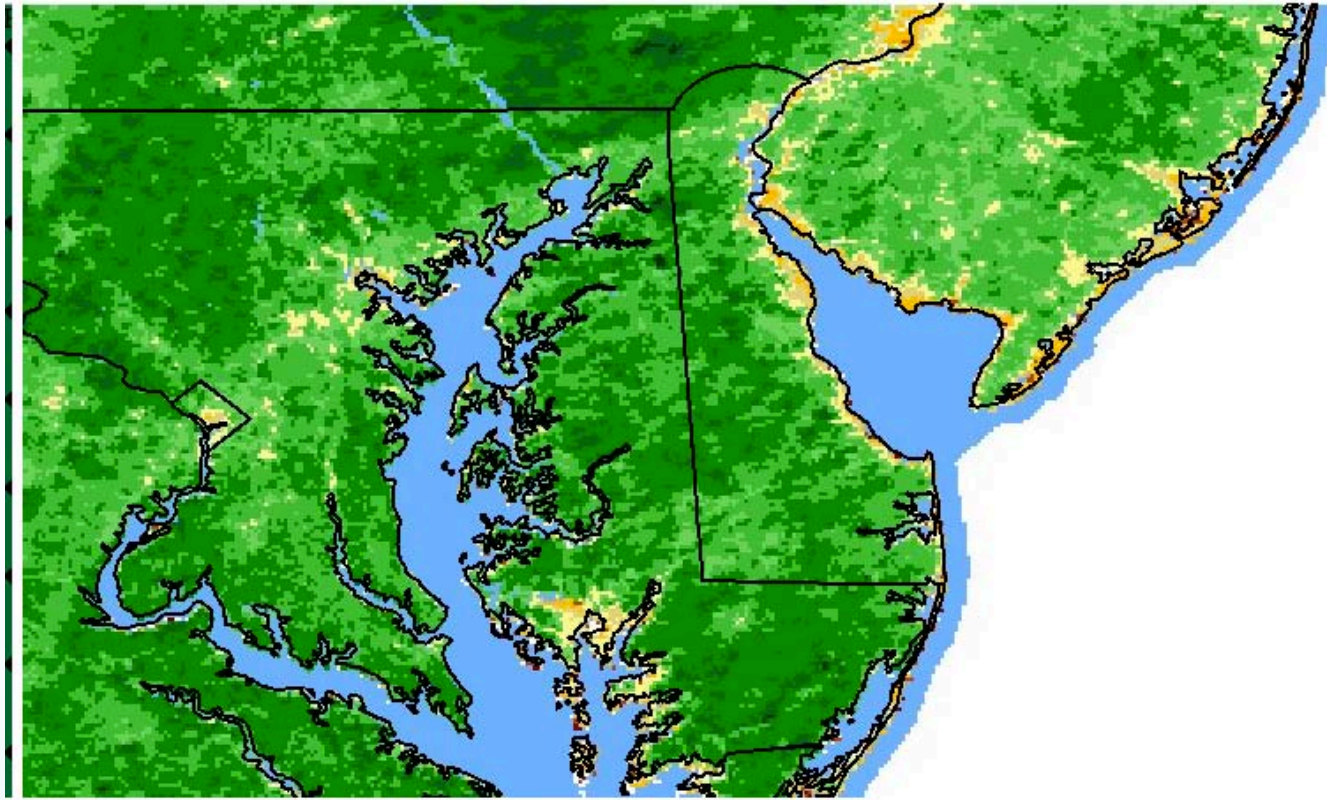
Delaware Climate Normals



Office of the Delaware State Climatologist
 Data source: National Climatic Data Center
 1981-2010 US Normals Data

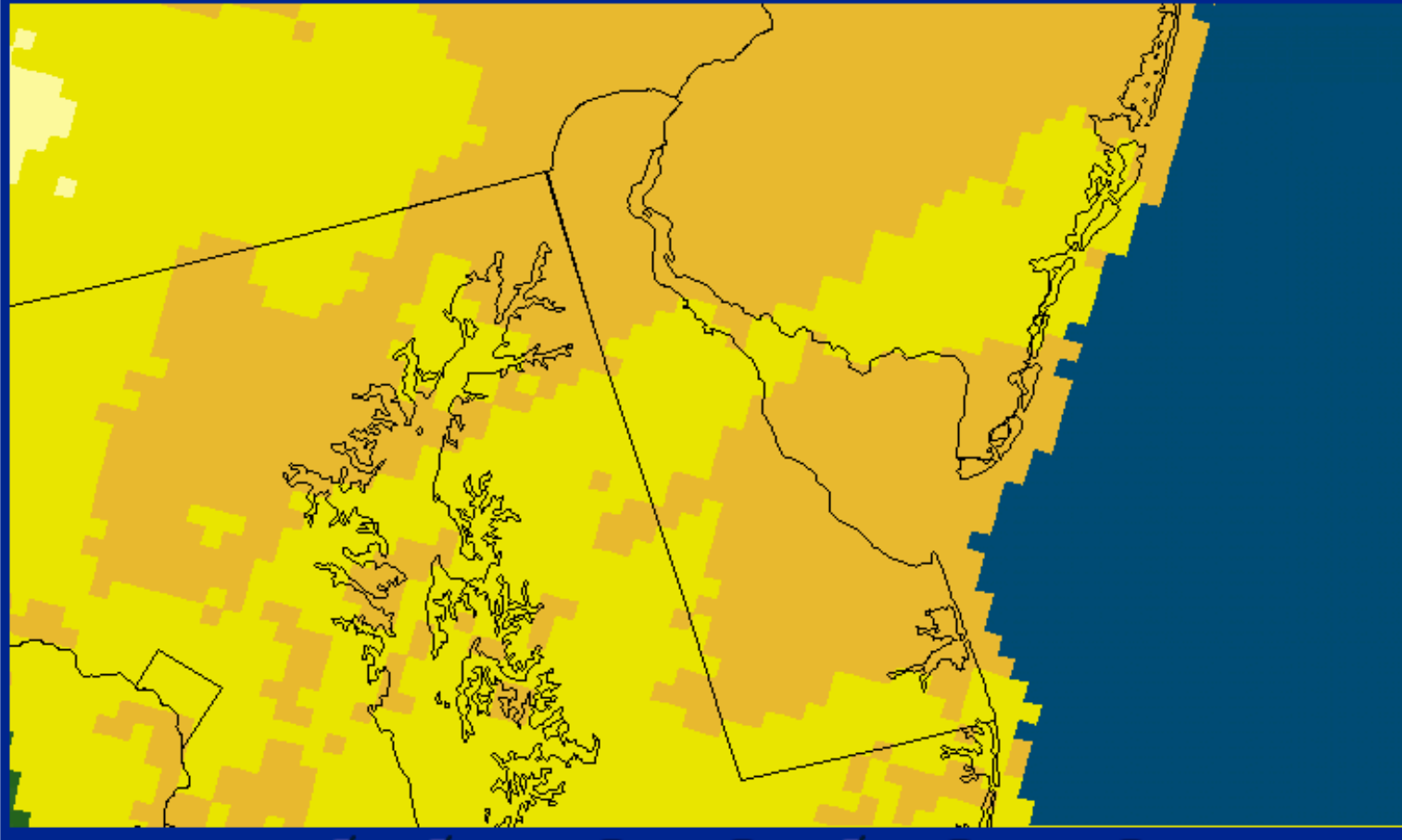
A Future Analysis System

Statewide Water Watch?

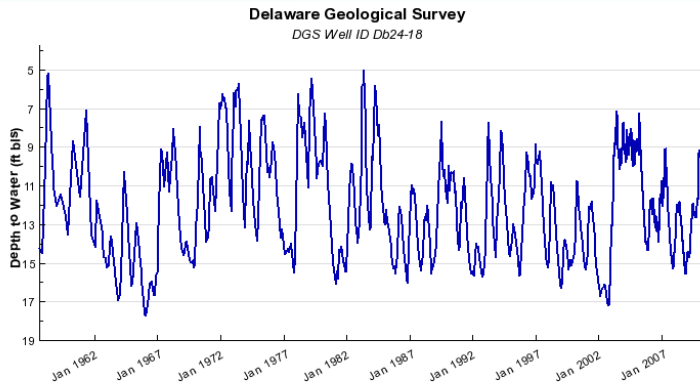


Daily Normalized Difference Vegetation Index (NDVI) available from satellite receiving station. Gives indication of vegetation “health”.

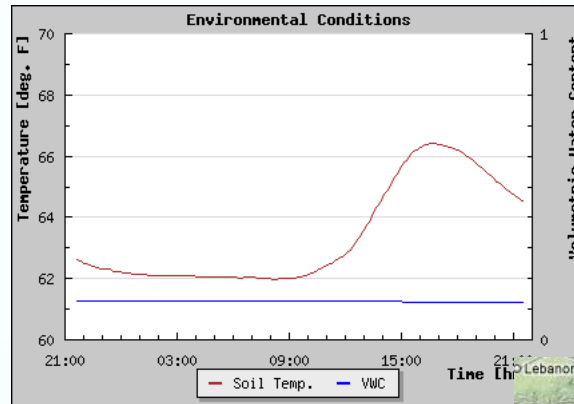
Delaware: Current 60-Day Departure from Normal Precipitation
Valid at 4/16/2012 1200 UTC - Created 4/16/12 14:12 UTC



Radar estimated precipitation available through
National Weather Service feeds.



Created on: March 22, 2010, 11:27 pm



Georgetown, DE-REC Station

ID	DGES	Network	DEOS
City/State	Georgetown/DE	Elevation	45 ft.
Latitude	38° 38' N	Longitude	75° 27' W

Daily Agricultural Statistics for October, 2011

Day	Avg Temp (°F)	Max Temp (°F)	Min Temp (°F)	GDD (base 50 °F)	Avg RH (%)	Max RH (%)	Min RH (%)	Avg Solar (MJ.m ⁻² .day ⁻¹)	Avg Wind Speed (mph)	Rainfall (in)	Ref ET (m.day ⁻¹)	Avg Soil Temp (°F)	Max Soil Temp (°F)	Min Soil Temp (°F)	Avg VWC	Max VWC	Min VWC
1	55.8	62.7	51.0	6.8	83.9	96.5	65.0	12.4	6.7	0.02	0.08	69.1	70.9	66.8	0.153	0.157	0.145
2	49.1	51.2	44.8	0.0	84.8	94.4	71.3	5.3	6.1	0.00	0.05	64.4	66.8	62.4	0.158	0.159	0.157
3	48.5	54.8	40.7	0.0	86.4	95.4	69.0	6.7	2.4	0.01	0.05	62.0	63.5	60.6	0.158	0.159	0.157
4	54.5	65.4	43.4	4.4	80.0	95.4	57.9	15.4	5.3	0.00	0.09	62.5	65.2	59.8	0.156	0.159	0.153
5	60.0	72.2	50.6	11.4	72.4	95.0	38.5	17.6	5.4	0.00	0.13	63.5	67.1	60.7	0.152	0.155	0.149
6	56.0	68.5	44.3	6.4	69.2	94.6	35.4	18.1	3.0	0.00	0.11	63.3	67.4	59.9	0.149	0.152	0.145
7	53.5	69.2	38.8	4.0	75.9	96.6	34.5	17.6	2.3	0.00	0.10	62.1	66.3	58.3	0.146	0.149	0.142
8	56.3	74.3	41.4	7.9	73.6	96.6	32.2	17.2	1.5	0.00	0.09	62.6	67.1	58.6	0.142	0.145	0.138
9	60.5	81.1	43.3	12.2	76.3	97.1	33.9	16.9	1.6	0.00	0.10	63.6	68.5	59.3	0.138	0.142	0.135
10	62.3	80.9	46.1	13.5	77.0	96.8	39.3	13.8	1.5	0.00	0.09	64.5	68.5	60.6	0.135	0.138	0.132
11	63.2	73.0	54.9	13.9	86.6	95.4	61.0	5.7	2.8	0.00	0.06	65.3	66.8	63.6	0.132	0.134	0.131
12	64.8	68.9	61.7	15.3	90.5	96.2	78.1	4.2	4.9	0.06	0.05	66.4	67.5	65.7	0.131	0.131	0.130
13	64.7	78.3	55.1	16.7	90.7	97.6	69.1	6.9	4.3	0.01	0.07	67.9	70.0	66.5	0.129	0.130	0.128
14	64.5	72.7	54.6	13.6	83.2	95.9	61.0	8.3	6.6	0.13	0.09	68.2	69.3	65.6	0.128	0.130	0.127
15	60.4	69.4	49.4	9.4	54.4	87.7	30.0	16.7	8.2	0.01	0.15	63.6	65.6	61.8	0.130	0.132	0.129
16	61.6	69.7	47.8	8.7	49.0	76.2	30.0	15.8	7.6	0.00	0.15	61.9	64.5	59.6	0.129	0.131	0.127

Monthly Agricultural Statistics

Temperature & RH		Soil		Miscellaneous	
Avg Temp (°F)	58.5	Avg Soil Temp (°F)	64.4	Avg Wind Speed (mph)	4.4
Highest Max Temp (°F)	81.1 (9th)	Highest Max Soil Temp (°F)	70.9 (1st)	Avg Solar (MJ.m ⁻²)	198.7
Lowest Min Temp (°F)	38.8 (7th)	Lowest Min Soil Temp (°F)	58.3 (7th)	Rainfall (in)	0.24
Avg RH (%)	77.1	Avg VWC	0.142	Monthly GDD (base 50 °F)	144.3
		Highest Max VWC	0.159 (3rd)	YTD GDD (base 50 °F)	3909.6
		Lowest Min VWC	0.127 (16th)	Monthly Ref ET (mm)	37.0
				YTD Ref ET (mm)	972.3



U.S. Drought Monitor

Northeast

April 10, 2012

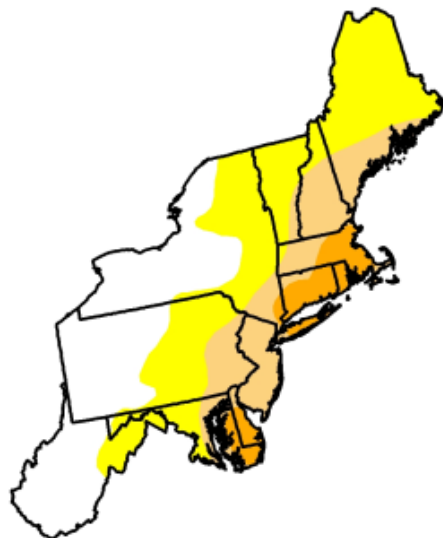
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	33.88	66.12	27.68	7.35	0.00	0.00
Last Week (04/03/2012 map)	36.11	63.89	9.87	0.00	0.00	0.00
3 Months Ago (01/10/2012 map)	96.35	3.65	0.00	0.00	0.00	0.00
Start of Calendar Year (12/27/2011 map)	96.69	3.31	0.00	0.00	0.00	0.00
Start of Water Year (09/27/2011 map)	97.24	2.76	0.00	0.00	0.00	0.00
One Year Ago (04/05/2011 map)	99.70	0.30	0.00	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional



The proposed system will have a much higher spatial and temporal resolution than the system currently in use for most drought monitoring applications.

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu>



Released Thursday, April 12, 2012
David Miskus, NOAA/NWS/NCEP/CPC



Operational Uses:

- emergency management
- agriculture (drought, irrigation scheduling, poultry mortality, etc.)
- natural resource monitoring (nutrient fluxes, water supply, air quality, etc.)
- transportation

Basic and Applied Science Questions:

- detailed watershed analysis (water balance, nutrient fluxes, etc.)
- meteorological studies (observational and modeling)
- agricultural studies
- ecosystem health (Inland Bays, Delaware Bay, watersheds)
- critical zone science
- climate variation and change
- data integration methodologies

Other Planned Work

- Gage-calibrated Radar Product
- Evapotranspiration Product

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<http://demac.udel.edu>

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