2012 Delaware Wetlands Conferences

Applications of Multi-Altitude Aerial Platform as Wetland Observing System

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Outline

What are the observing systems?

- Satellites observations through Satellite Receivig Stations of the CEOE, UD
  - Polar orbit and geostationary

- New Air-borne Remote Sensing Platform
  - Polar orbit and geostationary

Why have a Receiving Station?

- Real-Time access to data
  - Output Level-3/4 products are available within 15 minutes of satellite pass
- Algorithm Development
  - Access to raw/real-time data allows for custom algorithm development/improvements
- Assist Emergency Responders
  - Similar stations are running in Antarctica

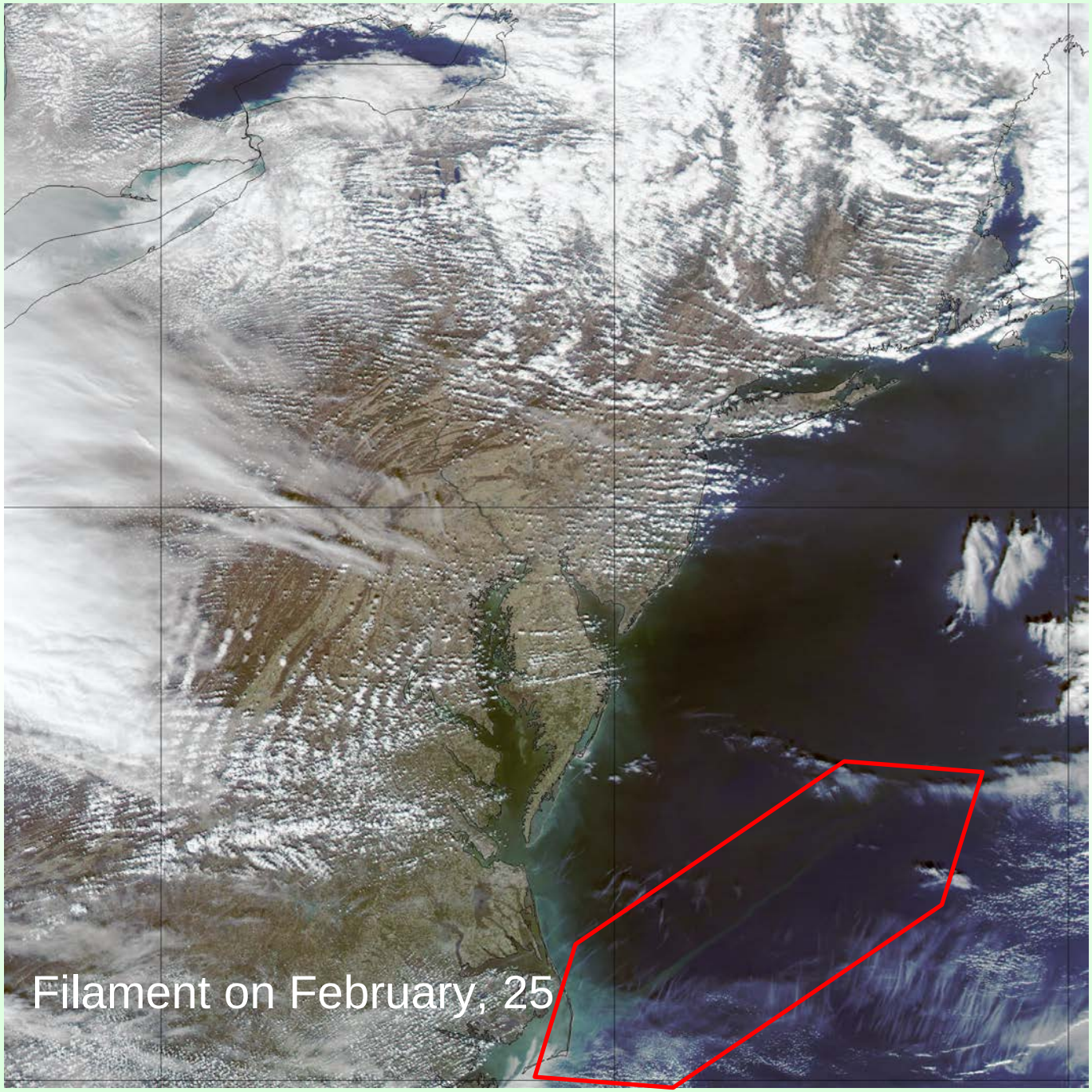
What makes up a receiving station?

Station consists of a 2.4M X/L band antenna and 4.3M Geostationary Antenna

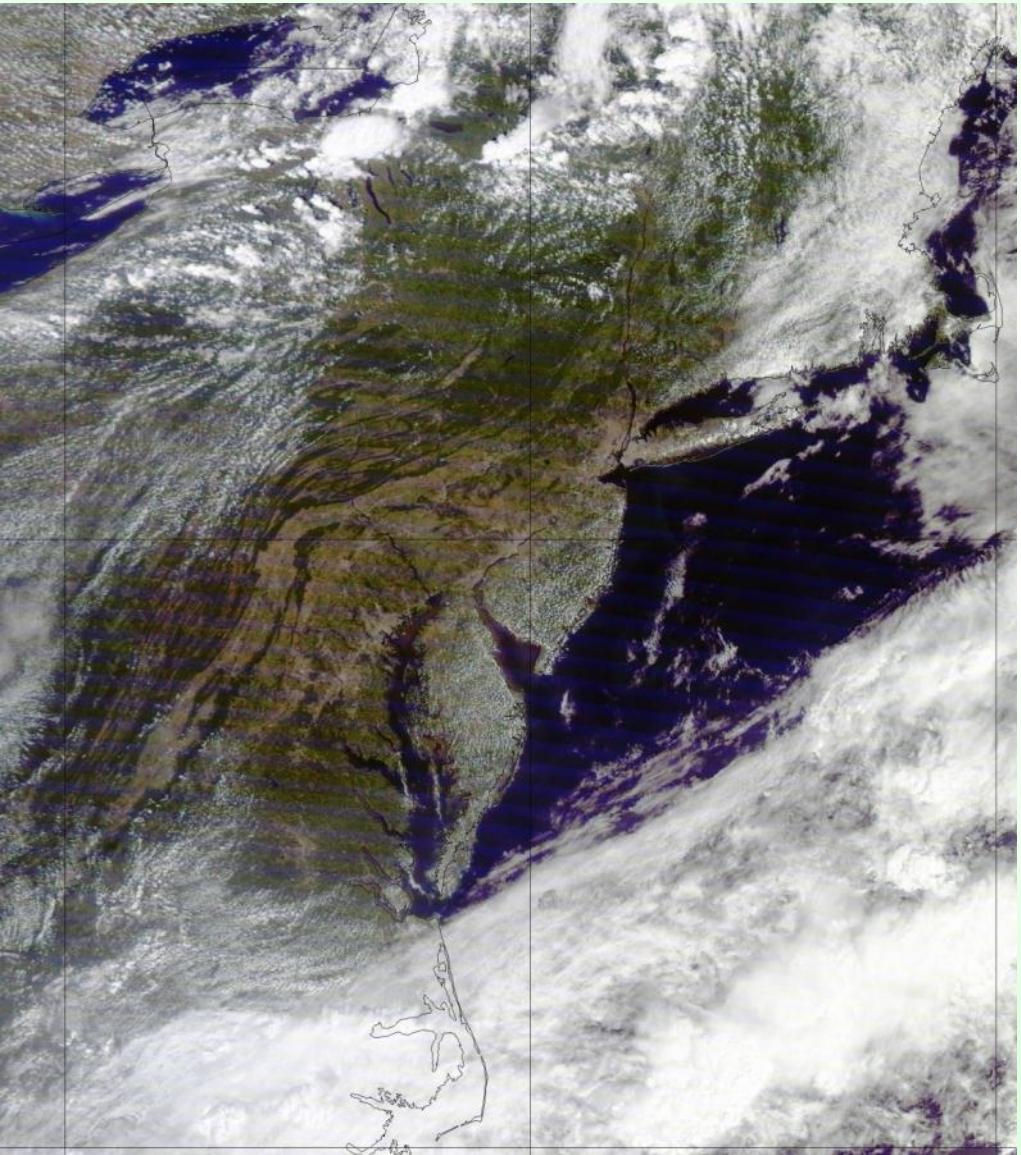
- Modis Aqua and Modis Terra
- Noaa-16, 18, 19, Metop, FY1-D
- GOES

Station Hardware

- Acquisition is handled by a TeraScan acquisition computer
- Processing is done by a TeraScan Rapid Acquisition Modis Processing System
- Data is archived to 16Tb NAS system

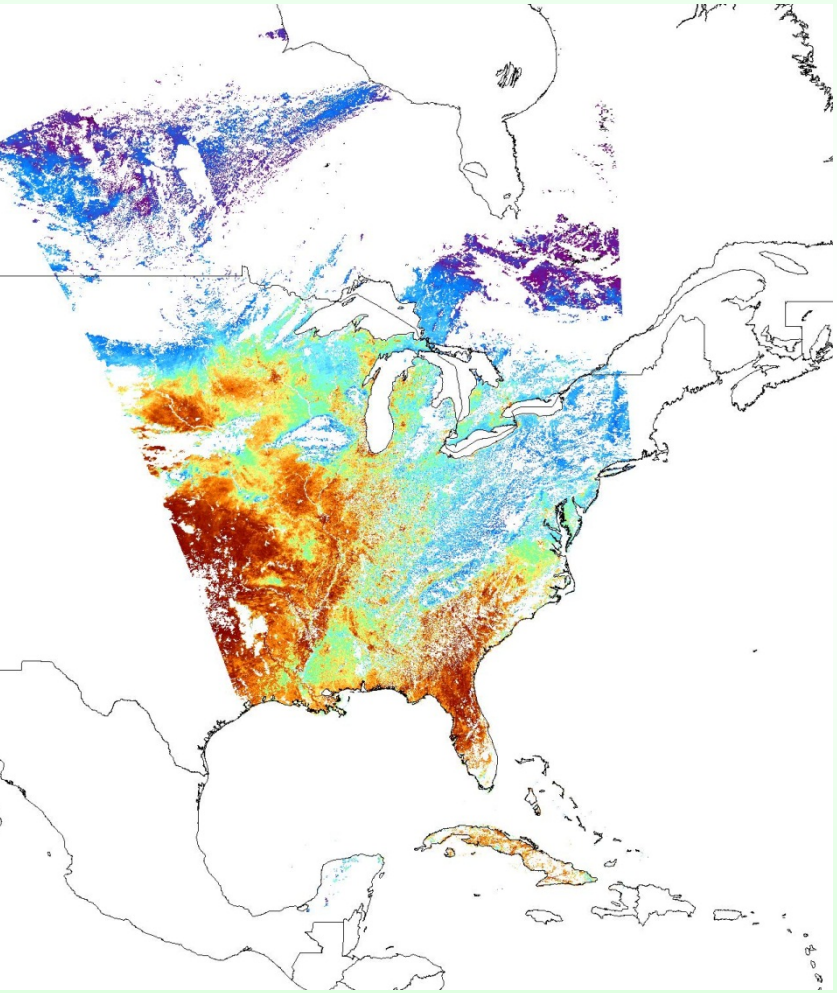

Filament on February, 25

Modis/AVHRR Data Ingest and Processing

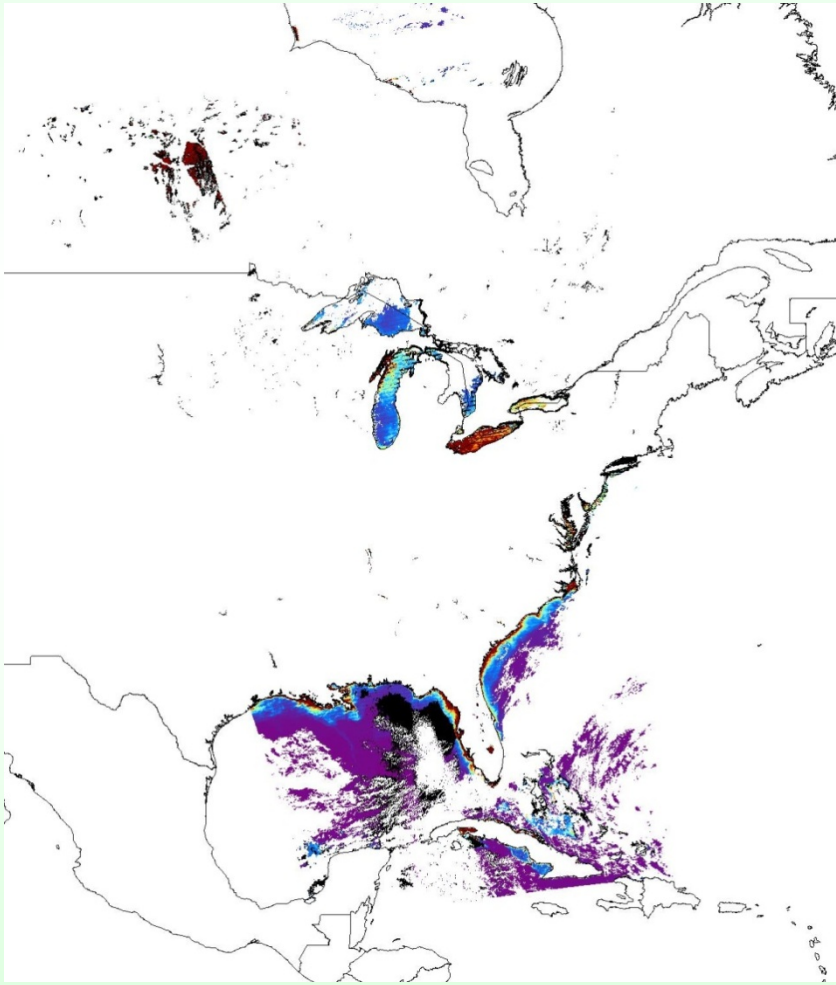


- Modis/AVHRR satellites are within view of receiving station for less than 15 minutes.
- Raw satellite data is captured and saved to disk.
- After satellite “pass” is completed the raw data is transferred to a processing server.

LST
2011-09-12

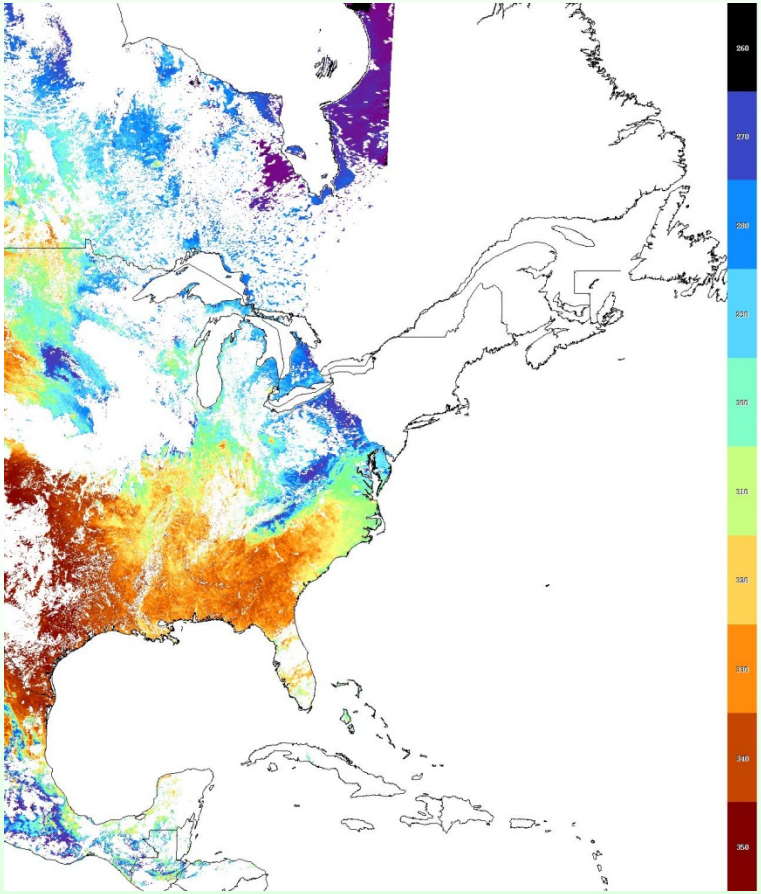


Chlor_a
2011-09-12



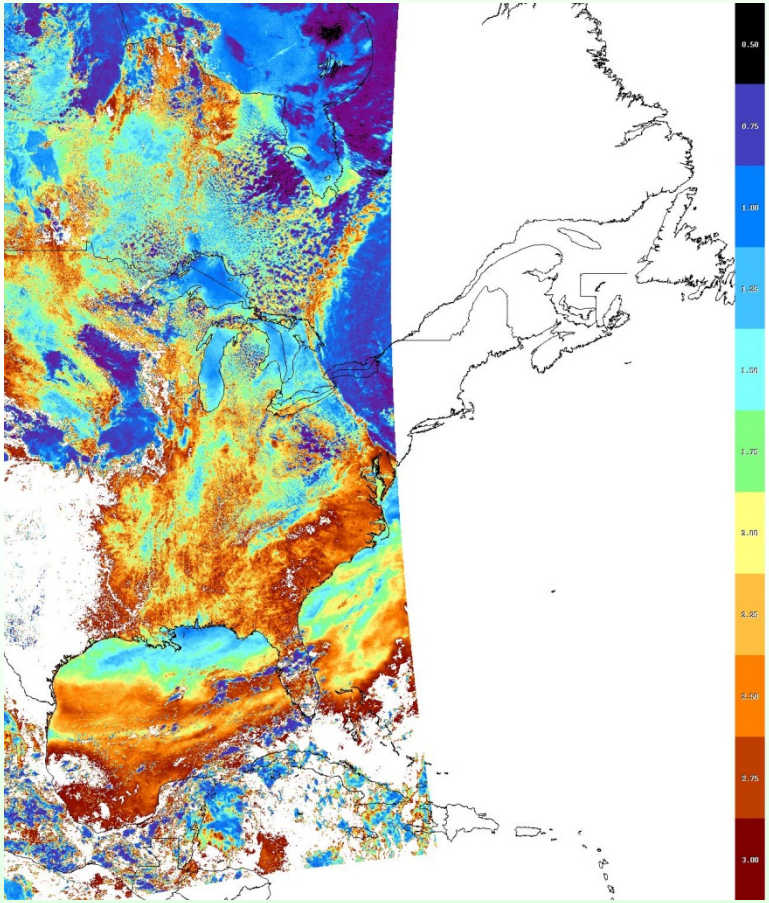
LST (NOAA)

2011-08-28

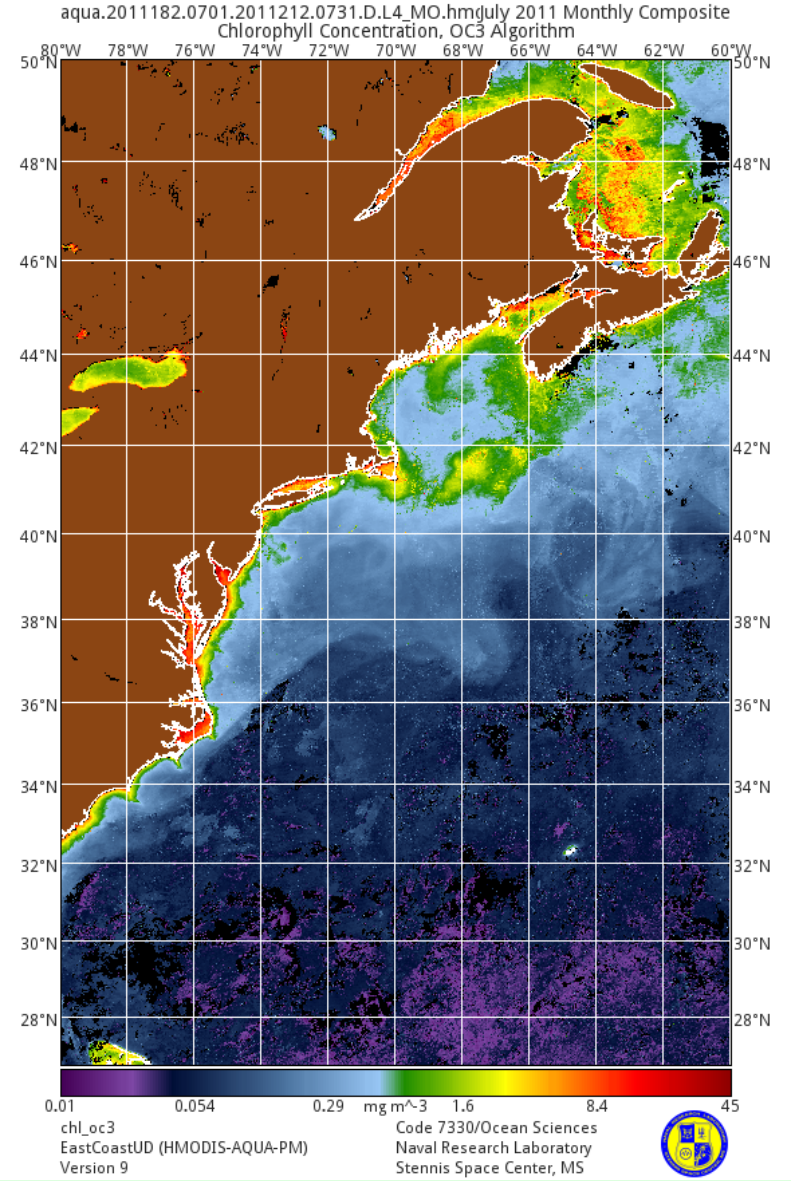


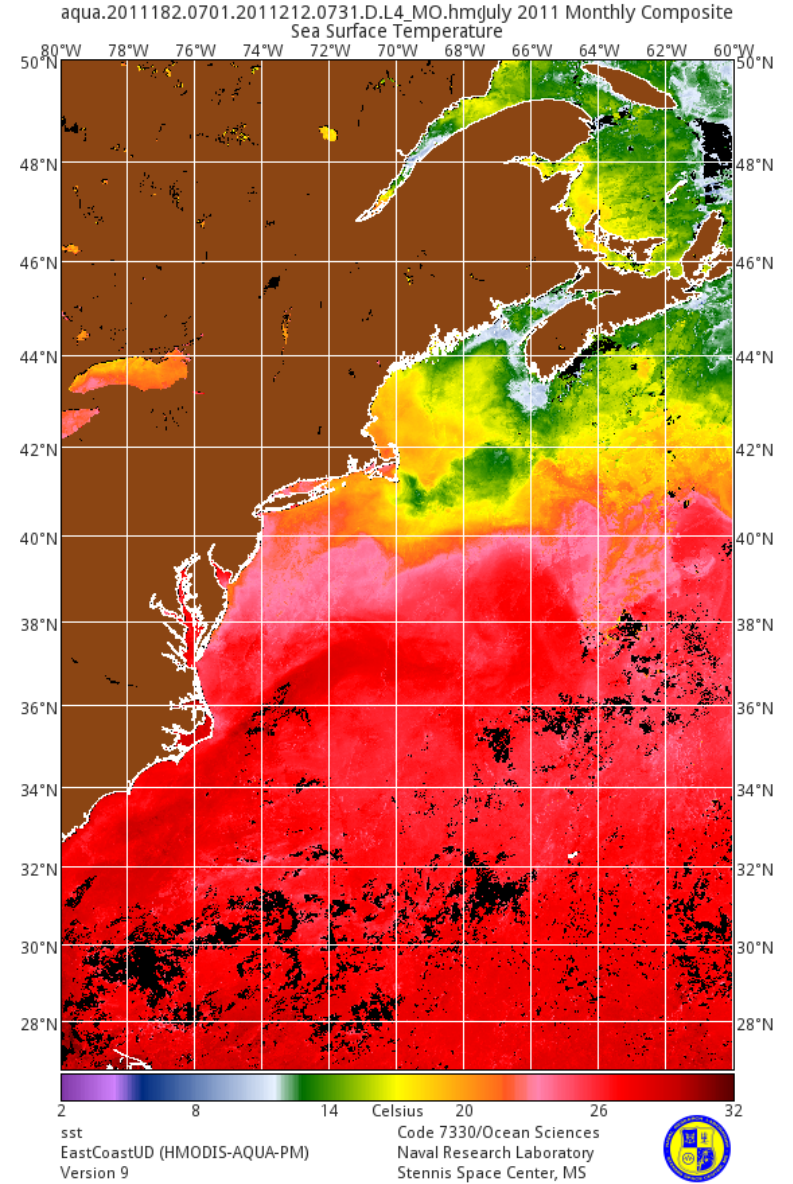
Water Vapor(NOAA)

2011-08-28



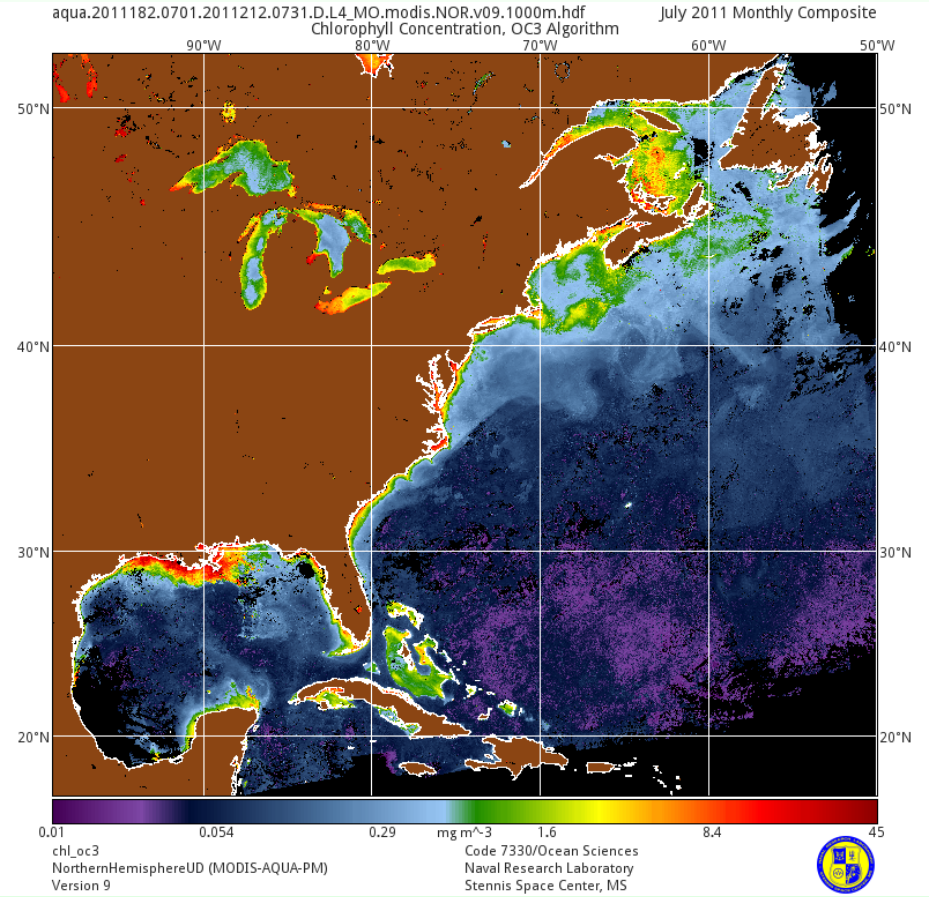
250M Chla and SST From APS Monthly Average for July

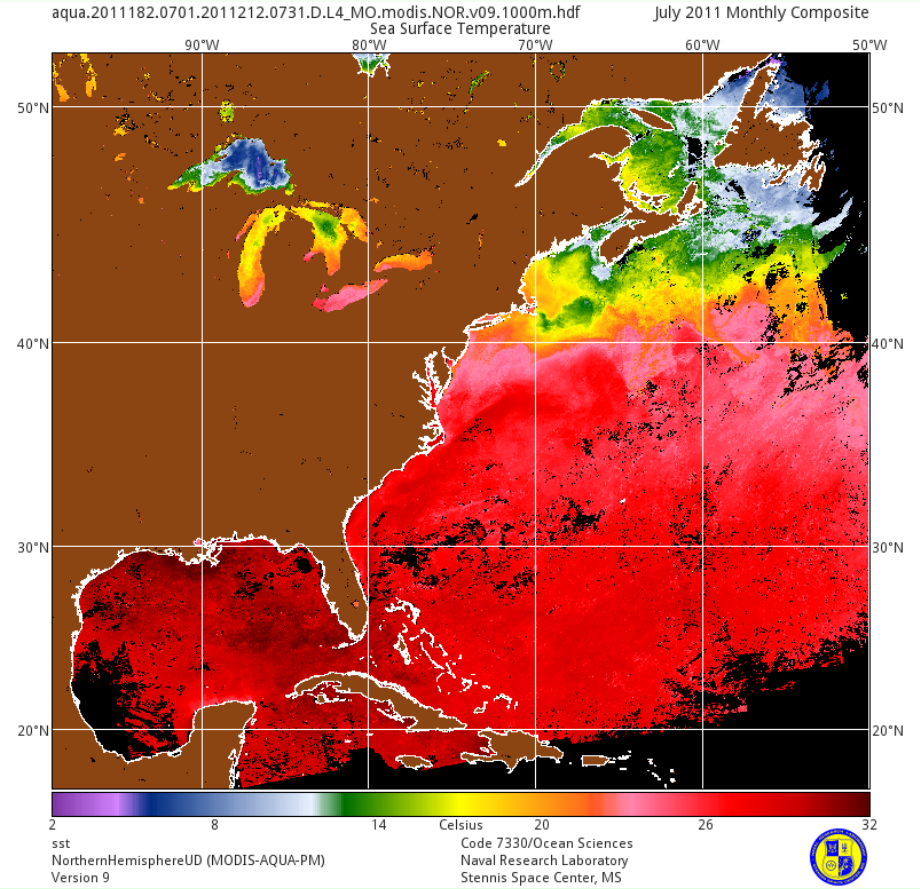




1km Chla and SST

Monthly Average for July

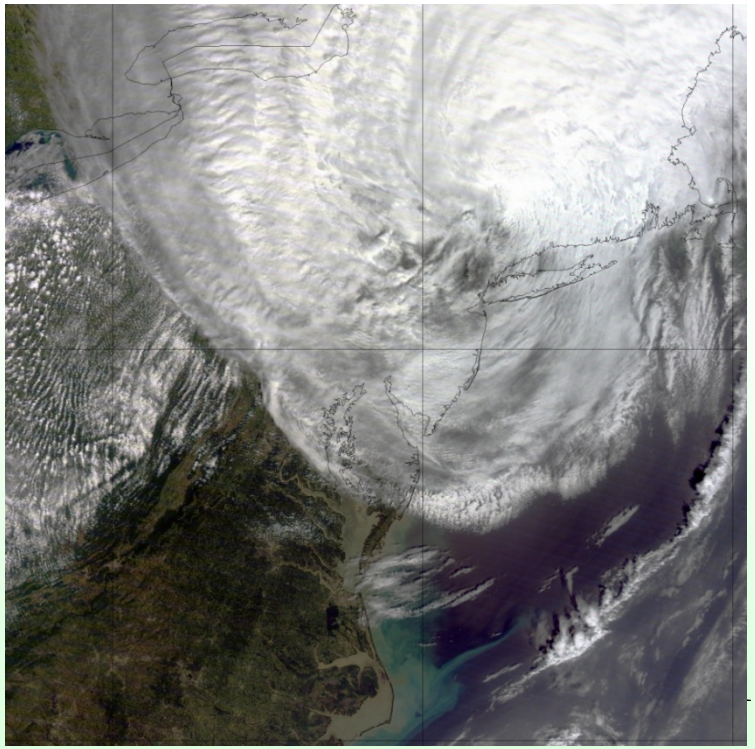




Data Visualization

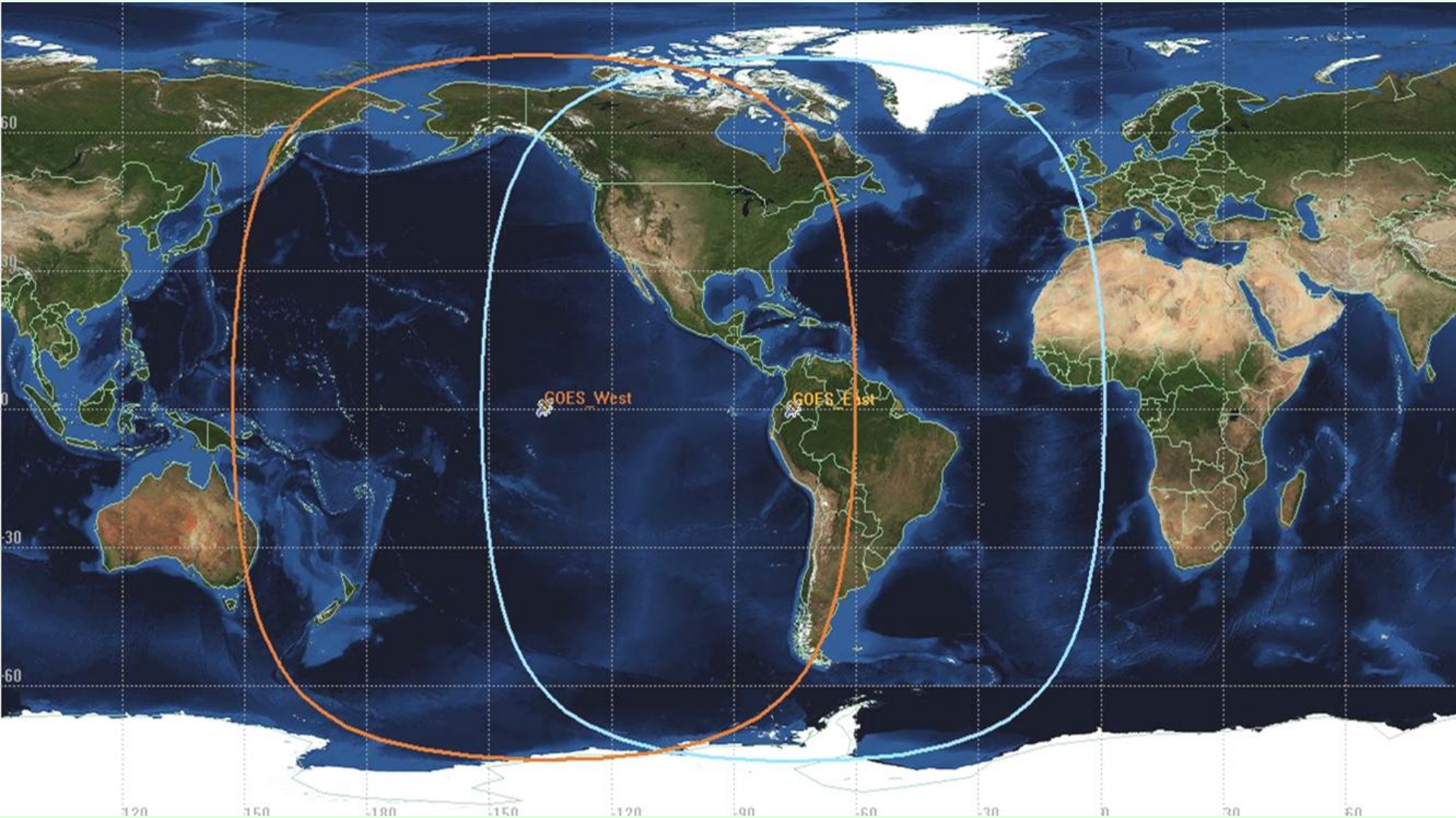
www.udel.edu/CRS

- Our scientists also use the datasets (in HDF/NetCDF format) to create Google Earth KMZ files for data visualization
  - East Coast
  - World Chlorophyll
  - World SST
- Modis KMZ Files



Geostationary Antenna

GOES Visible Areas



Geostationary Data Ingest

- Geostationary antenna is locked on to GOES-13 (GOES-EAST)
- Data is continuously acquired from satellite
- Several different scan sectors are available from Continental US to Full Globe
- Pass lasts between 5 and 30 minutes

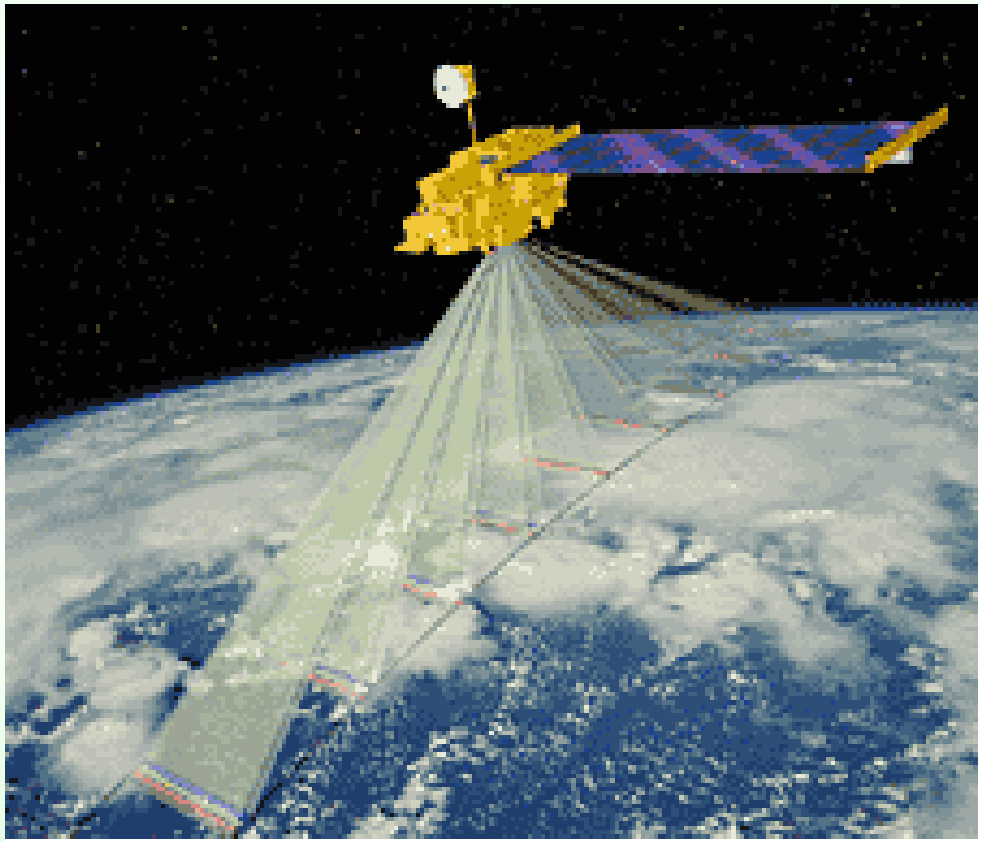
Geostationary Processing

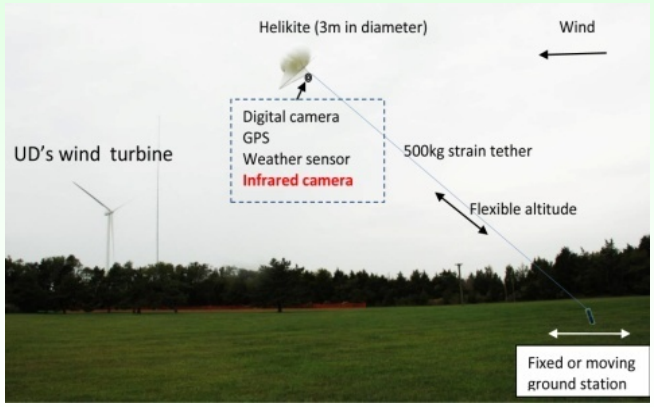
- Mainly used for Atmospheric products
  - Clouds
  - Water Vapor
  - Visible/IR Channels
- Can also handle SST

Geostationary Animations

- Datasets are also used to create animations of the days conditions
- Daily Animation
- 3 Hour Visible Animation
- 6 Hour IR Channel

Why air-borne Remote Sensing





	Aerostat	**Helikite Aerial Platform (HAP)**	**UAV**
Volume	1800m^3 (514 Helium Tanks)	7m^3 (2 Helium Tanks)	NA
Length	32m	3m	~3m wing
Duration	15days	30days	< 6 hours
Payload	225kg	10kg	20kg

Air-borne Remote Sensing

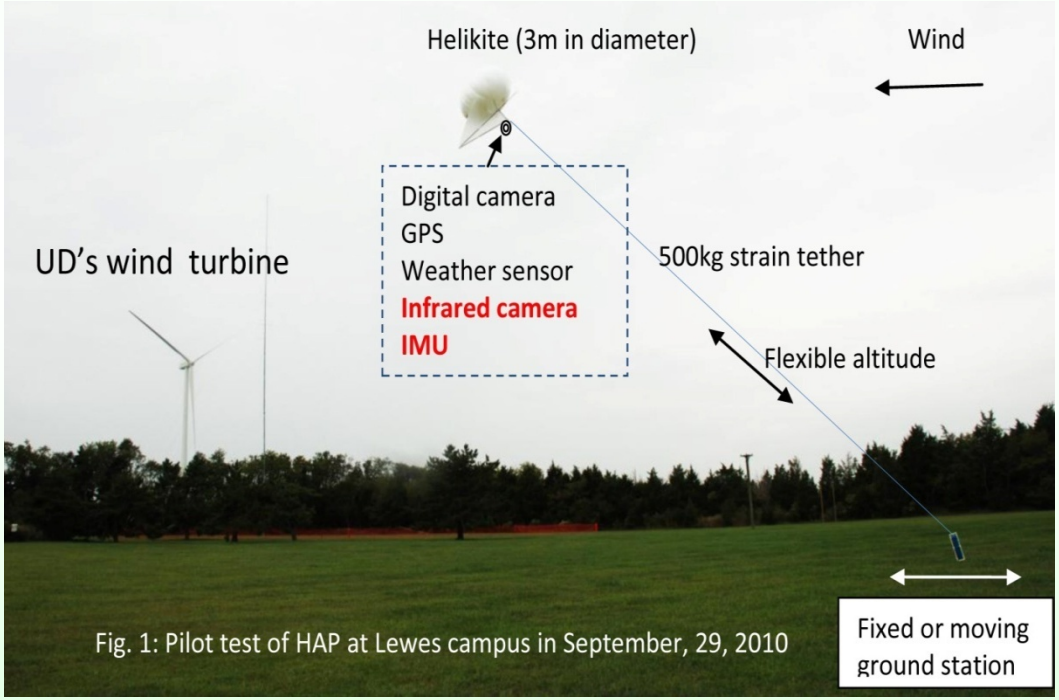


Fig. 1: Pilot test of HAP at Lewes campus in September, 29, 2010

Jo and Yan, 2011, Patent

Plumes between 10 sec

Bay
water I

Bay
water II

Bay water III

Images: http://128.175.74.246/helikite/

UD agriculture Farm

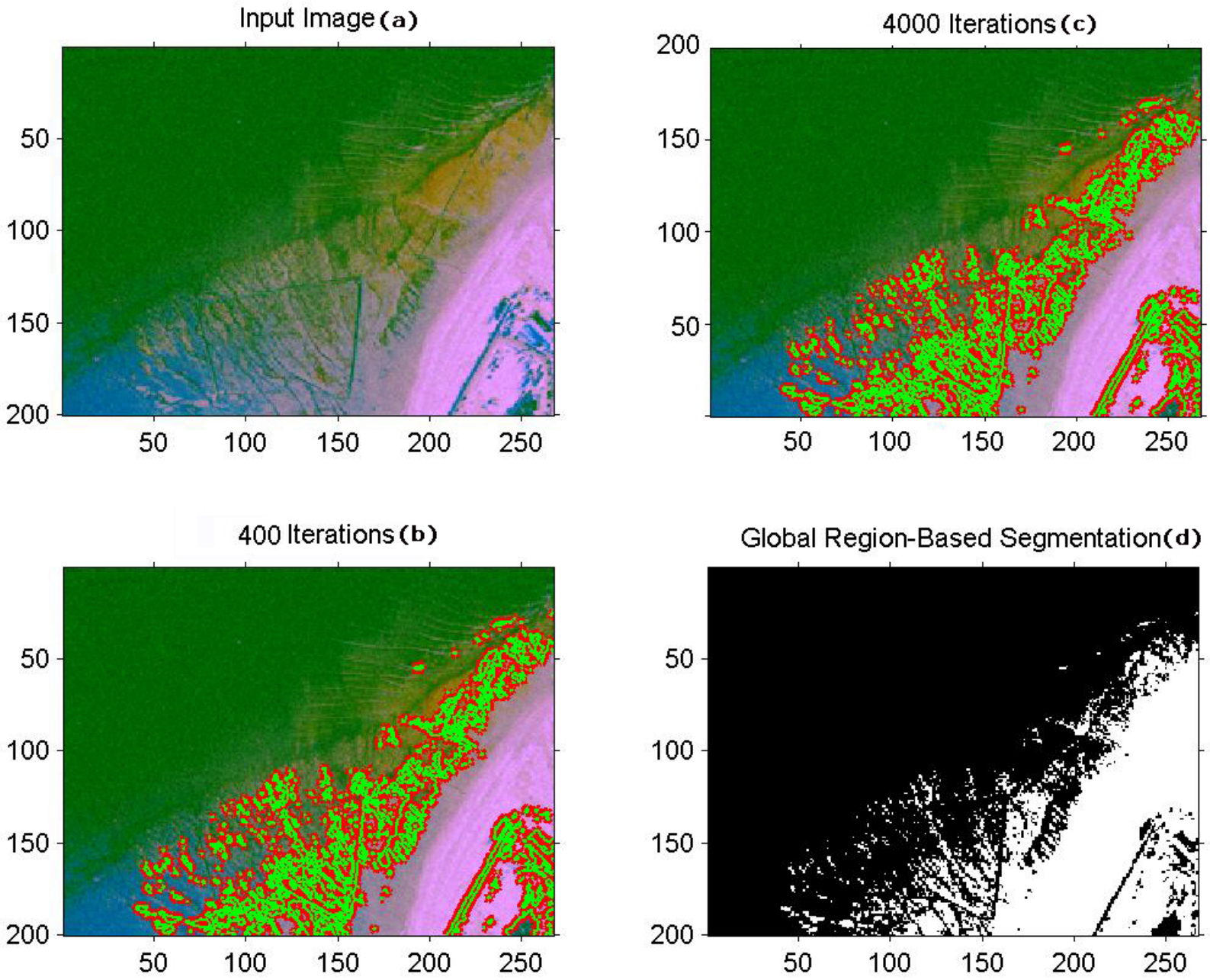
Bay water IV

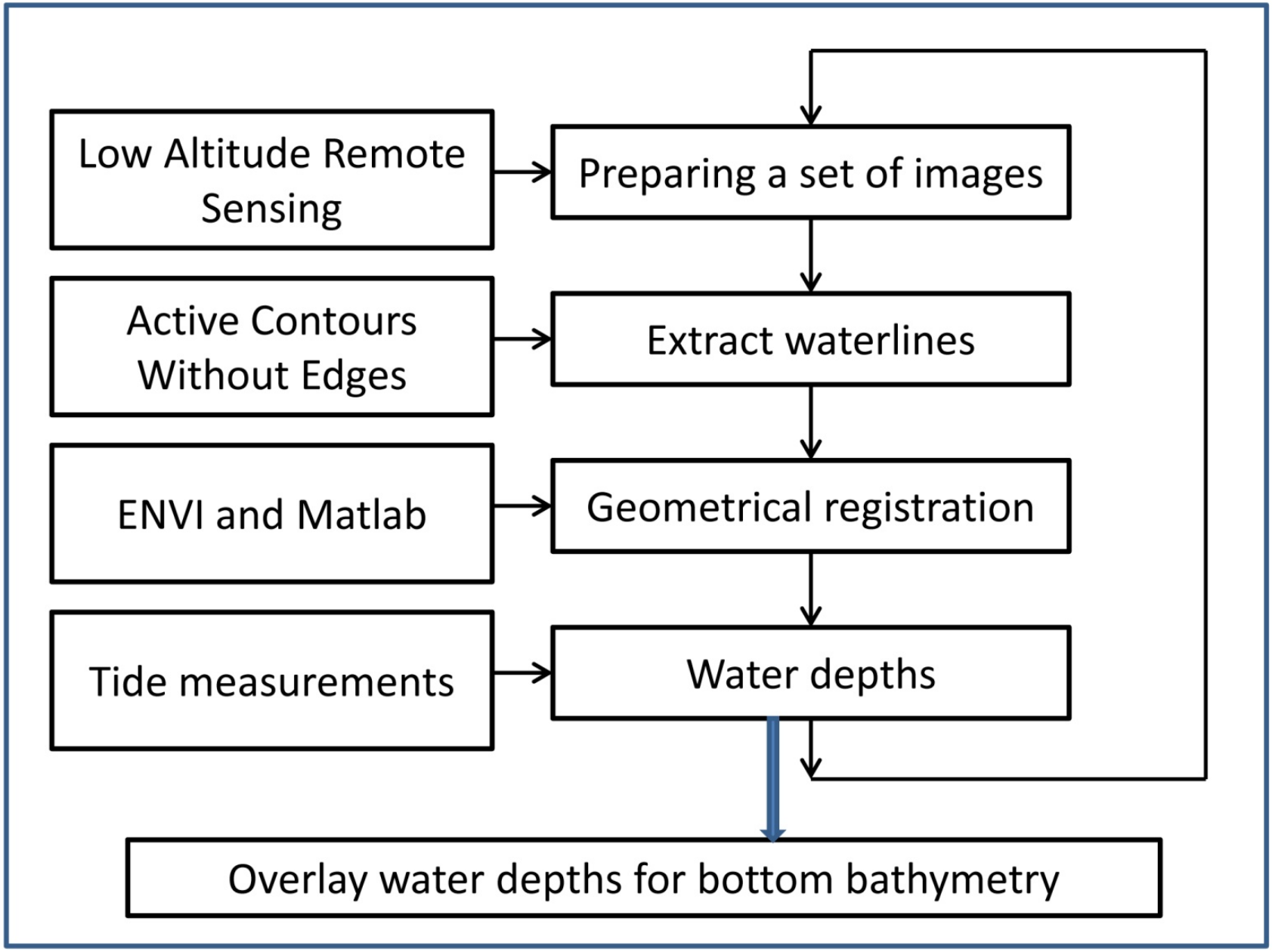
Active Contours Without Edges (ACWE) developed by Chan and Vese

$$F(c) = \int_{incide(c)} |u_0(x,y) - c_1|^2 dxdy + \int_{outside(c)} |u_0(x,y) - c_2|^2 dxdy$$

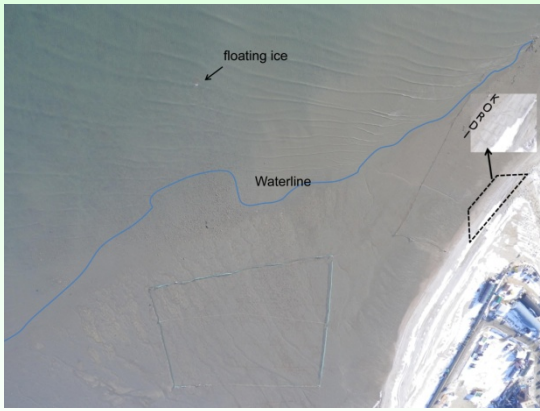
$$\phi(x,y) = \begin{bmatrix} 0 & \text{if (x,y) is on the curve} \\ <0 & \text{if (x,y) is inside the curve} \\ >0 & \text{if (x,y) is outside the curve} \end{bmatrix}$$

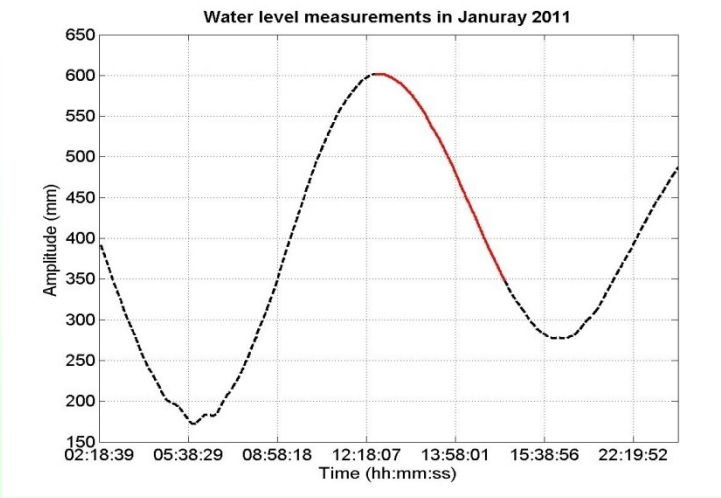
$$\frac{\partial \phi}{\partial t} = \left[\mu div\left(\frac{\Delta \phi}{|\Delta \phi|} \right) - \left(\lambda_1 (u_0 - c_1)^2 + \left(\lambda_2 (u_0 - c_2)^2 \right. \right. \right]$$

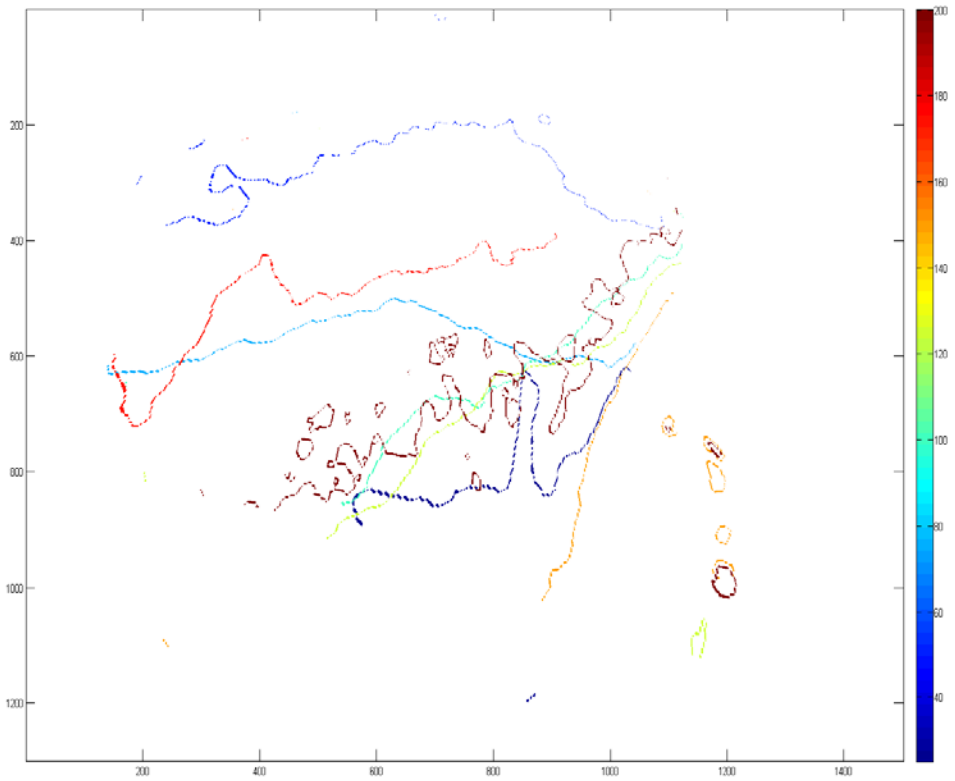

Input Image (a)
4000 Iterations (c)
400 Iterations (b)
Global Region-Based Segmentation (d)
50
100
150
200
250


Low Altitude Remote Sensing
Active Contours Without Edges
ENVI and Matlab
Tide measurements
Preparing a set of images
Extract waterlines
Geometrical registration
Water depths
Overlay water depths for bottom bathymetry

Waterlines and Bathymetry







Why right tools

- Monitoring (long-term) process
  - Events, Phenomena, or trends
- Analyzing changes due to ...
- Assessing changes
- Predicting changes

- For that, we need to know environmental processes in the system

Applications
Anytime, Anywhere, and any resolutions (AAA)

- Plumes
- Ground water seepage
- Mapping bottom bathymetry
- Invasive species
- Pollutant include oil spill
- Oyster bed, water and air quality
- SAV: Submerged Aquatic Vegetation

And rip current, fish, birds, etc.

And hands on experiments

Thank you!

Questions for Jo

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