Calibration and Validation of Ocean Color in Coastal Waters

Ocean Color Meeting
Washington DC April 2004

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NRL

Issues in coastal waters –

-Optically Complex waters

-– Need for separating the Chlorophyll, CDOM , Detritus, Organic Inorganic particles etc .

- Spatial variability in coastal waters
  - coherence length is much shorter
  - spatial sampling – requires adaptive sampling
  - concerns regarding sampling the same water mass

- Bottom reflectance contamination

-Coastal aerosols (atmospheric correction)

-Vertical Subsurface structure

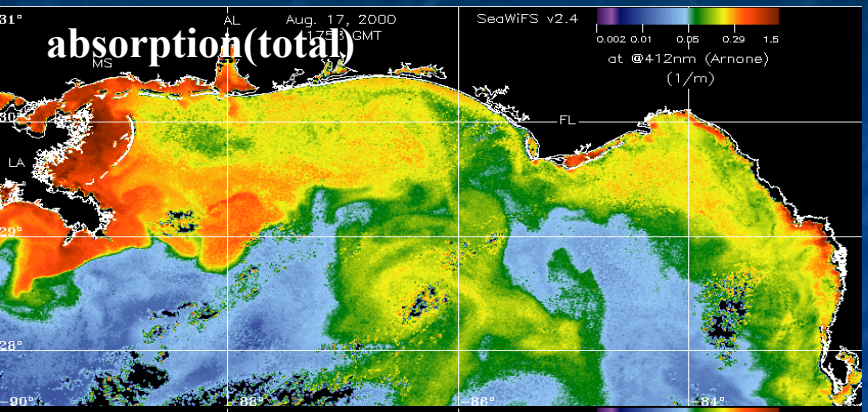
Surface signature is not coupled with profile.

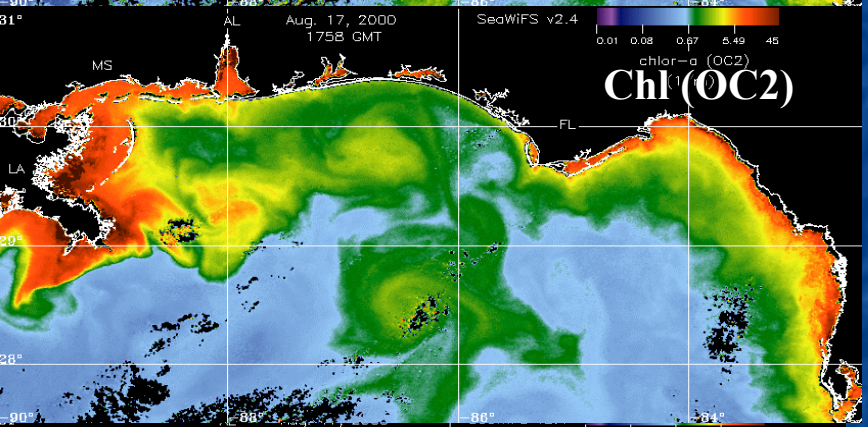
-Hyperspectral in the near future.

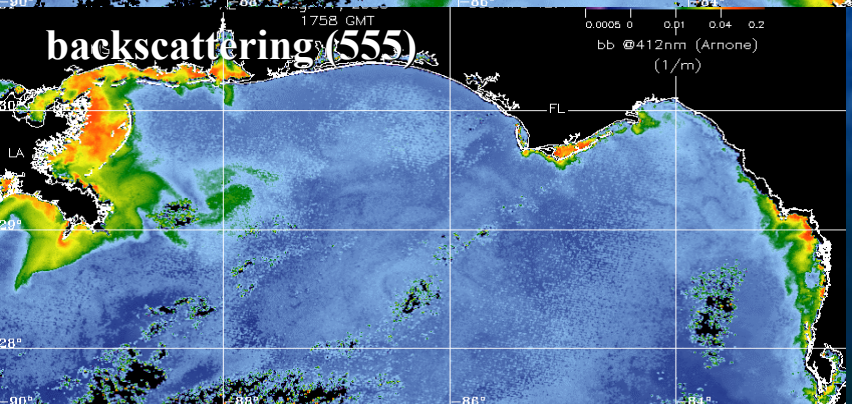
-Stronger color signatures,

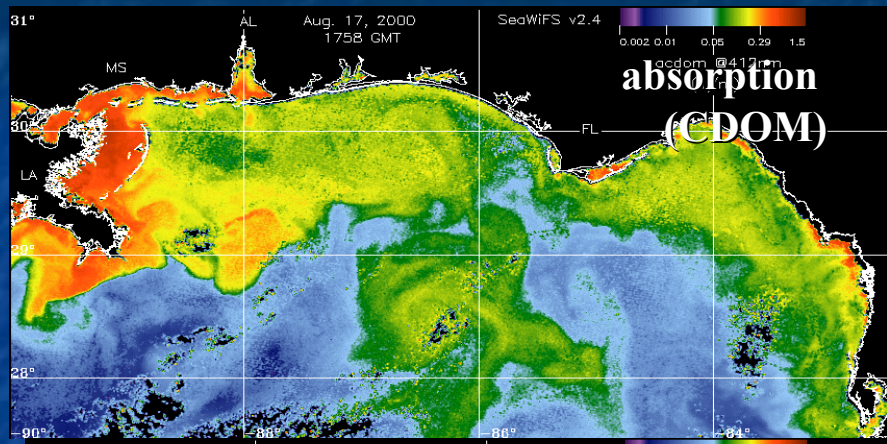
- strong absorption in blue requires increased sensitivity

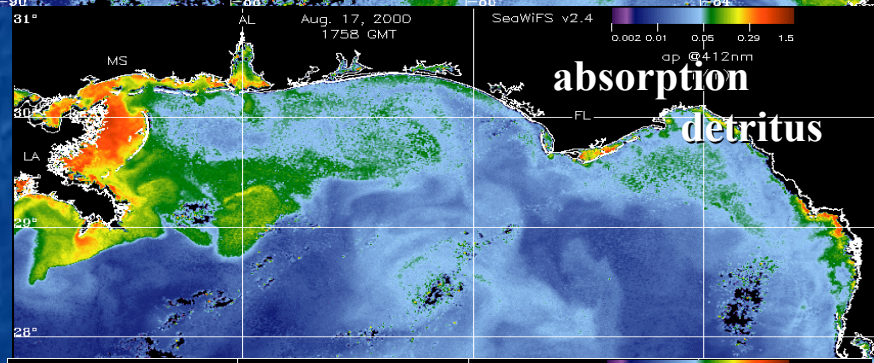
Optical Classification of Water Masses
Optically Complex Waters

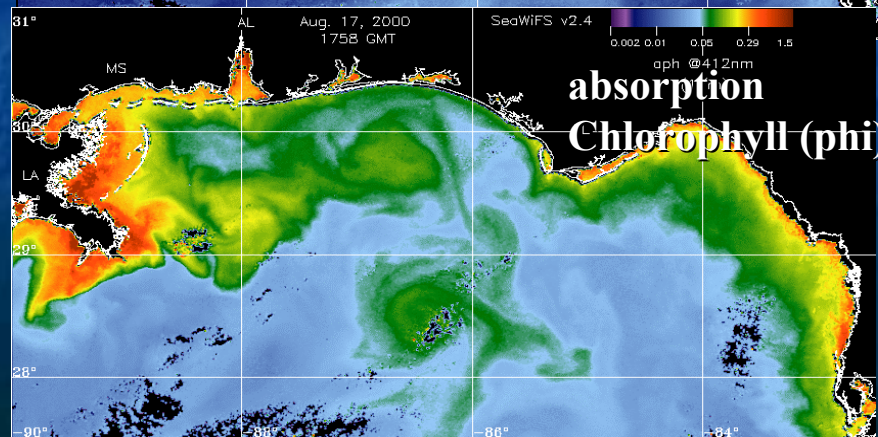












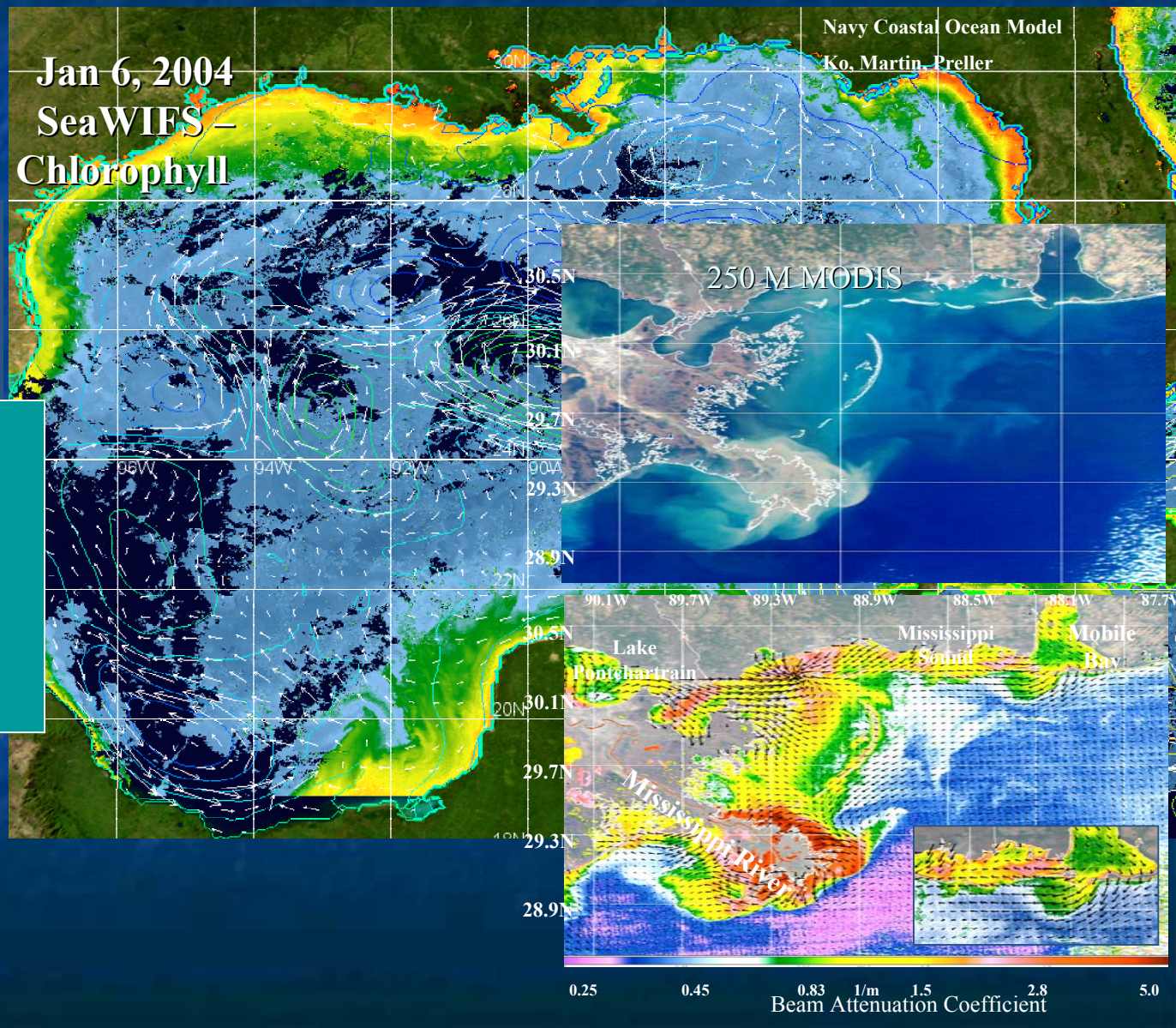
High resolution Products in coastal areas Occur at shorter Time Scales

MODIS –
Terra, (900L)
Aqua (1400)

Channel	1	620 - 670 nm	250 m
	2	841 - 876 nm	250
Channel	3	459 - 479	500 m
	4	545 - 479	500
	5	1230 - 1250	500
	6	1628 - 1652	500
	7	2105 - 2155	500

Ocean
Channels

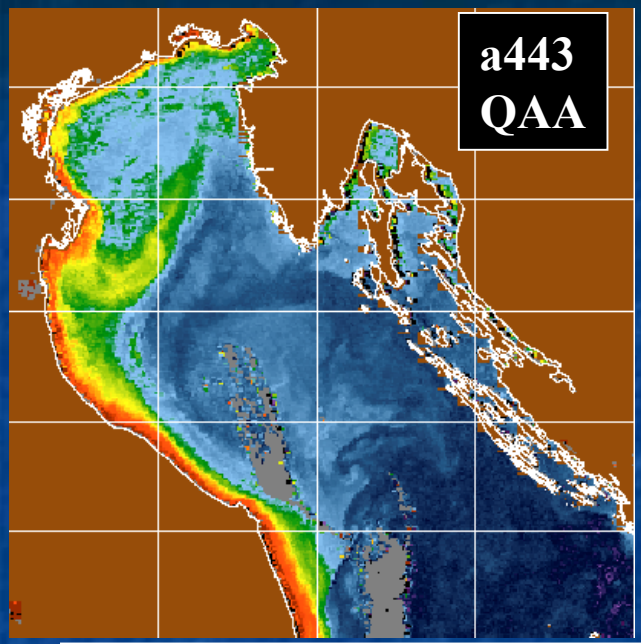
Sea Surface Temperature
day / night

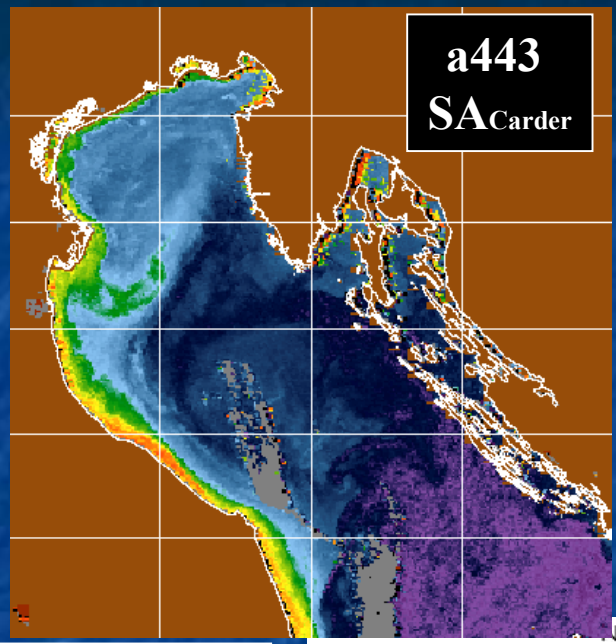


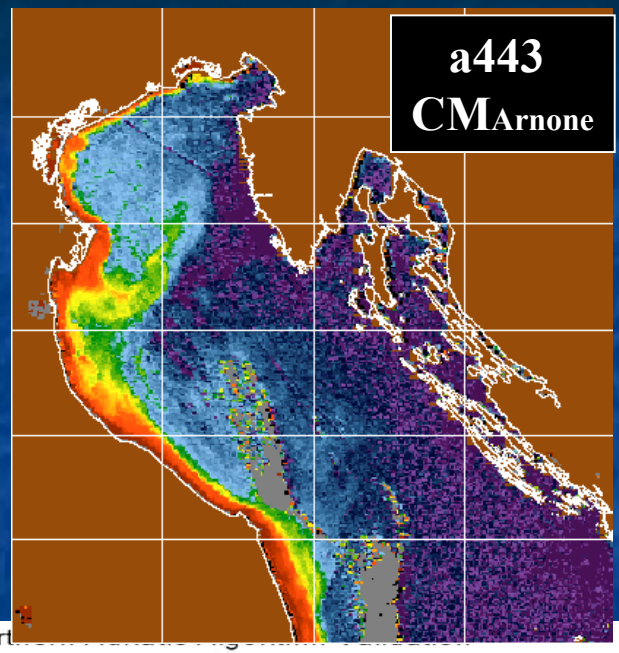
End

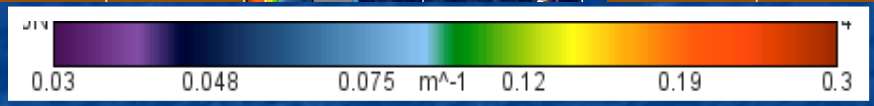
Validation in Spatially Variable waters

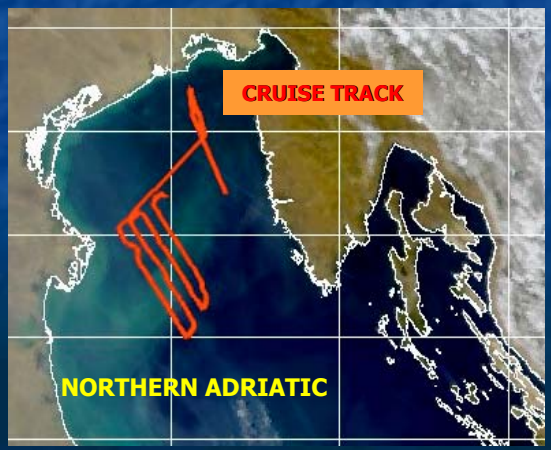
Optical Algorithm Validation – Northern Adriatic











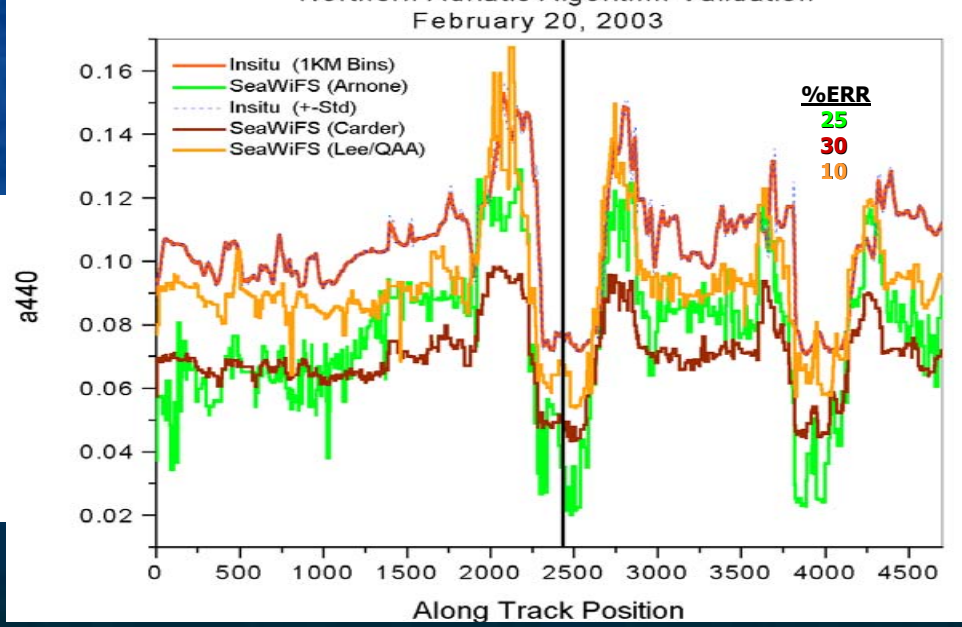
4,700 Continuous Underway Samples

Insitu

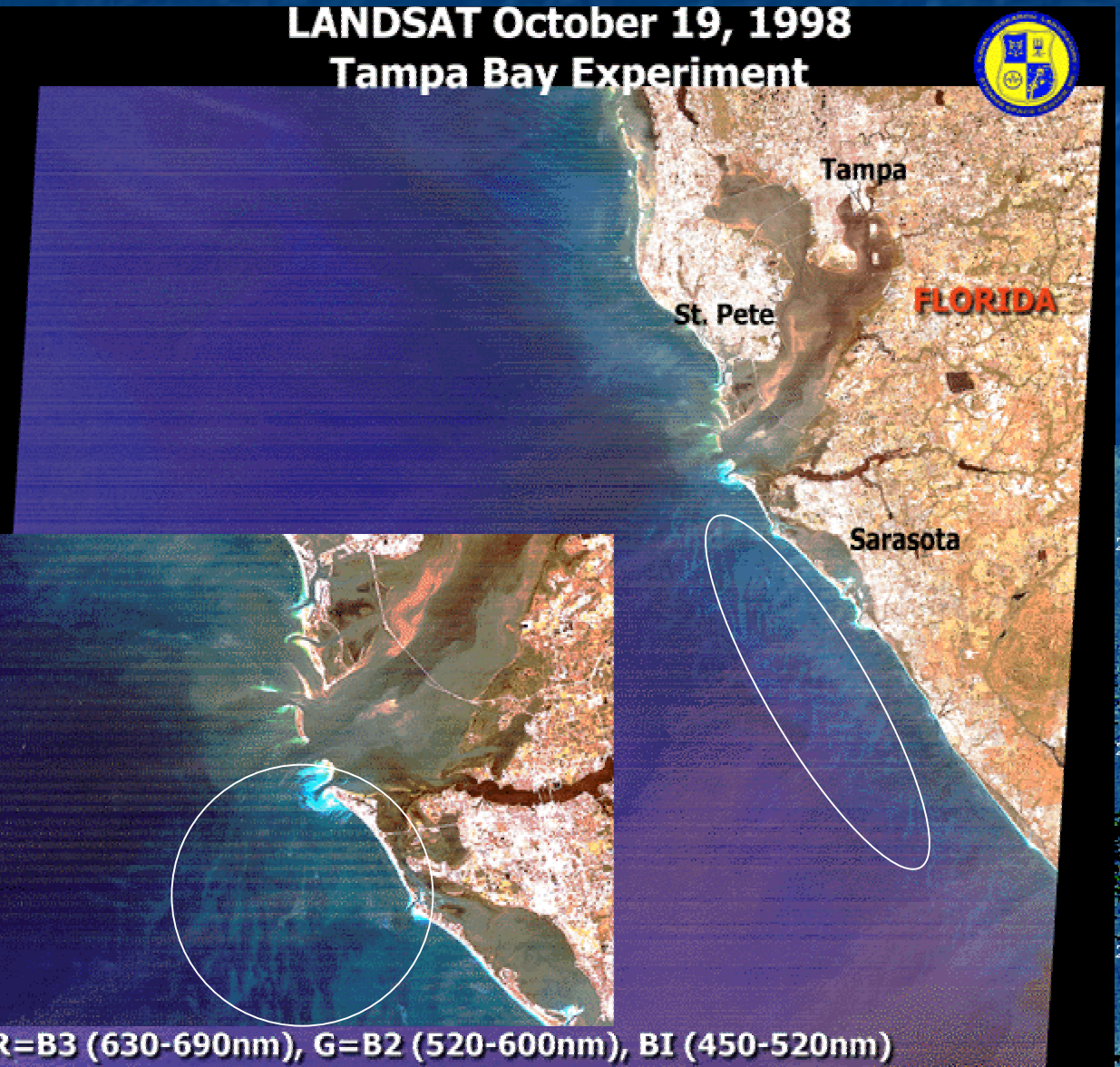
QAA

SA- Carder

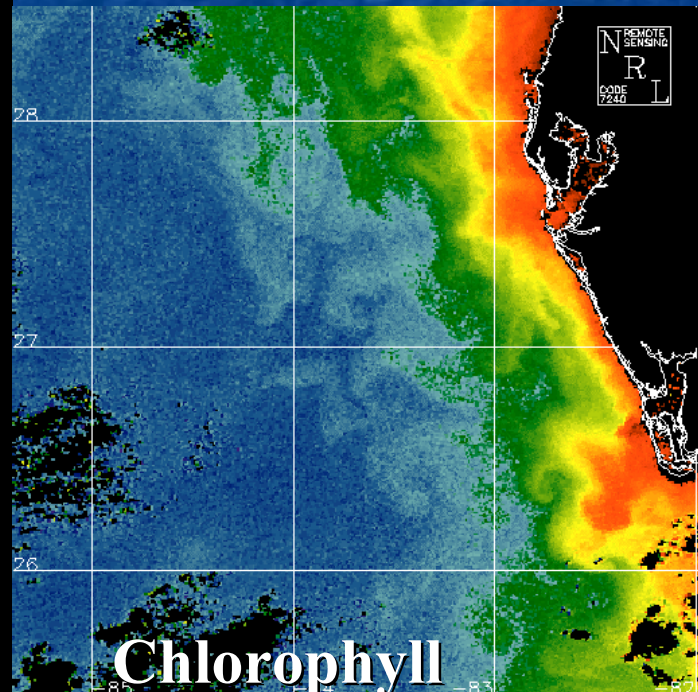
CM- Arnone



Sensing of Optically Shallow Water

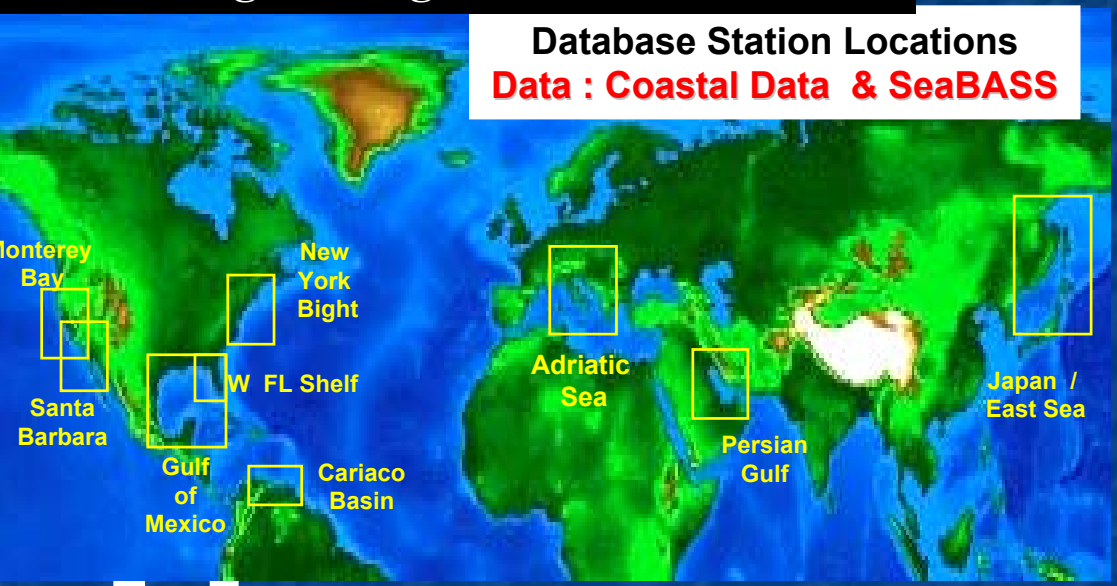


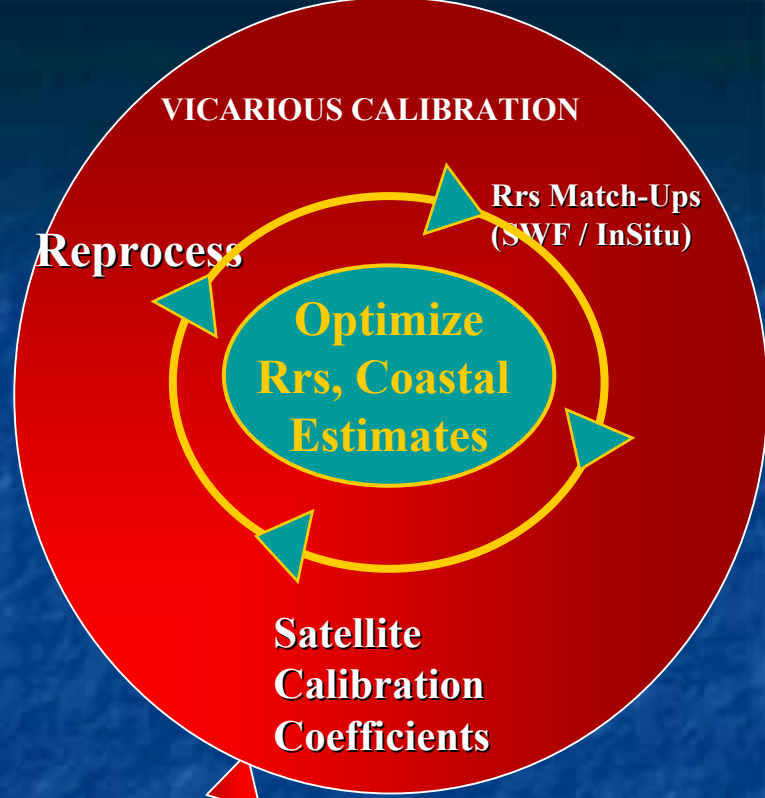
- contribution of bottom reflectance to remote sensing reflectance,



Automated Validation / Satellite Vicarious Calibration

- Multiple Satellite/ real time
- Evaluating New algorithms and methods





Insitu Optics Data

SQL Database (validation)

New NPP, Hyperion

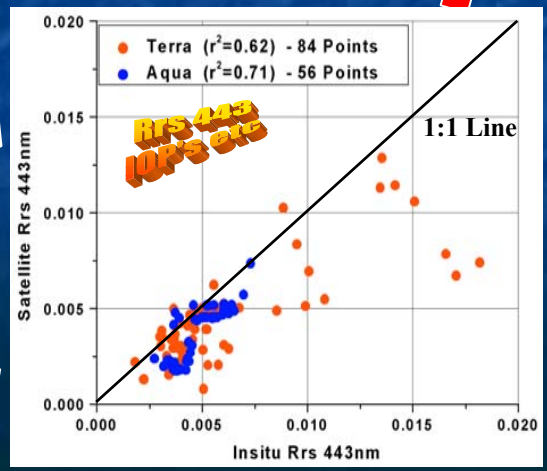
Terra

Data

SeaWiFS

Reflectance Absorption, backscattering

SQL Database



Product Selection
Temporal Selection
Spatial Selection
Omitting Bad Data (Flags)
- Epsilon Failures
- Clouds
- Satellite Zenith Angle
- Invalid Data

Possible Sites for Calibration / Validation

Selection of Coastal Sites for Coastal Calibration

Looking for areas which characterized a wide variety of coastal optical processes
- CDOM, chlorophyll, detritus, sediments (scattering) etc
- aerosols
- ? Others?

-Locations of Coastal calibration sites

-Lake Okeechobee	- High CDOM (atmospheric correction)
-Gulf of Maine	-
-Chesapeake Bay	-
-Monterey Bay	- Biological Signal
-Miss River	- high sediment / CDOM
-Columbia River Plume	-

-Others?

Measurements for Coastal CAL-Val

Remote Sensing Reflectance

above and below water surface In water measurements – Instrument shadowing

- Above water measurement

Hyperspectral sensors
Sunglint
Standards for Ref. Card Inherent optical properties
(spectral absorption and backscattering)

Inherent Optical Properties

absorption / Scattering and calibration (temperature, salinity, scattering)
filter pad absorption spectra
CDOM from filtered (in-situ and water samples)
Backscattering- Hydroscatt, ECOVSF, others

Bottom reflectivity

Chlorophyll, CDOM, detritus

Suspended Sediments

Particles concentrations (absorption from detritus)

Others?

Summary

Considerations :

- Continue / extend the development of SEABASS to include Coastal Ocean Properties
- Enable near real time match-up in coastal areas.
  - automated methods to validation products.

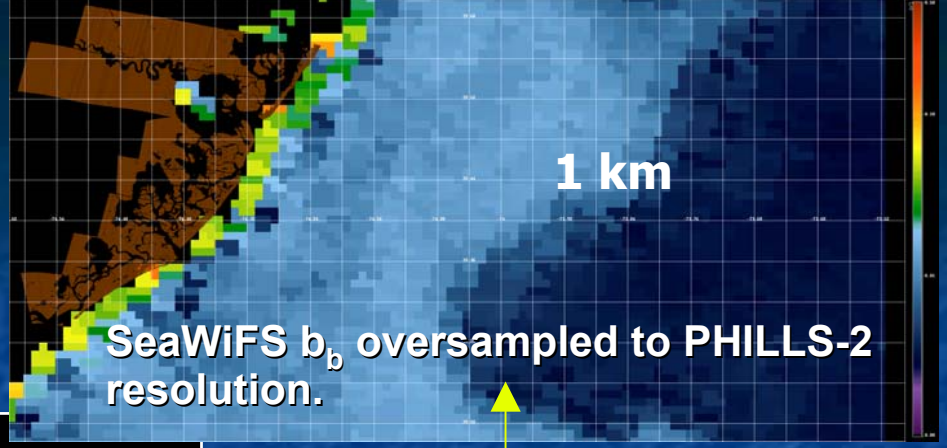
- Provide methods to integrate or assimilate coastal observations into satellite algorithms for cal- val efforts.

- Link these with the NPP / NPOES calibration validation program

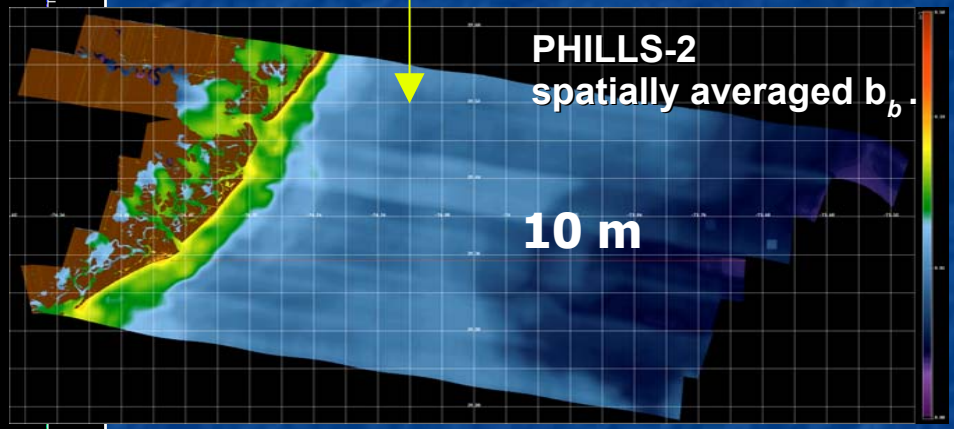
- Couple within the IOOS and ORION programs

Coastal Measurement Issues - Spatial Variability

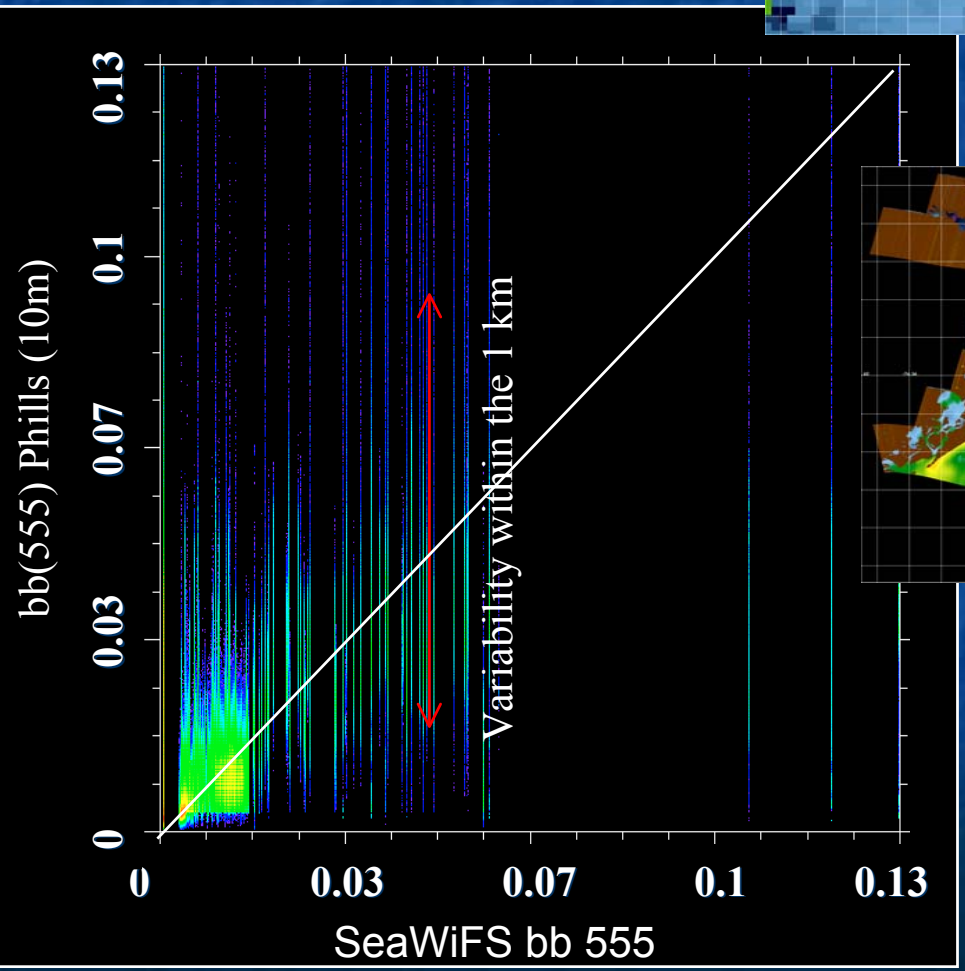
SeaWIFS and Phills



Correlation coefficient of .752



Spatially averaged using 109x109 pixel sliding window to approximate SeaWiFS resolution.



- Mean of all in-shore pixels found to be .025, .008 for off-shore pixels.

Casey et al, 2001
Bissett et al. submitted TOS
Moline et al. submitted