



High-Resolution Bio-Optical Property Fields in the Northern Gulf of Mexico: Five-Year Ocean Color Time Series

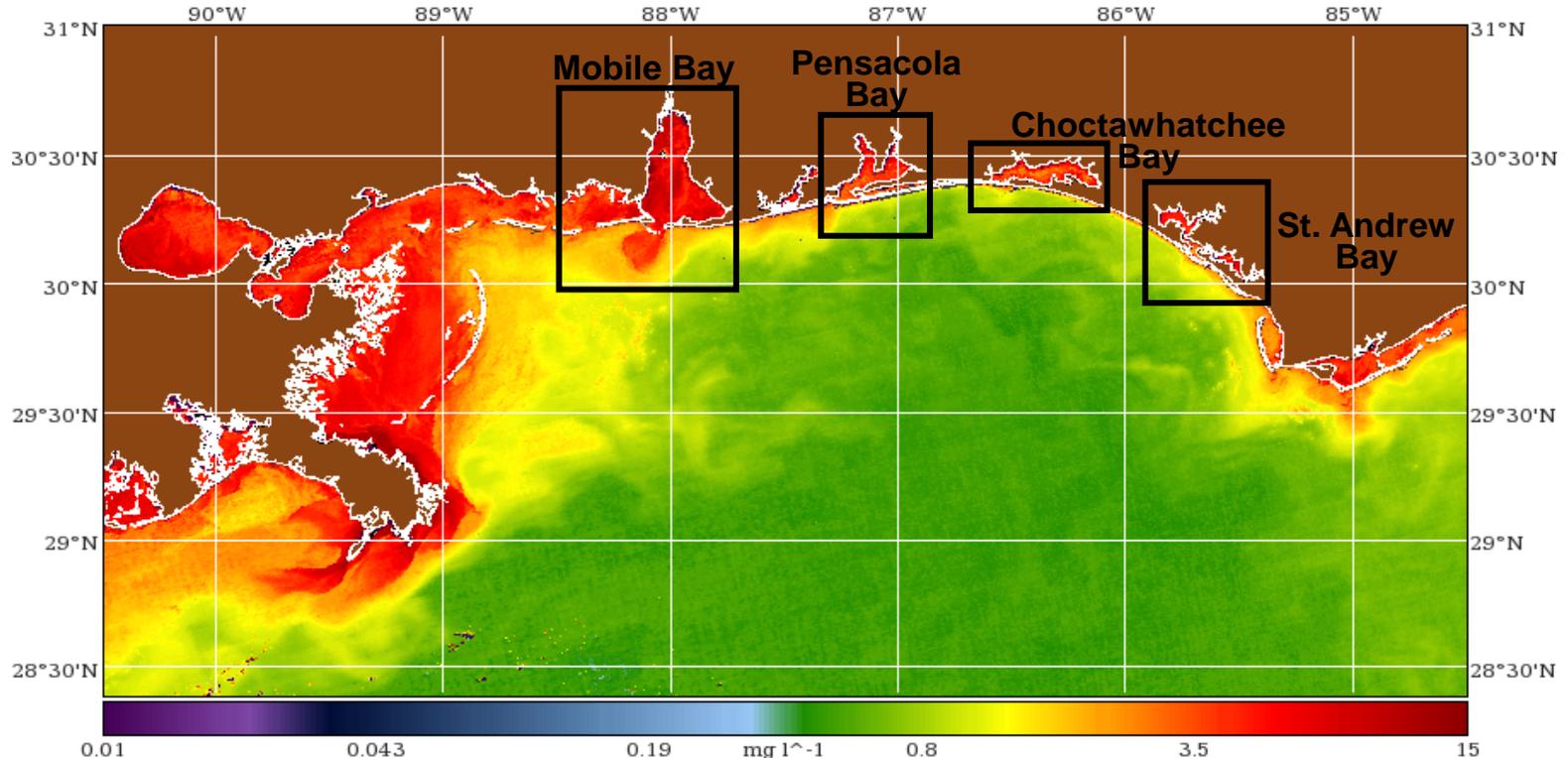


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Objectives

- *Establish baseline bio-optical properties for coastal habitats in the Northern Gulf of Mexico (5-year satellite climatology).*
- *Communicate this information to environmental resource managers to aid decision making (dredging operations, turbidity, etc.).*

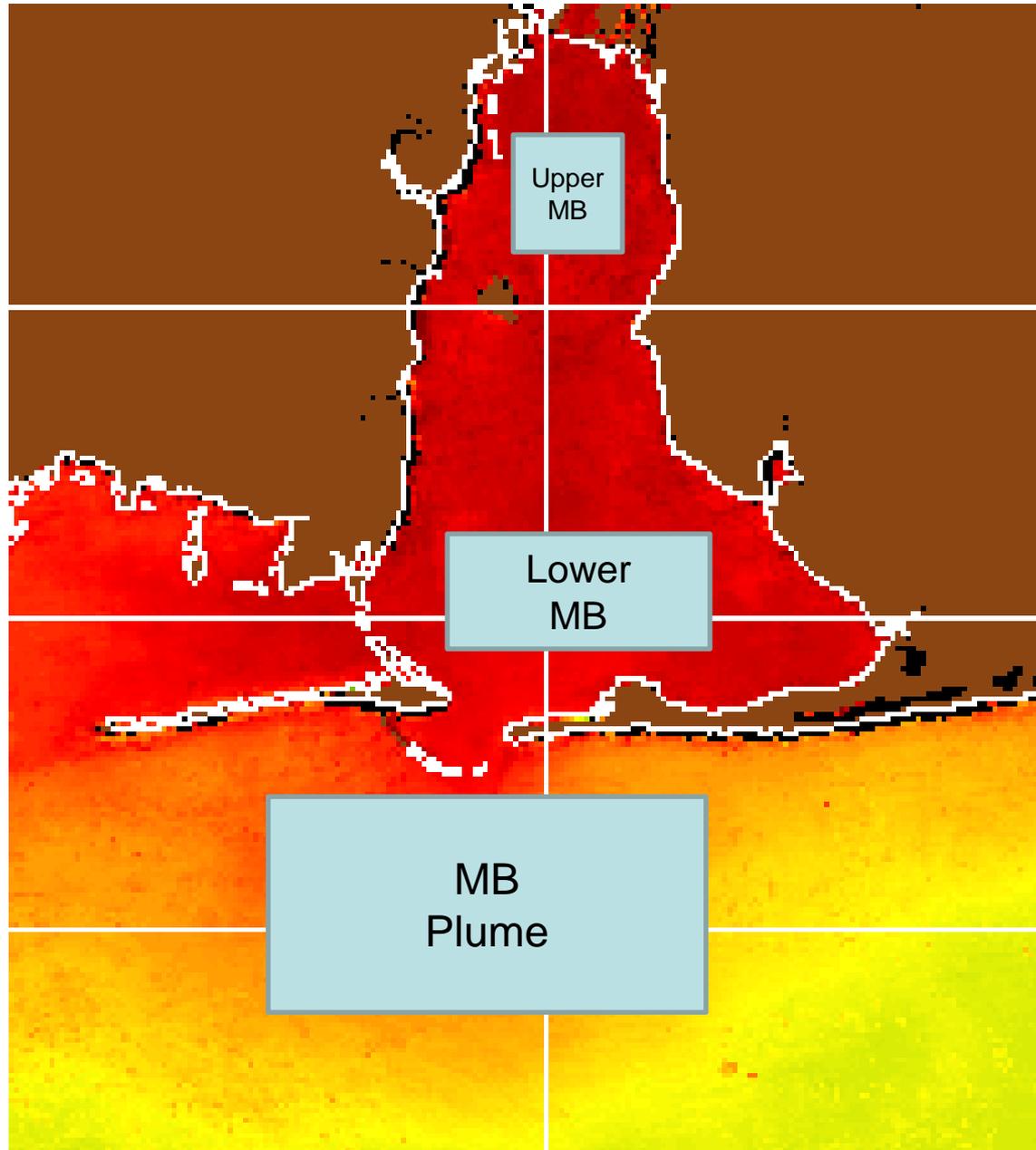


Bio-Optical Products - MODIS Aqua, high-resolution (250m)

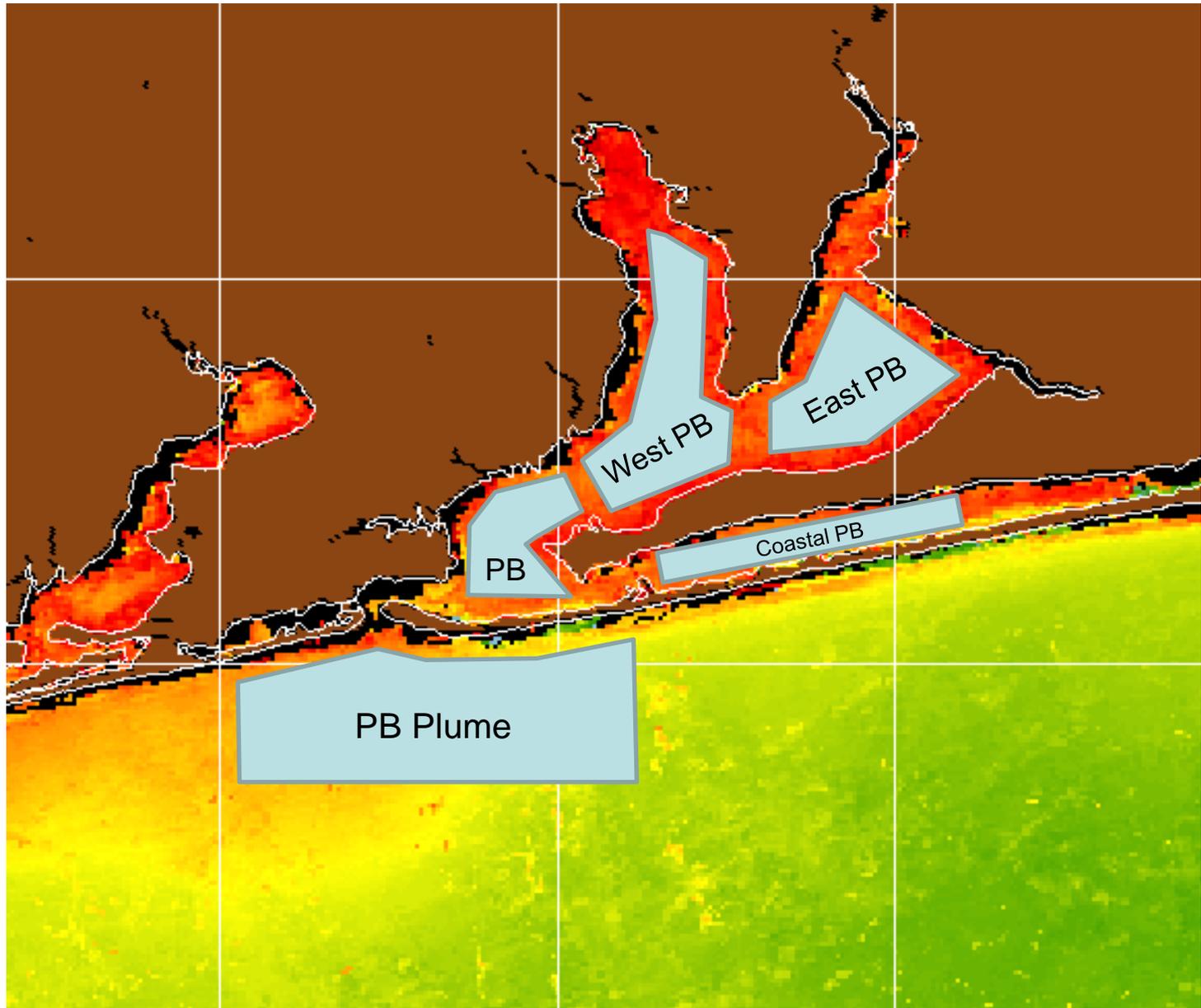
(for each bay and sub-region; weekly, monthly products):

- Total Suspended Solids (TSS)
- Particulate Inorganic Matter (PIM)
- Particulate Organic Matter (POM)
- Diffuse Attenuation Coefficients at 488nm (Kd_488)
- Euphotic Depth (Zeu)

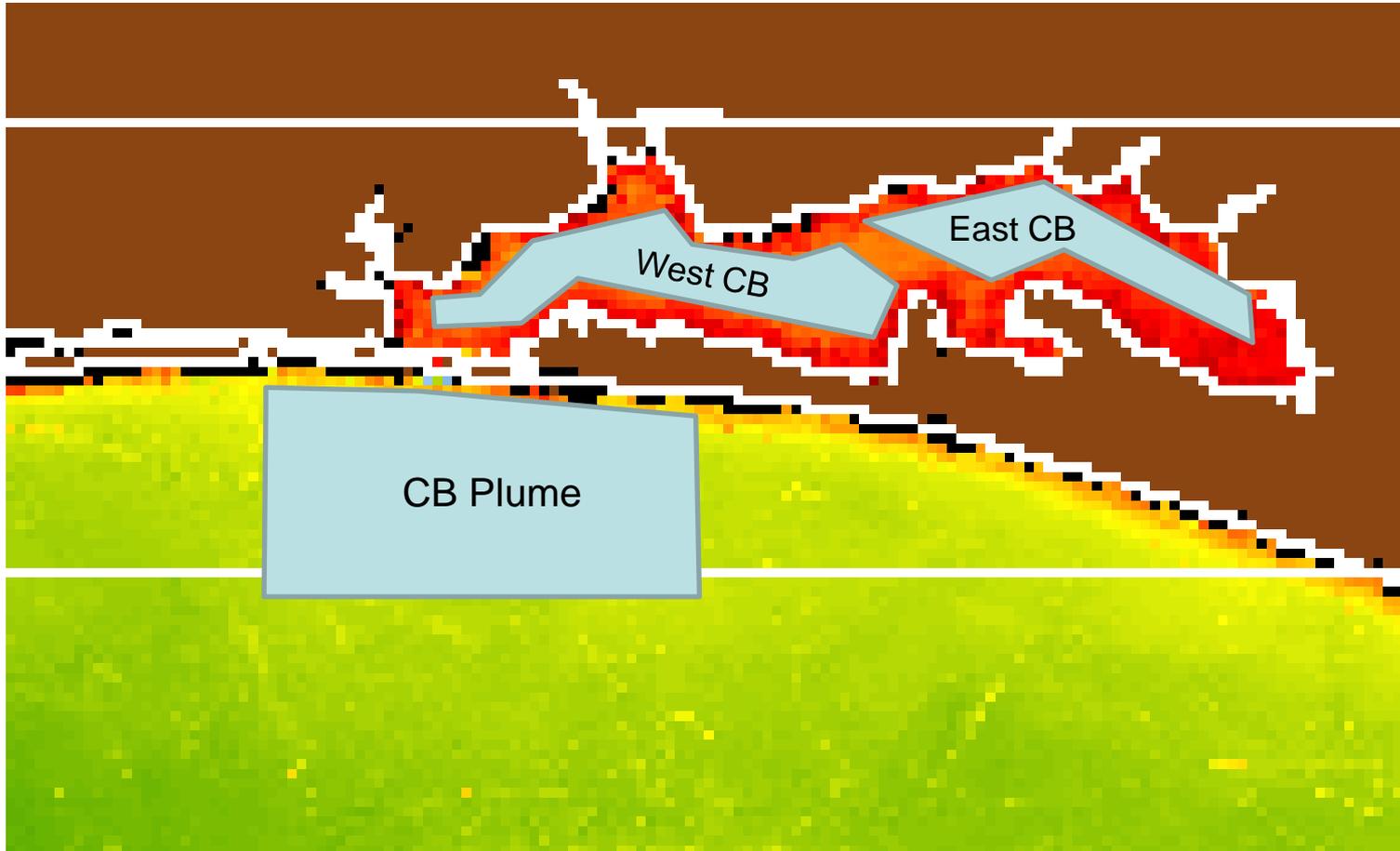
Mobile Bay, AL



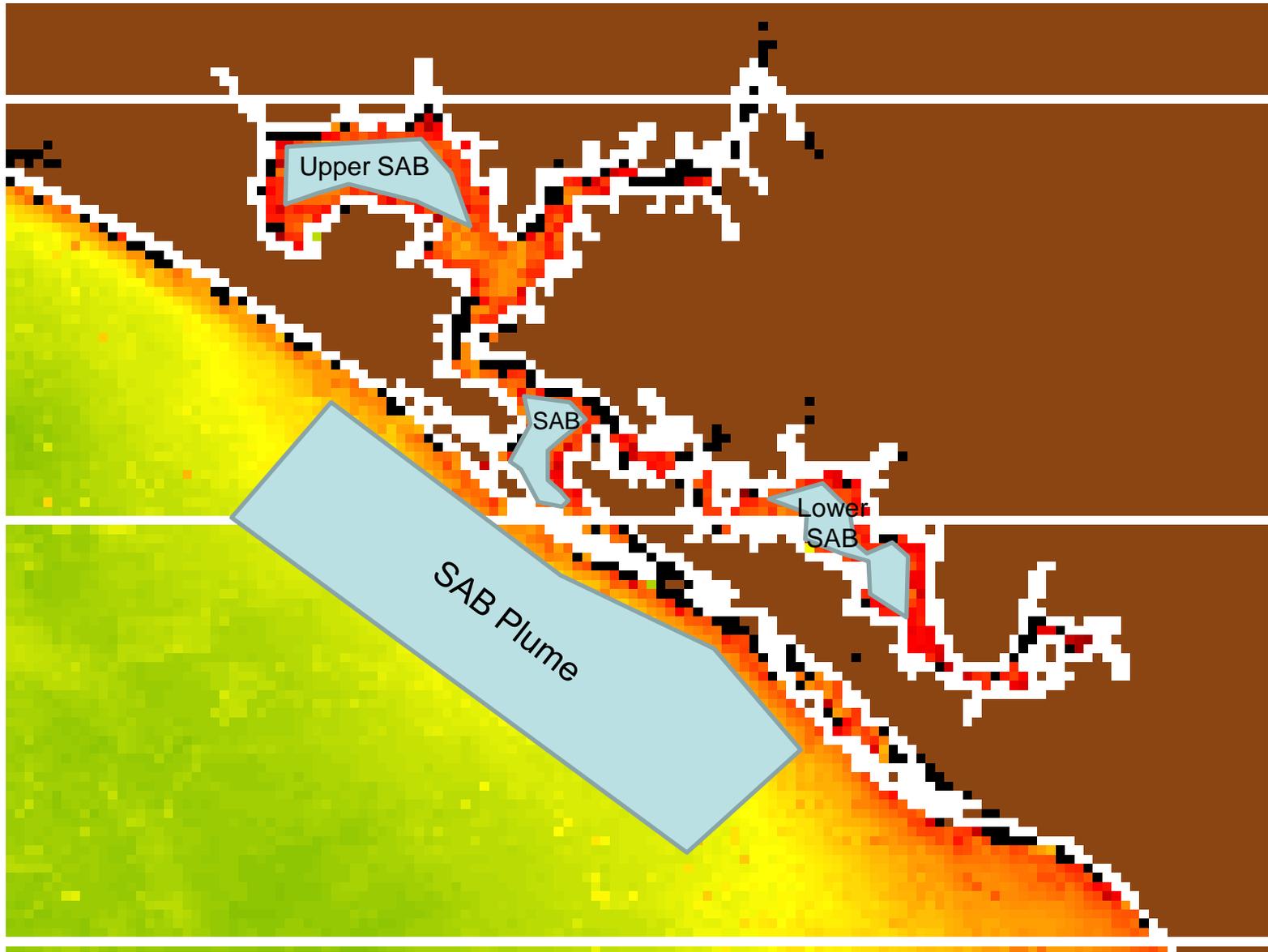
Pensacola Bay, FL



Choctawhatchee Bay, FL



Saint Andrew Bay, FL



Hyperspectral Imager for the Coastal Ocean (HICO)

NRL controls HICO operations

- *Target selection*
- *Target acquisition*

HICO Specifications

- *100m spatial resolution*
- *87 spectral channels (400-900nm)*
- *5.7 nm spectral resolution*

Bio-Optical Products

- *Chlorophyll*
- *Absorption coefficient (phyto, CDOM, sediment/detritus)*
- *Backscattering coefficient*
- *Diffuse attenuation coefficient*
- *Beam attenuation coefficient*
- *Euphotic depth*
- *TSS (organic, inorganic)*
- *Optical water mass classification*

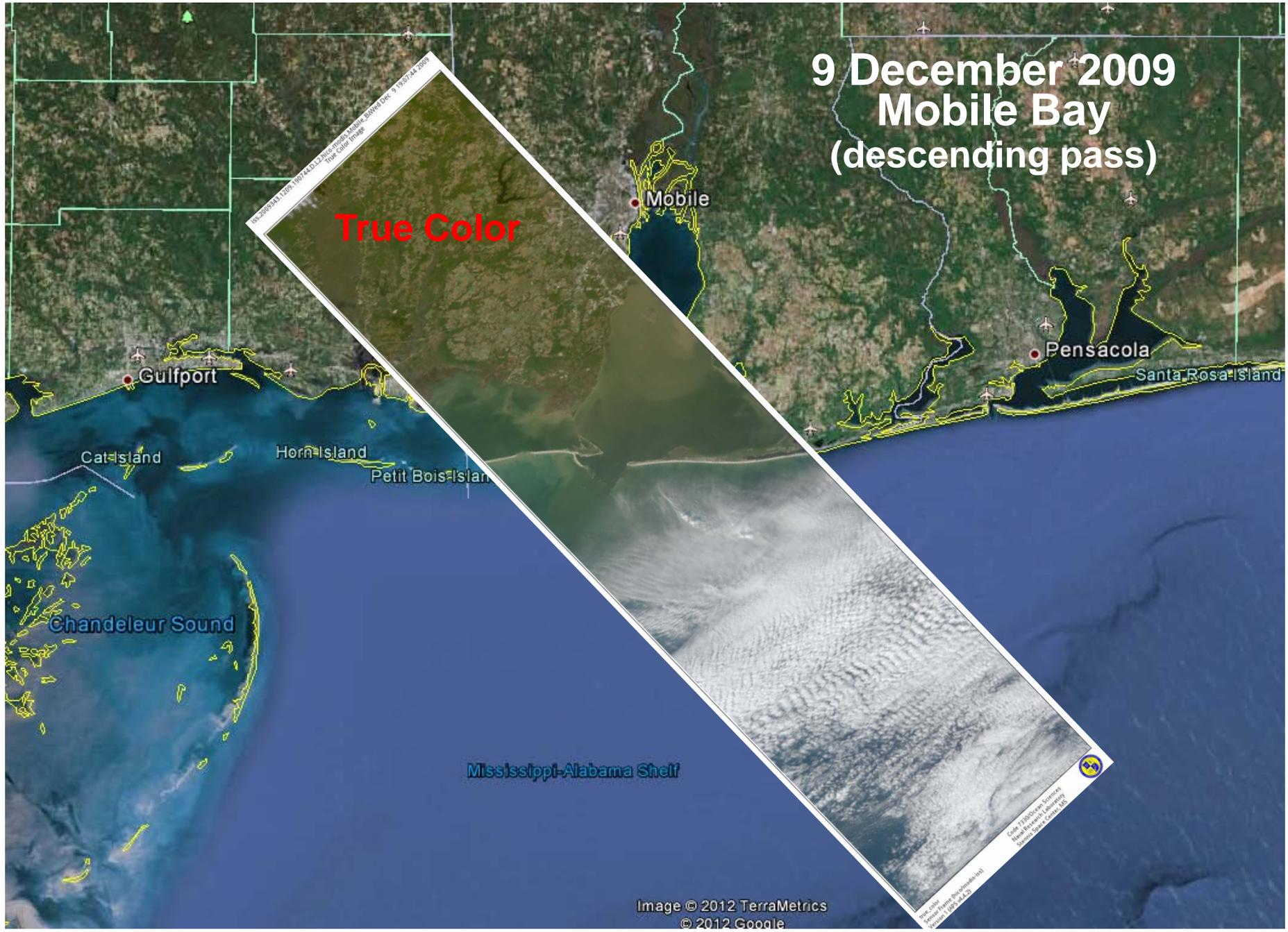
HICO Processing

- *Convolved to “MODIS-like” bands (multispectral)*
- *Full hyperspectral*
- *Consistent with processing for other ocean color sensors (SeaWiFS, MODIS, MERIS, VIIRS)*



9 December 2009
Mobile Bay
(descending pass)

True Color



Mississippi-Alabama Shelf

Coastal and Estuarine Science
Center
P.O. Box 12000
Tallahassee, FL 32309-1200
www.fishbase.org

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9 December 2009
Mobile Bay
(descending pass)

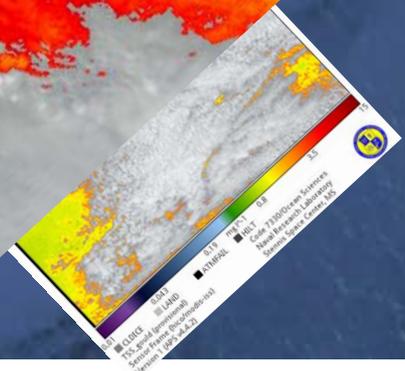
TSS

Pensacola

Santa Rosa Island

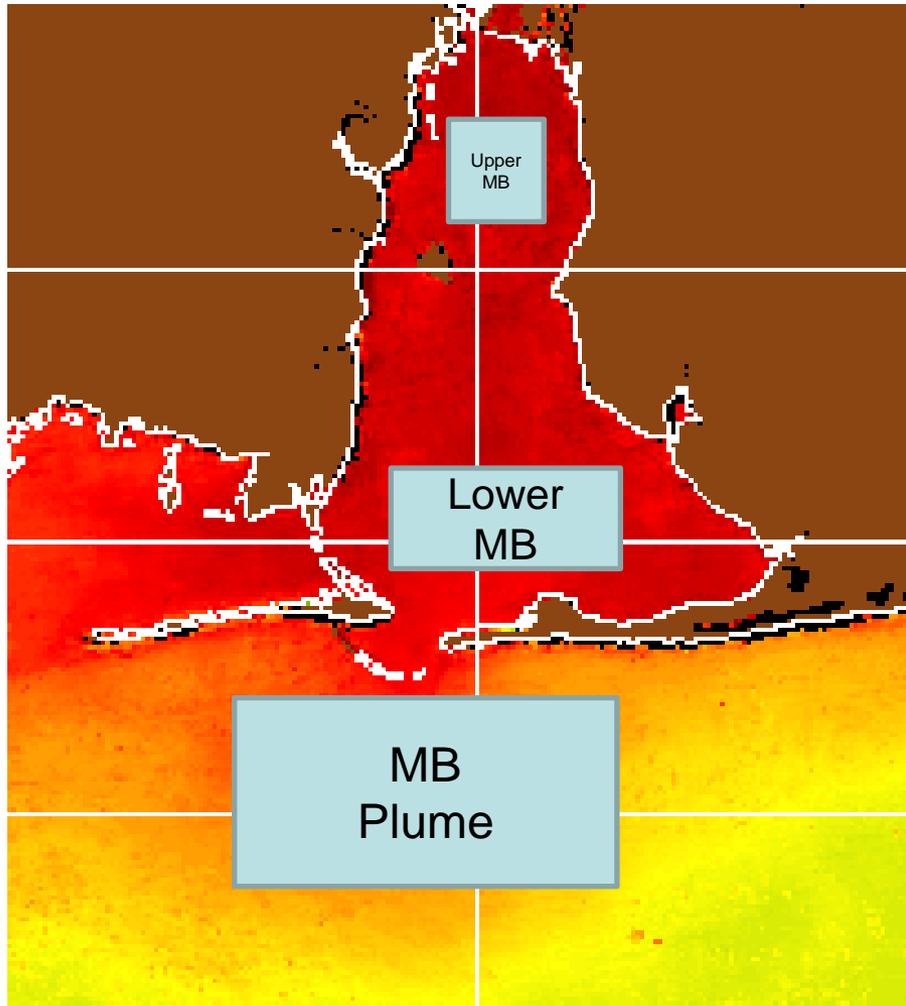
Cat Island

Chandeleur Sound

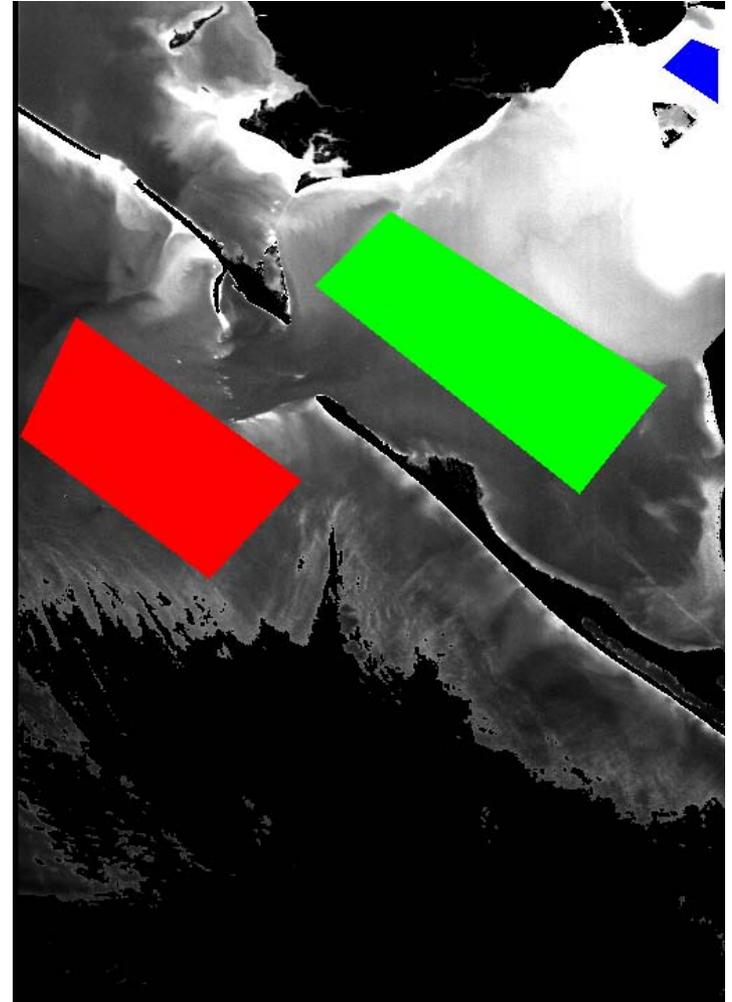


Mobile Bay, AL

MODIS time-series



HICO (single image)



- *not exactly the same areas covered by the sub-regions.*
- *weekly mean vs. individual scene.*

MODIS (weekly mean, 12/3-12/10/2009) vs. HICO (12/9/2009)

Region	Property	MODIS time-series	HICO	% Difference (HICO – MODIS)
Plume	TSS	4.0	4.7	17.5
	PIM	3.1	3.9	25.8
	POM	1.0	0.7	30.0
	Zeu	11.0	9.0	18.2
	K _d (488)	0.63	0.61	3.2
Lower Bay	TSS	9.5	6.5	31.6
	PIM	8.1	5.6	30.9
	POM	1.4	0.8	42.8
	Zeu	4.5	6.6	46.7
	K _d (488)	1.68	0.96	42.8
Upper Bay	TSS	11.8	17.7	50.0
	PIM	10.4	16.7	60.6
	POM	1.4	1.0	28.6
	Zeu	6.1	3.1	49.2
	K _d (488)	1.89	2.14	13.2

generally increasing differences



TSS (mg/l) PIM (mg/l) POM (mg/l) Zeu (m) K_d (m⁻¹)

11 September 2011
Pensacola Bay
(ascending pass)

Mobile

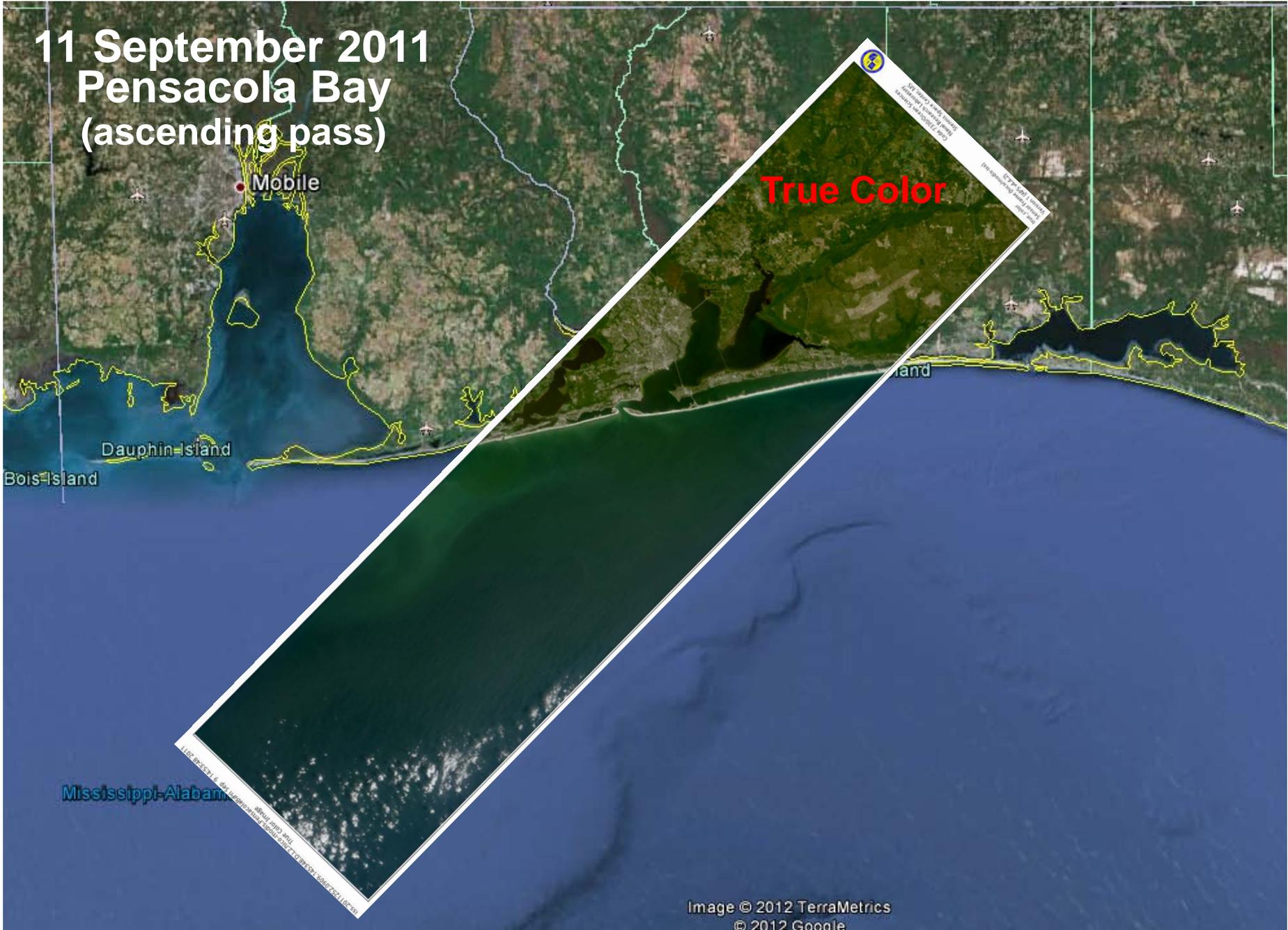
True Color

Dauphin Island

Bois Island

land

Mississippi-Alabama



11 September 2011 Pensacola Bay (ascending pass)

Mobile
Dauphin Island
Bois Island

TSS



Mississippi-Alabama

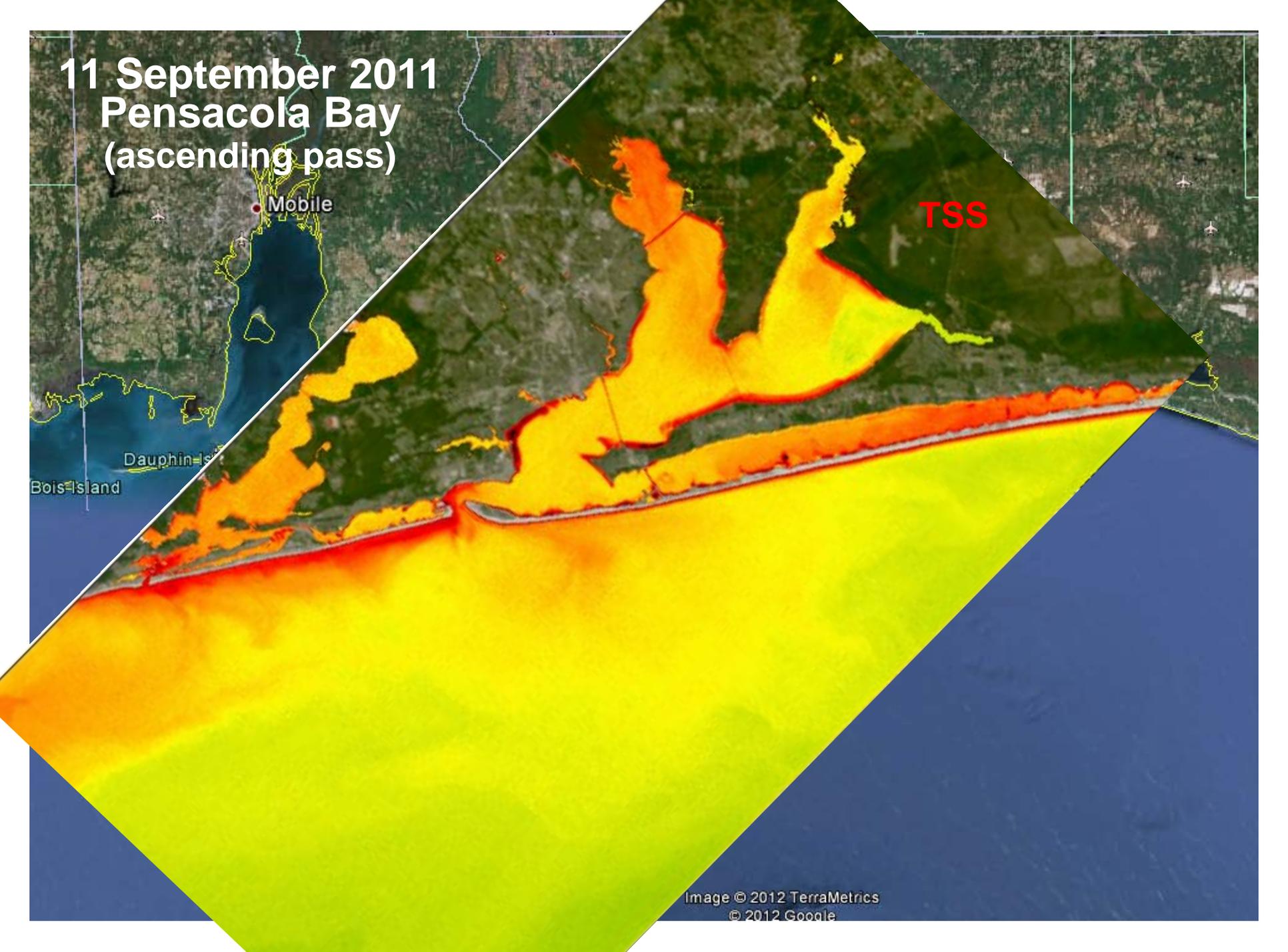
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Dauphin Island

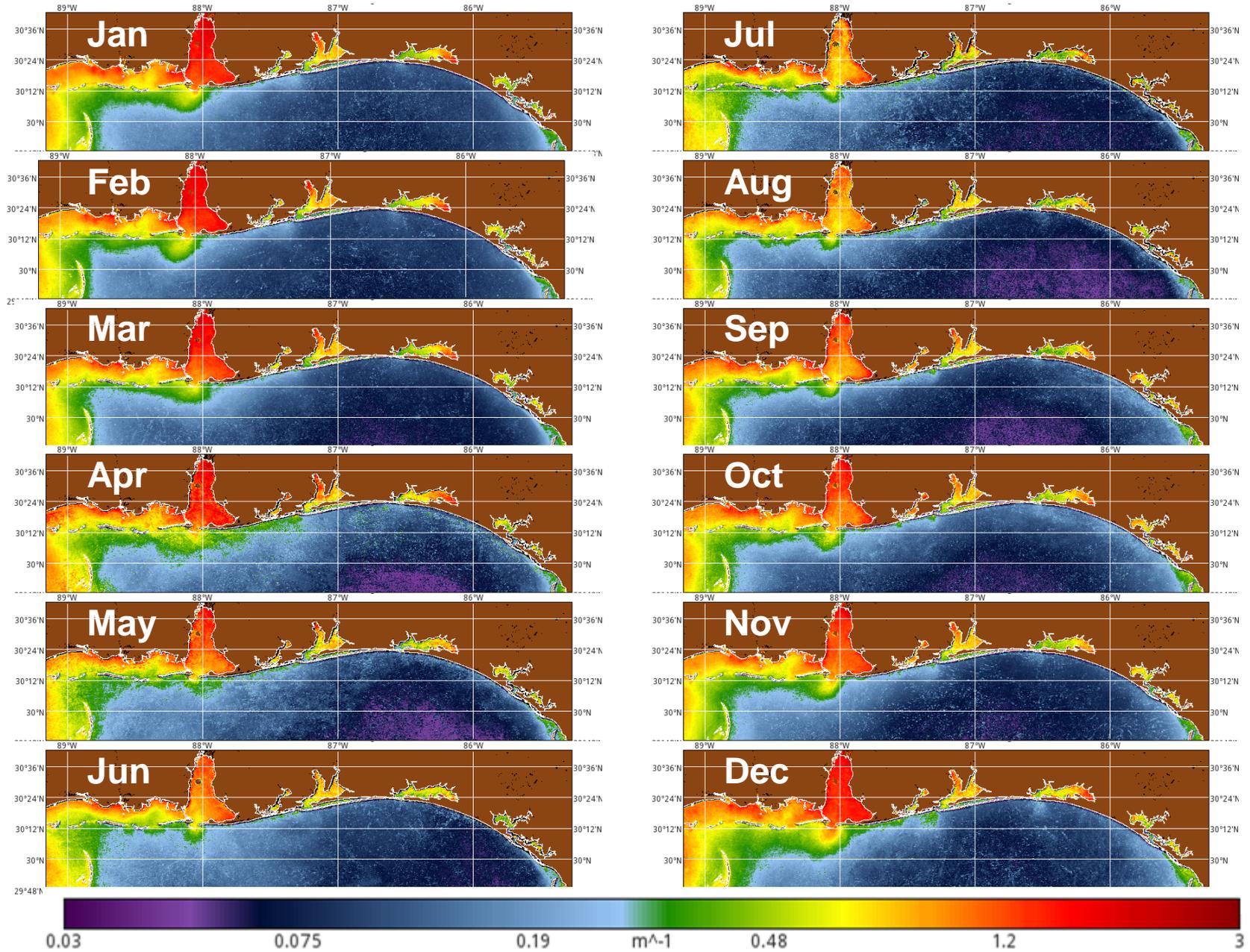
Bois Island

TSS



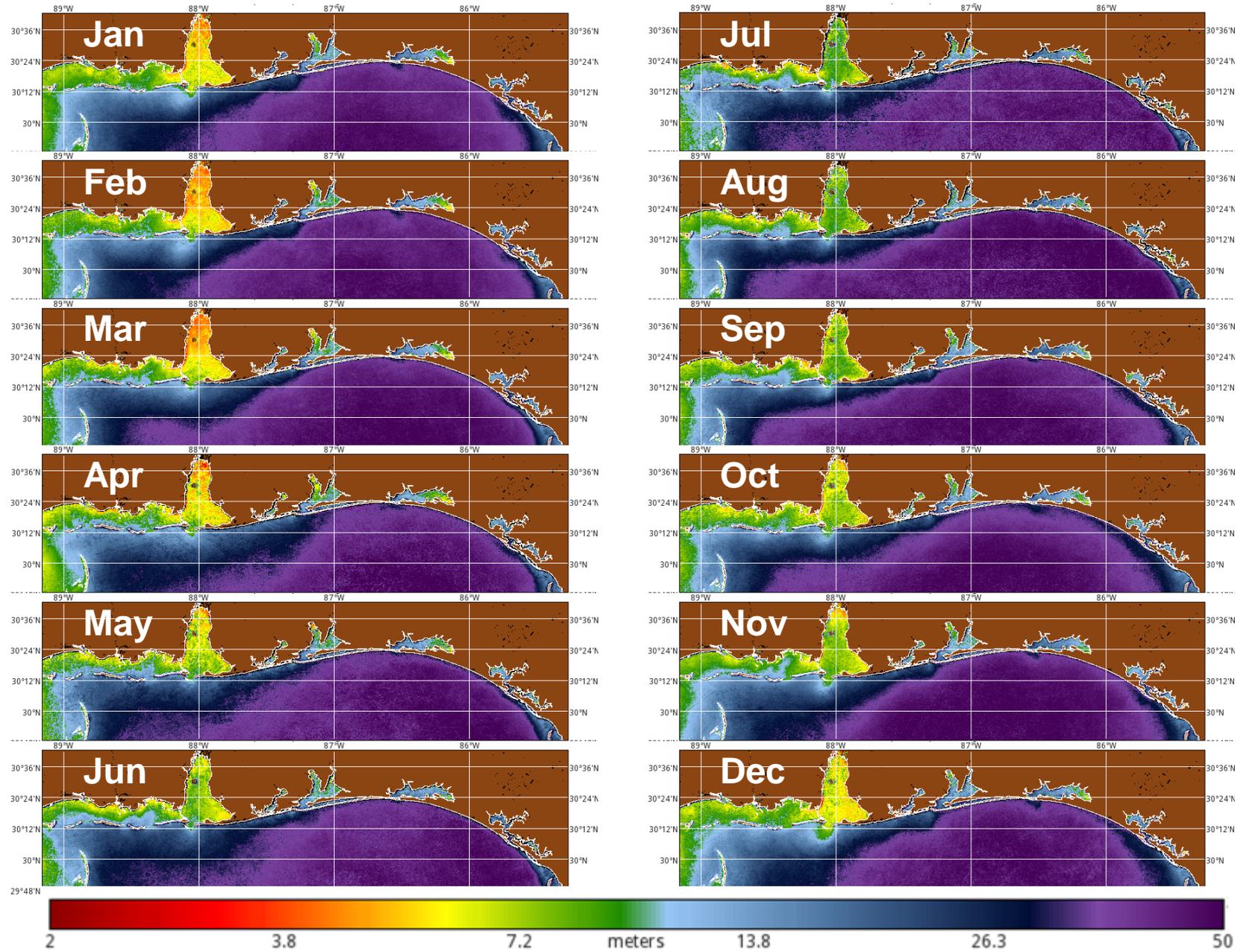
Time-Series Analysis – MODIS High-Resolution (250m) Bio-Optical Products

Monthly Composites (2005-2009), $K_d(488)$



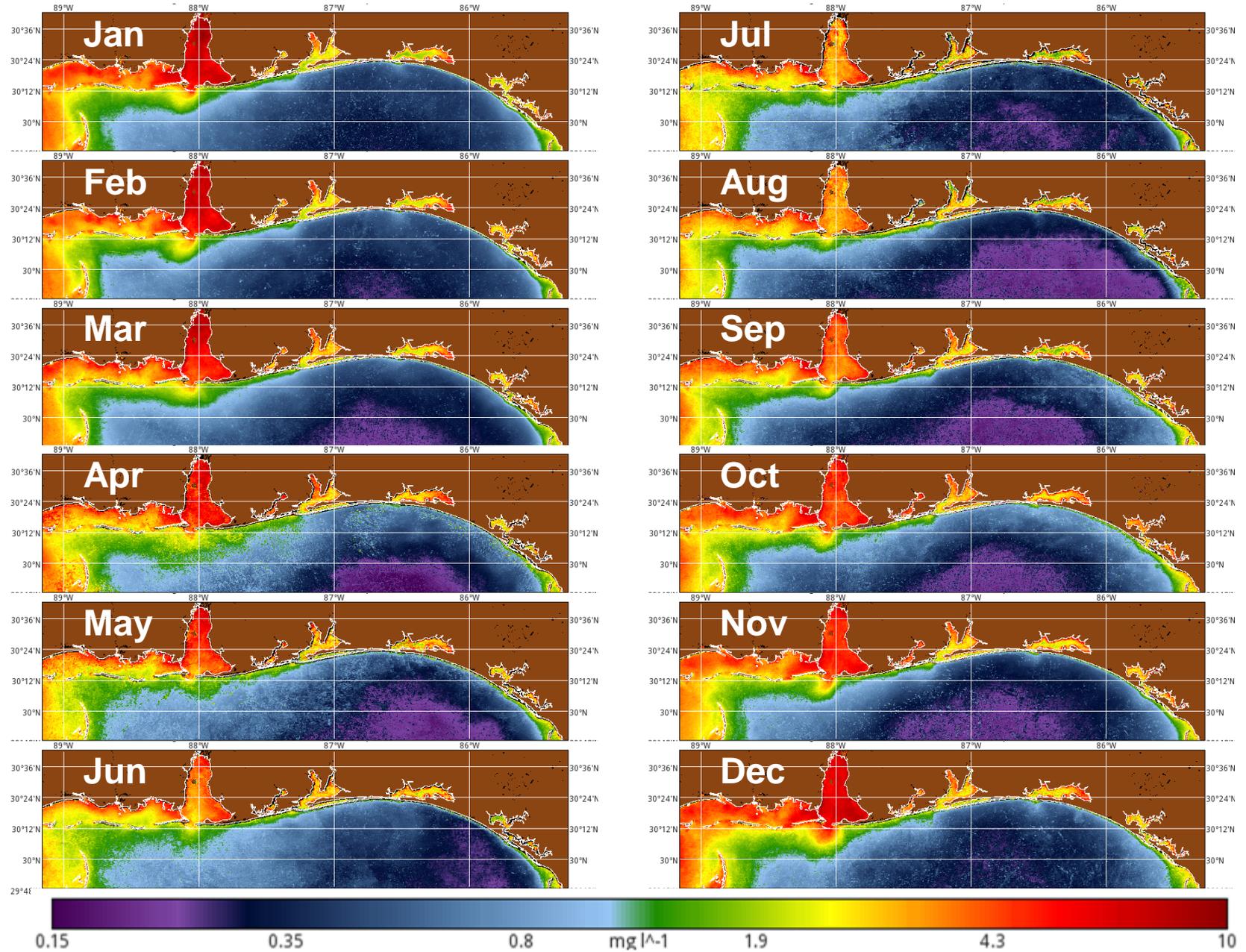
Time-Series Analysis – MODIS High-Resolution (250m) Bio-Optical Products

Monthly Composites (2005-2009), Z_{eu}



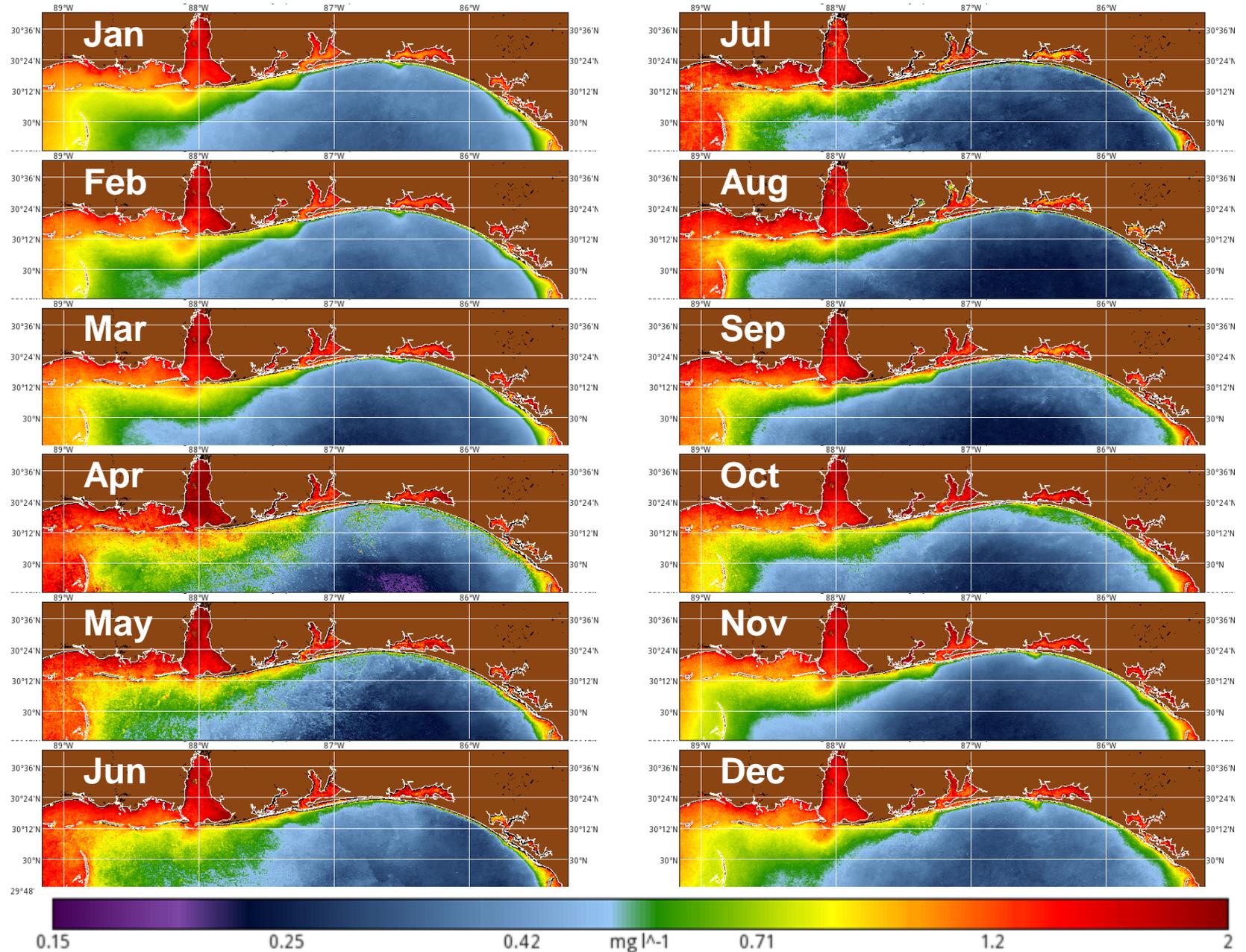
Time-Series Analysis – MODIS High-Resolution (250m) Bio-Optical Products

Monthly Composites (2005-2009), PIM



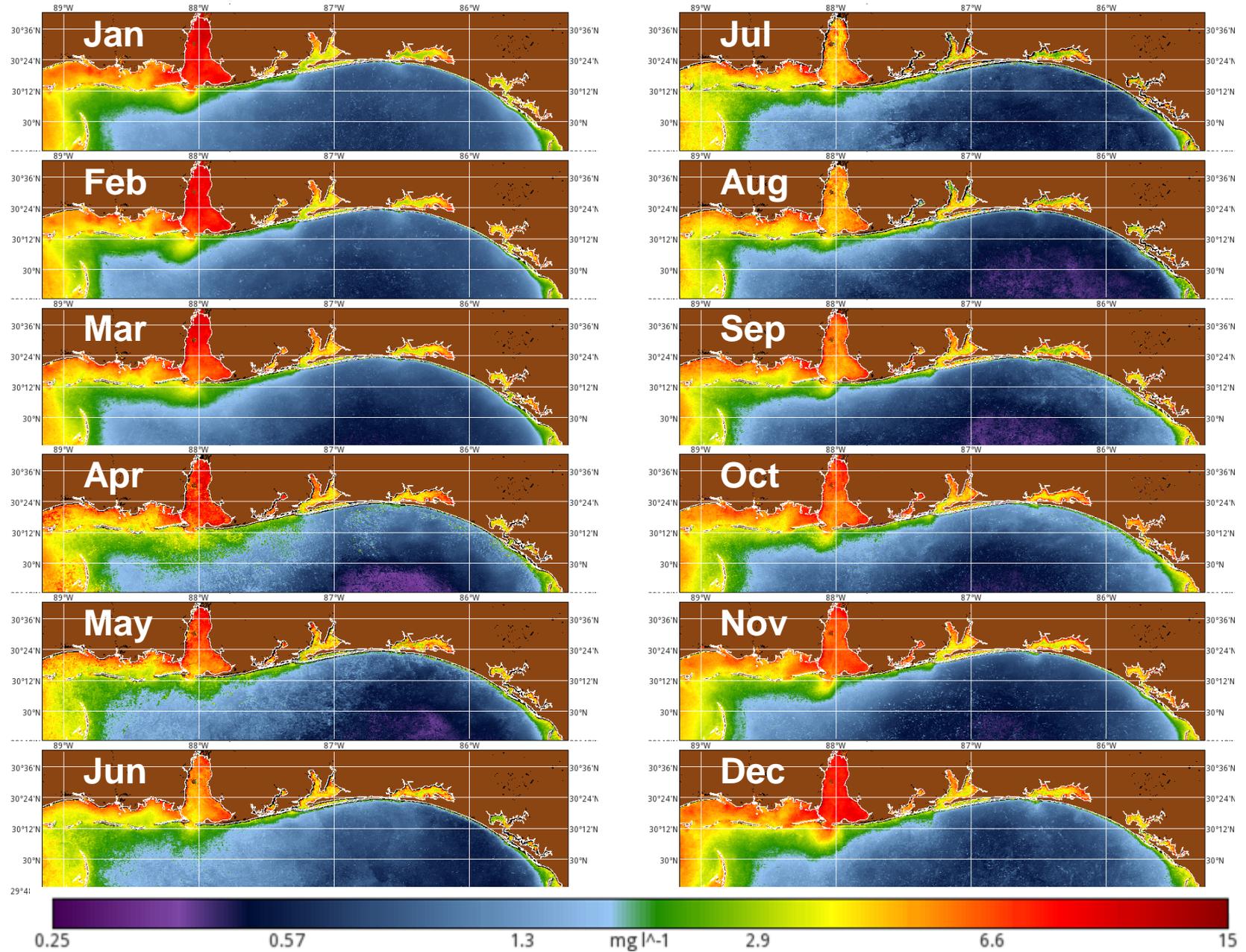
Time-Series Analysis – MODIS High-Resolution (250m) Bio-Optical Products

Monthly Composites (2005-2009), POM



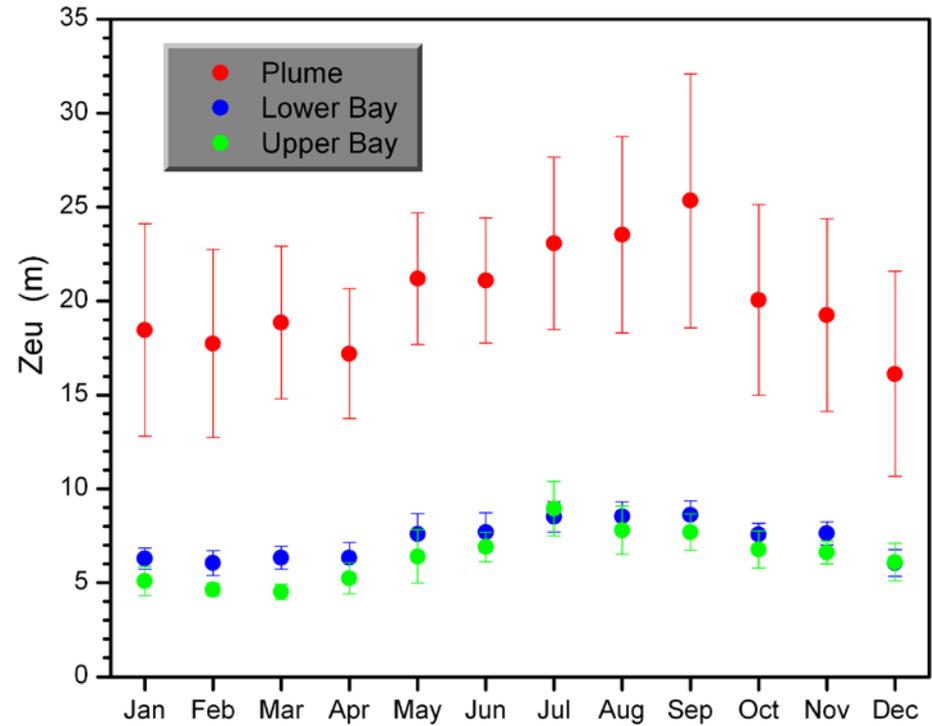
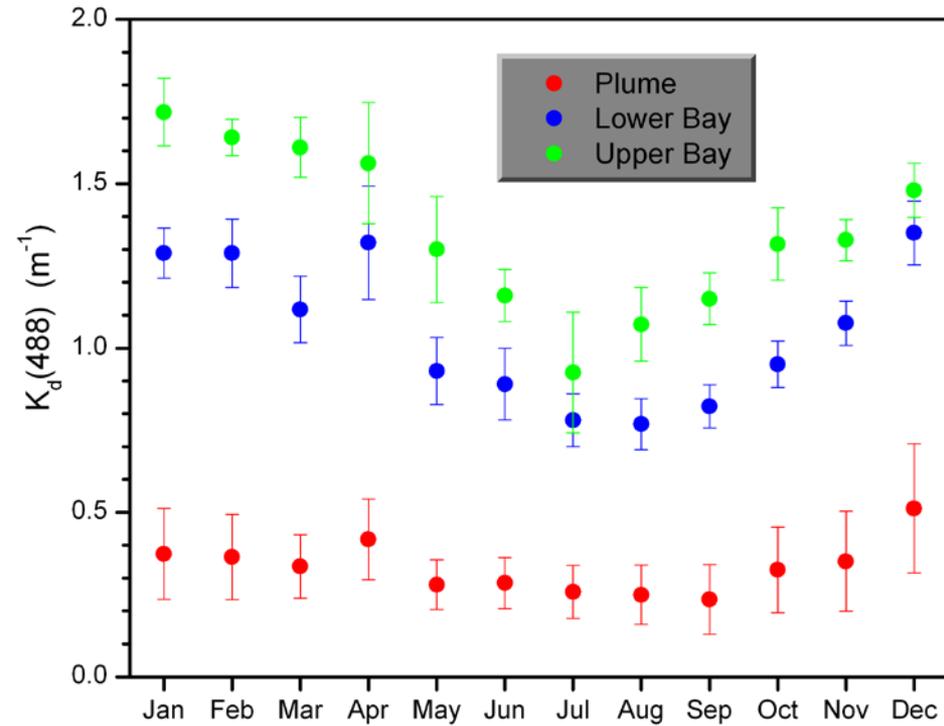
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Monthly Composites (2005-2009), TSS



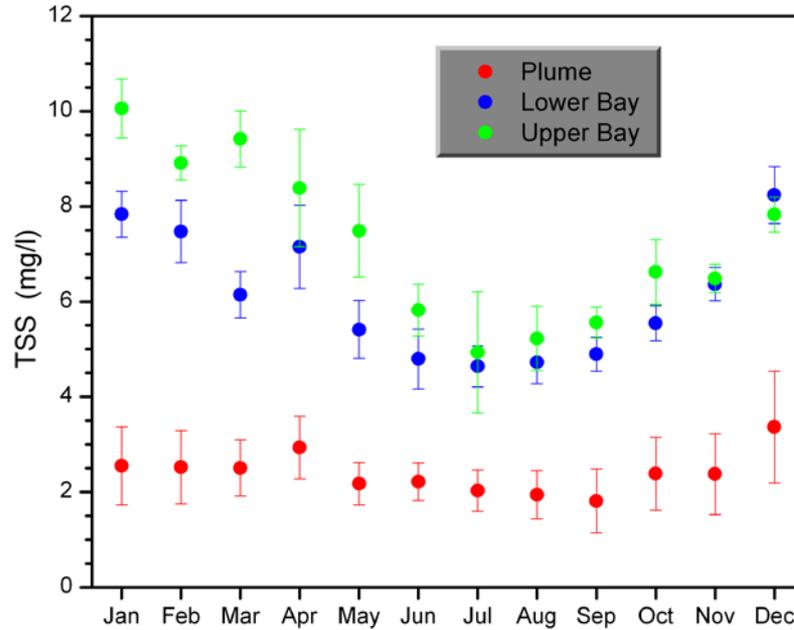
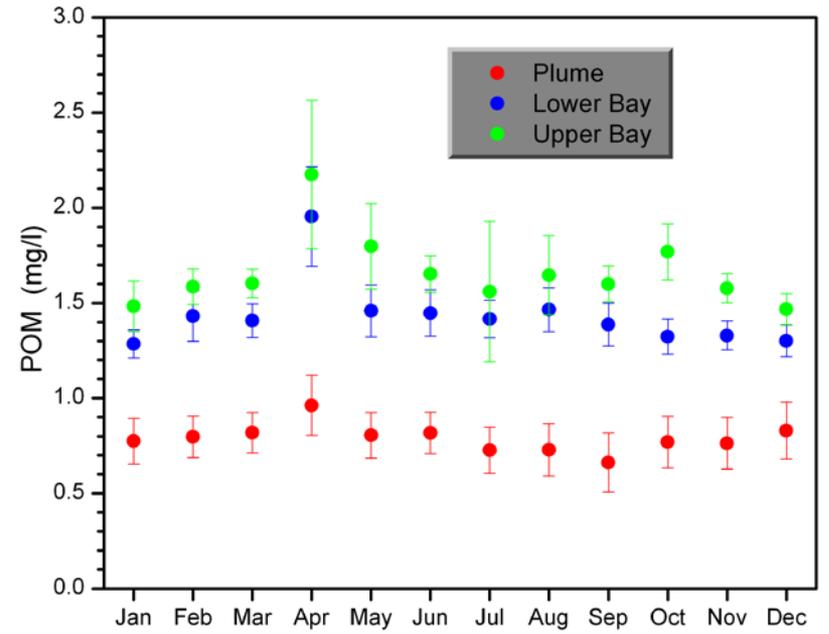
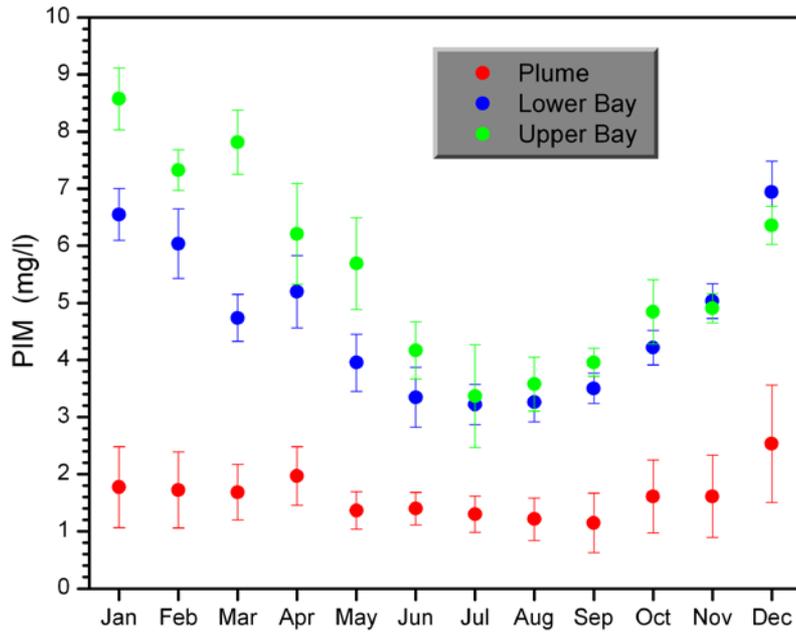
Time-Series Analysis – Within Bays

5-Year Monthly Averages (2005-2009), Mobile Bay



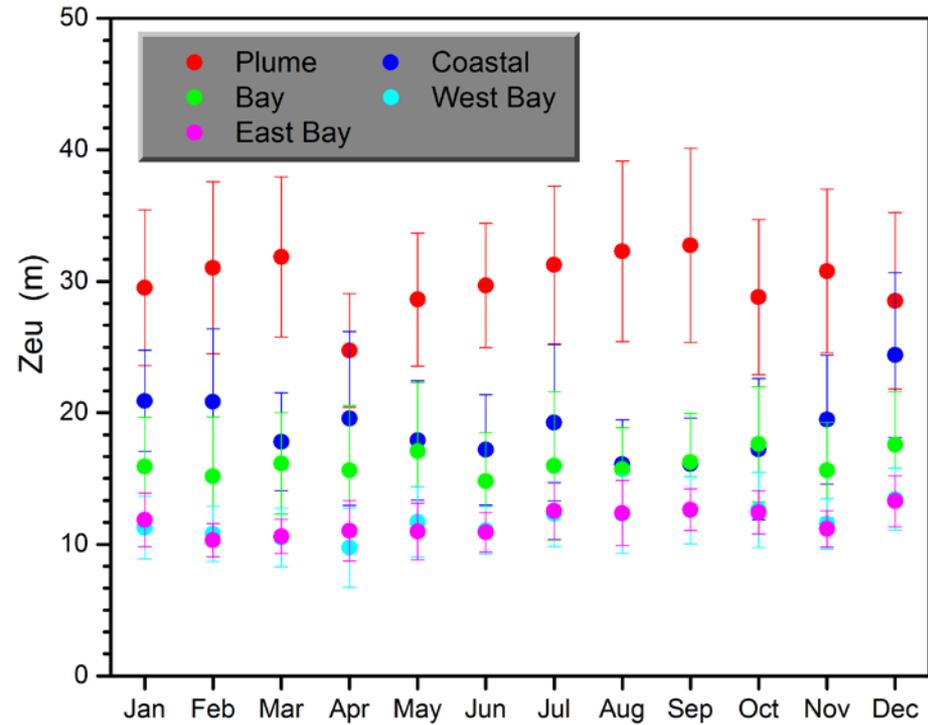
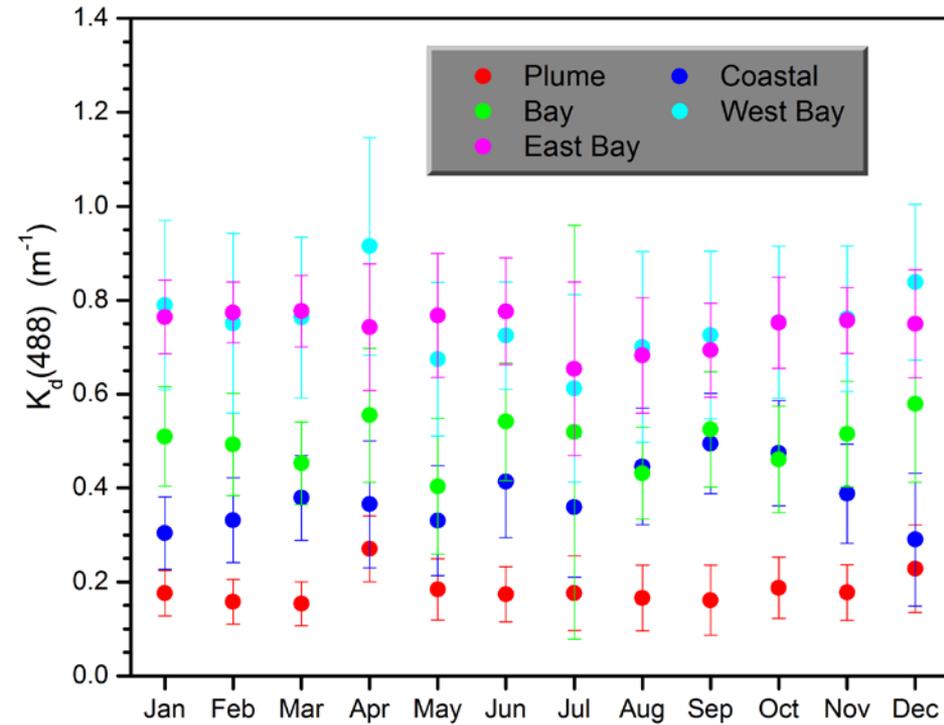
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5-Year Monthly Averages (2005-2009), Mobile Bay



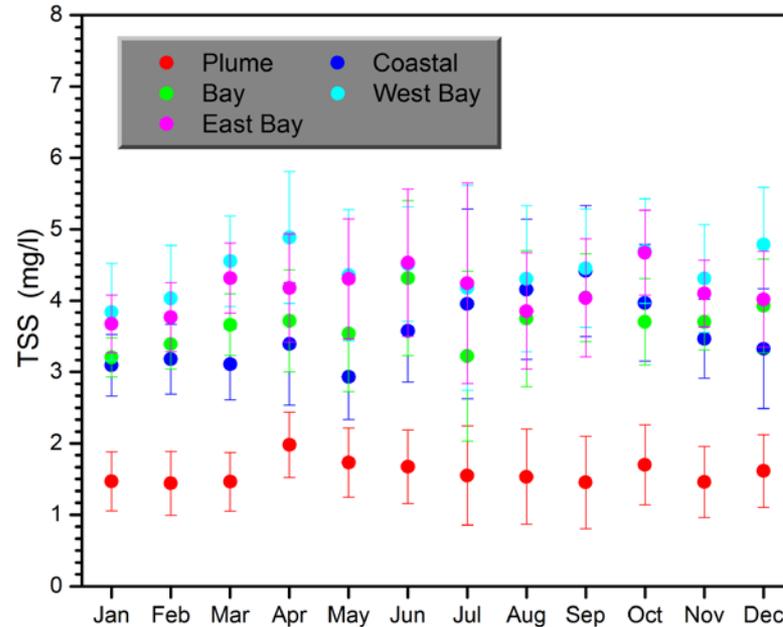
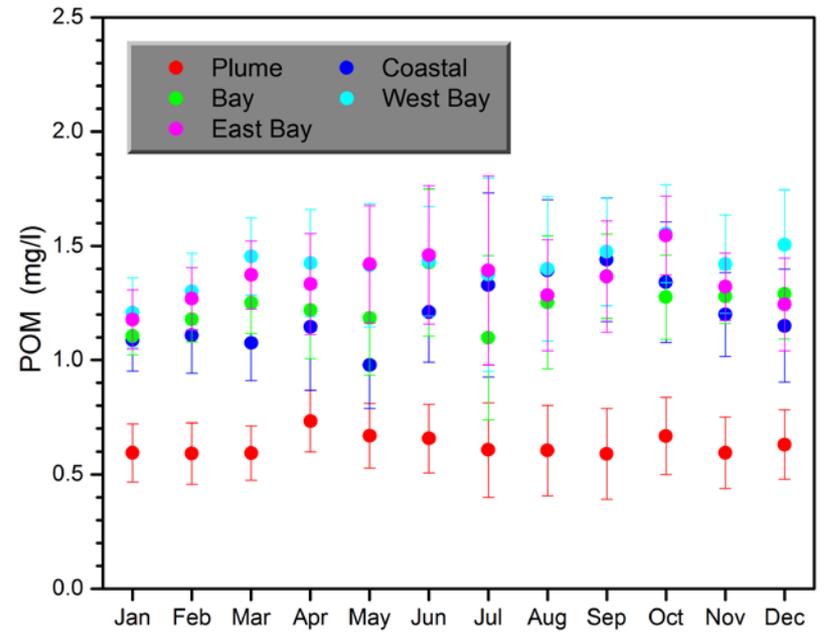
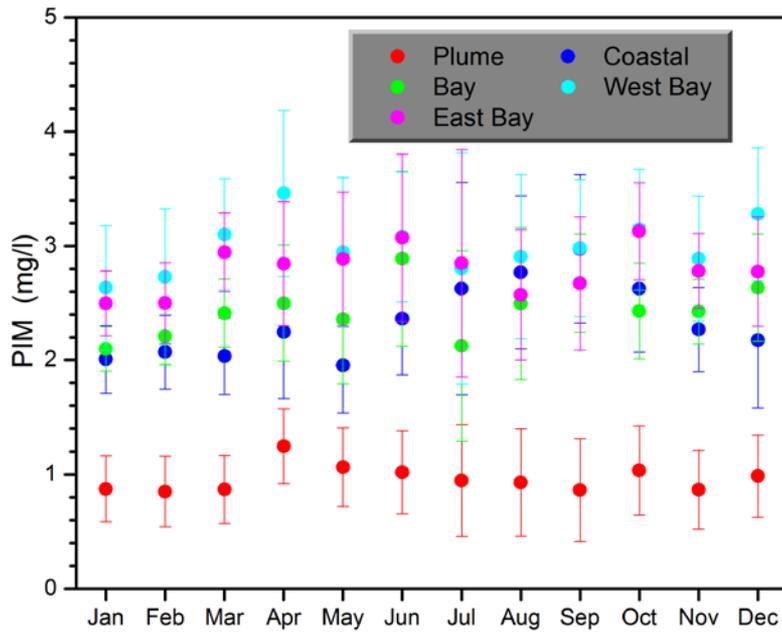
Time-Series Analysis – Within Bays

5-Year Monthly Averages (2005-2009), Pensacola Bay



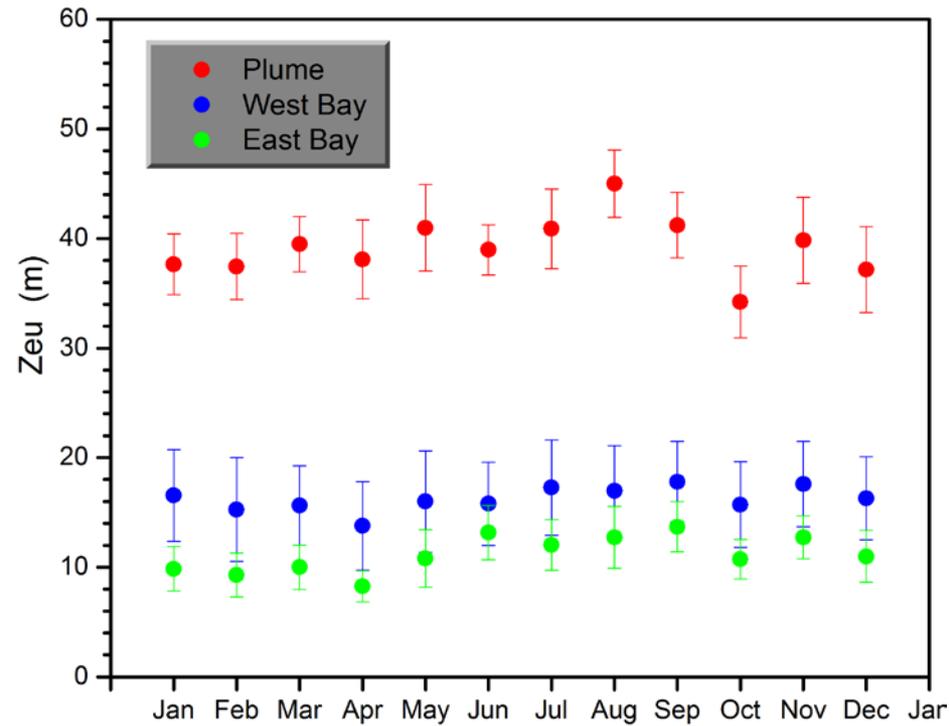
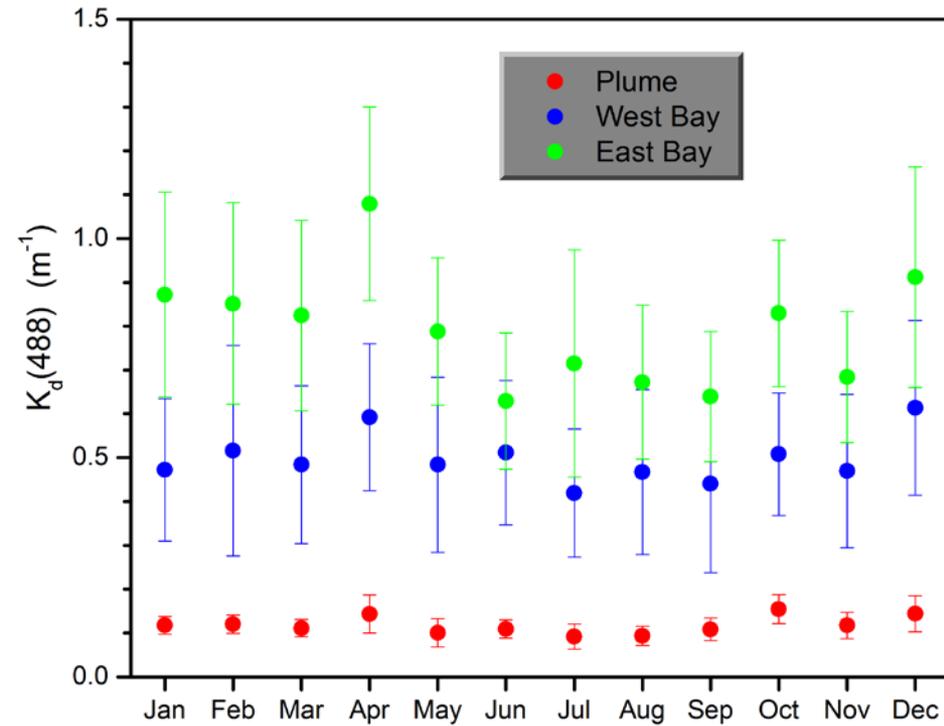
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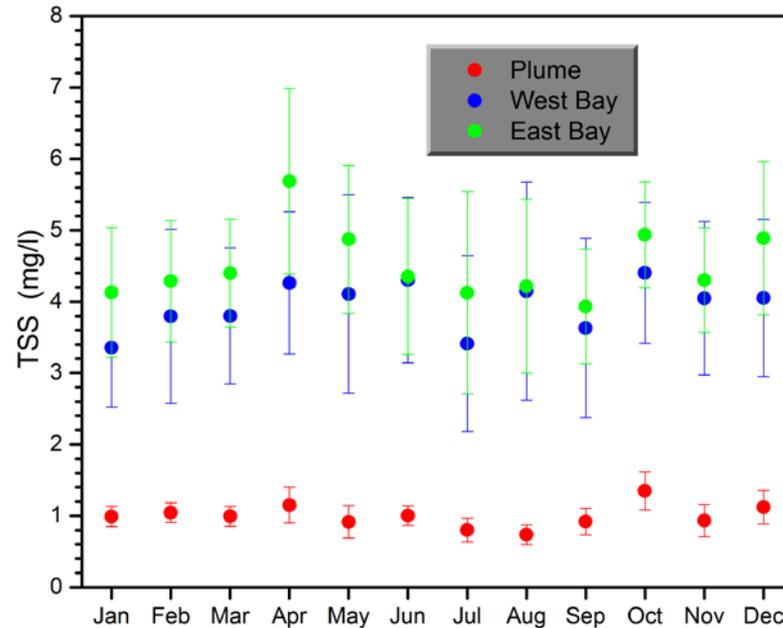
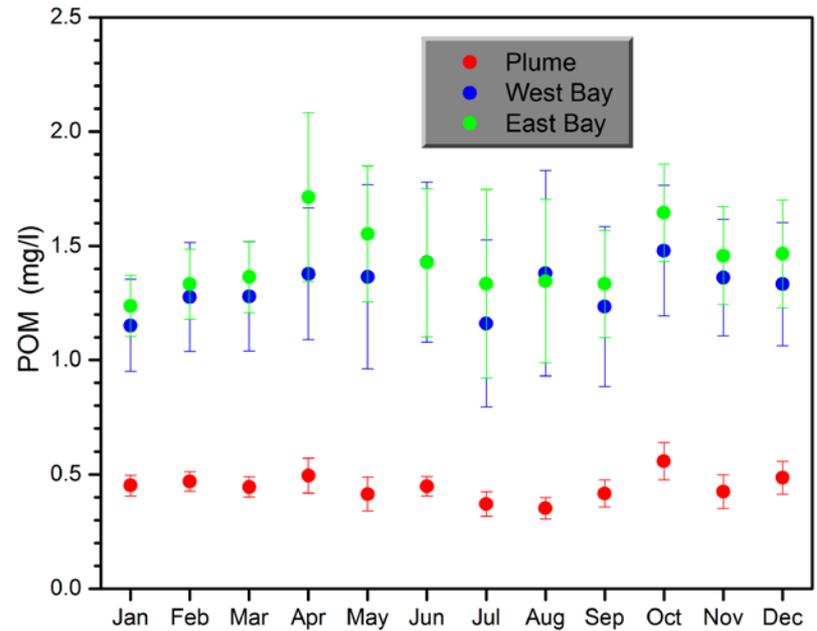
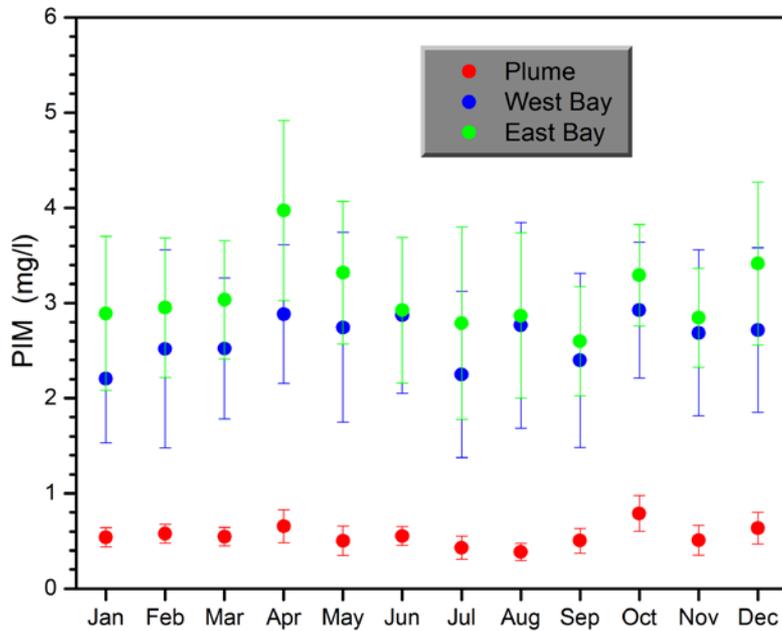
Time-Series Analysis – Within Bays

5-Year Monthly Averages (2005-2009), Choctawhatchee Bay



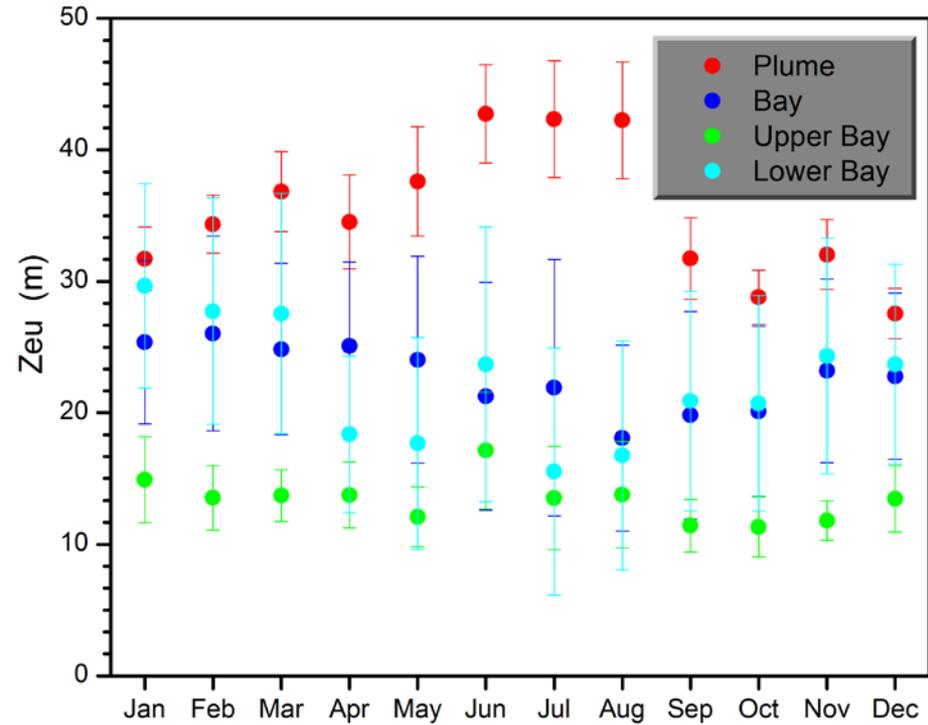
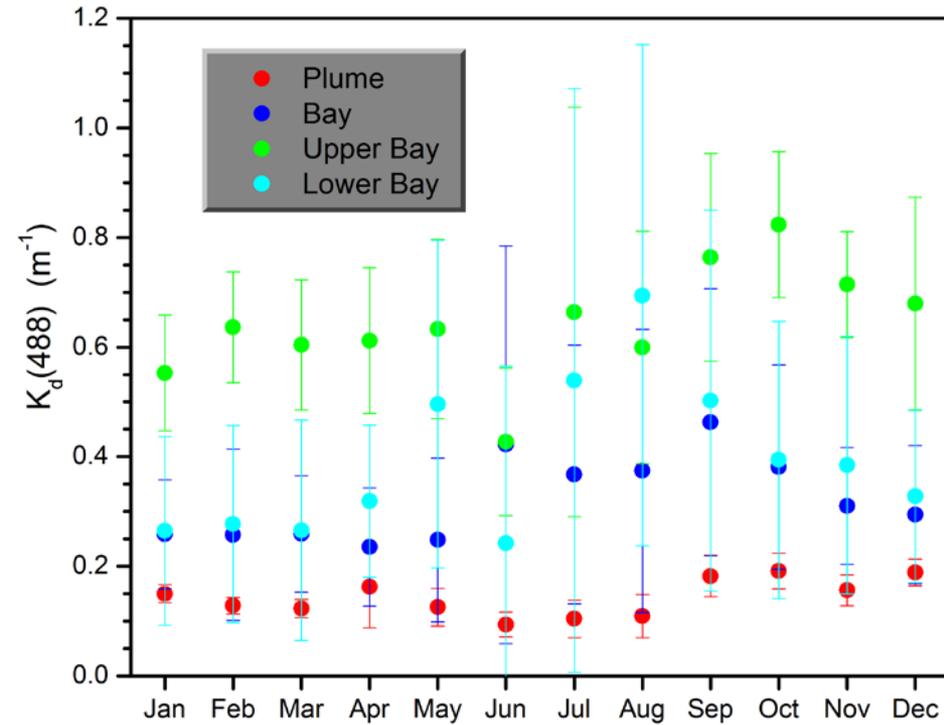
Time-Series Analysis – Within Bays

5-Year Monthly Averages (2005-2009), Choctawhatchee Bay



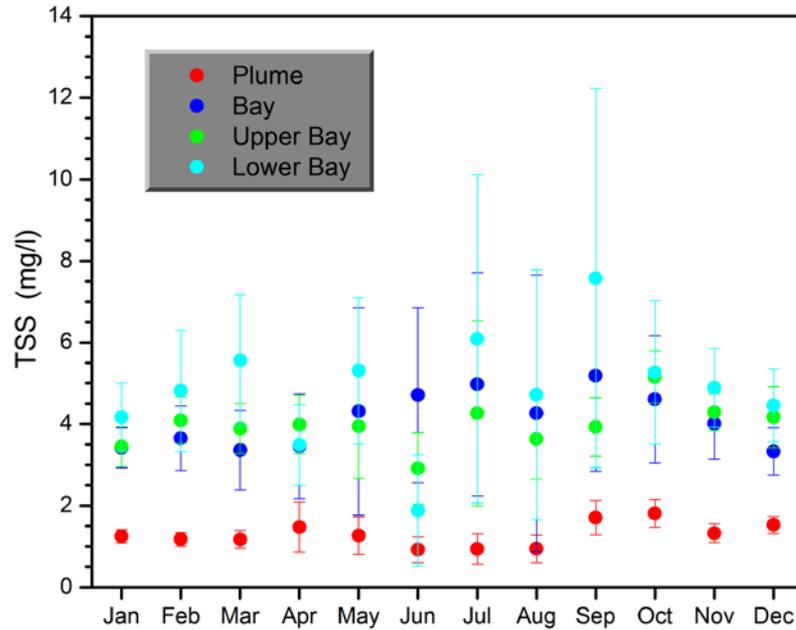
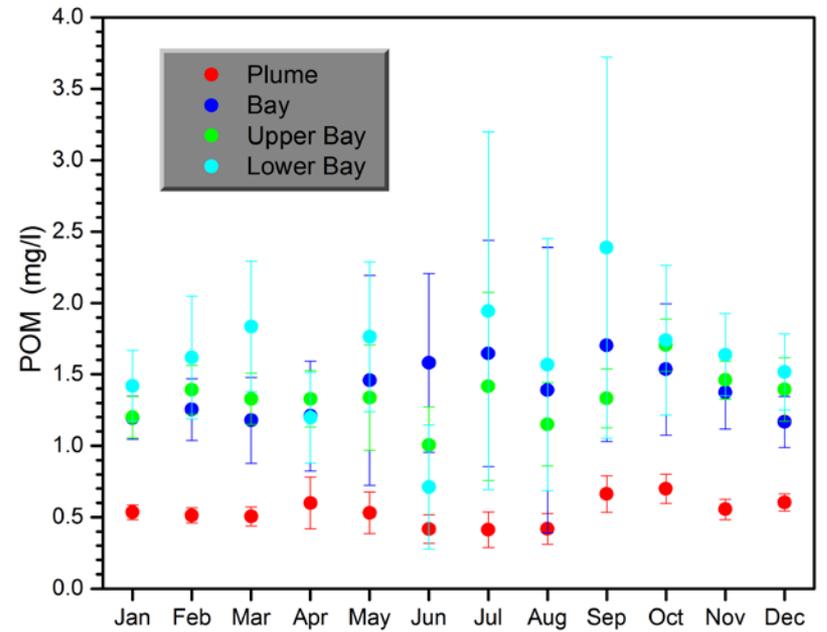
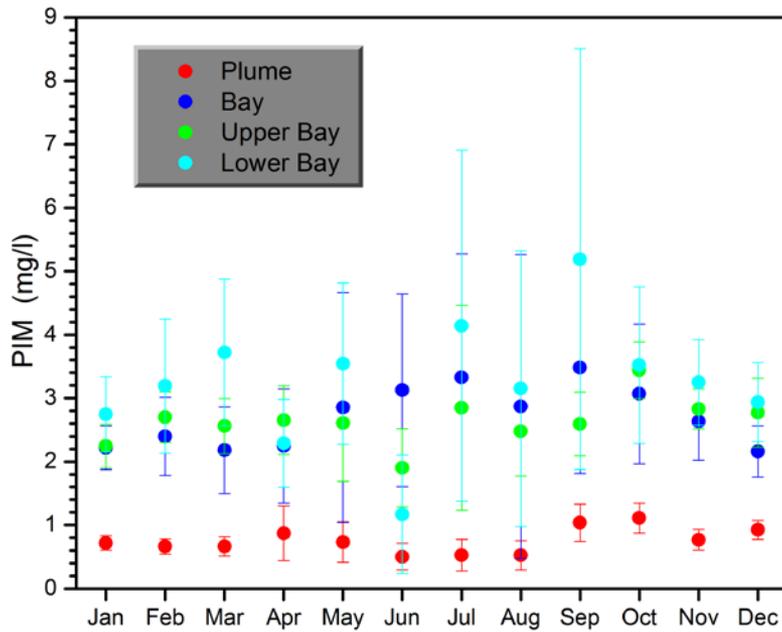
Time-Series Analysis – Within Bays

5-Year Monthly Averages (2005-2009), St. Andrew Bay



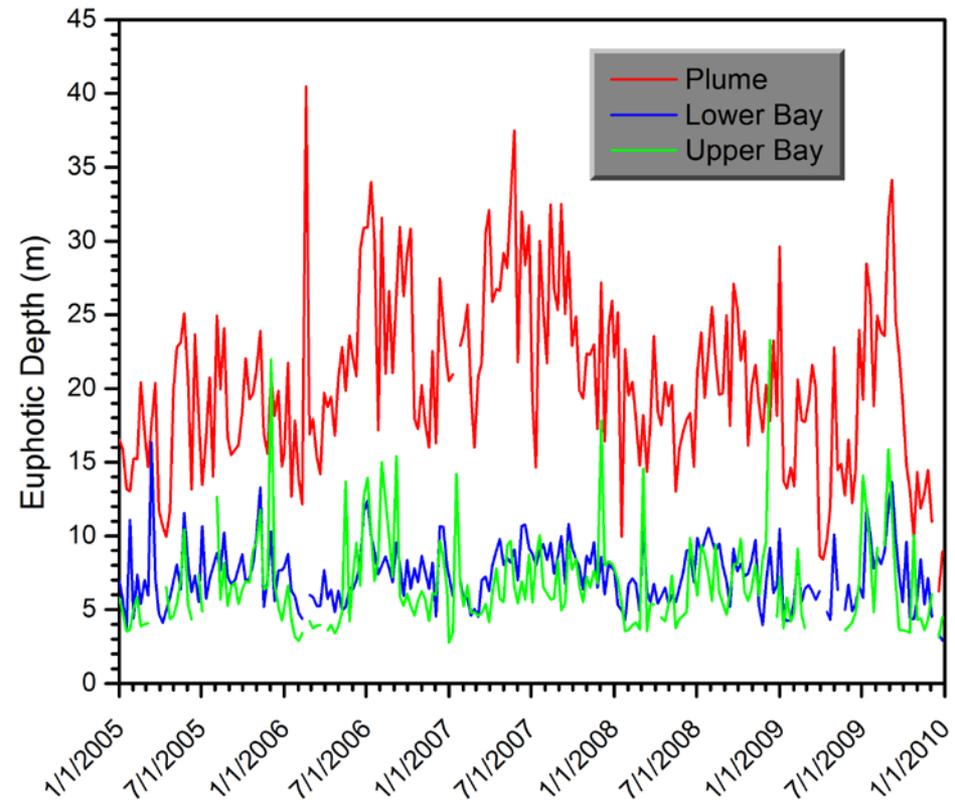
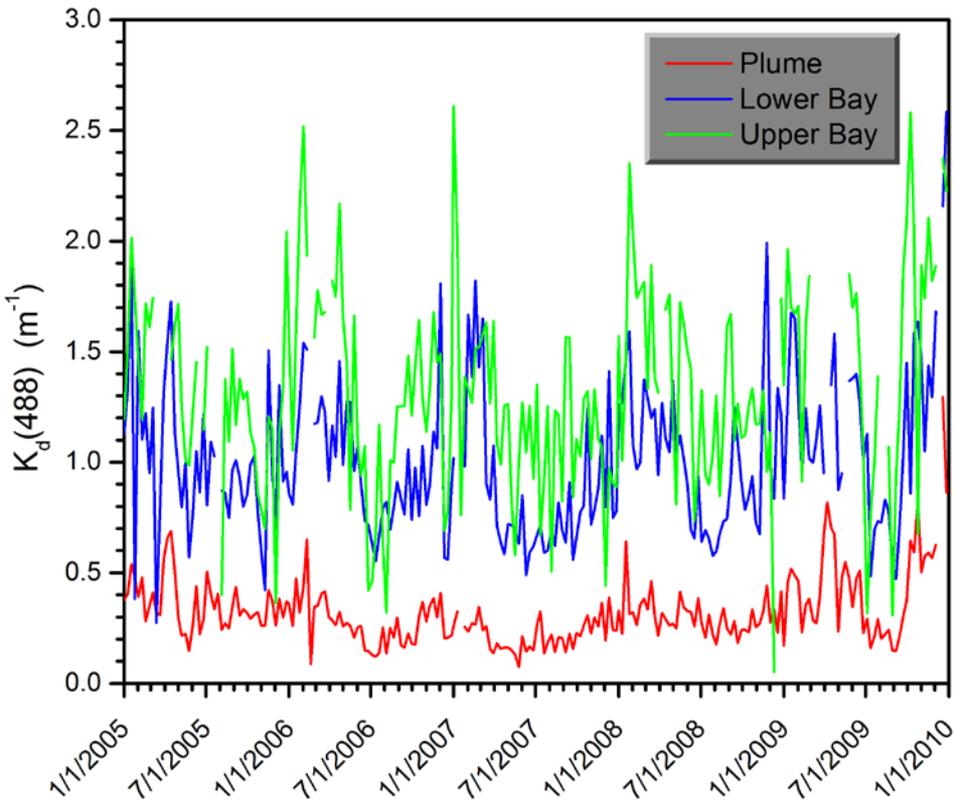
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5-Year Monthly Averages (2005-2009), St. Andrew Bay



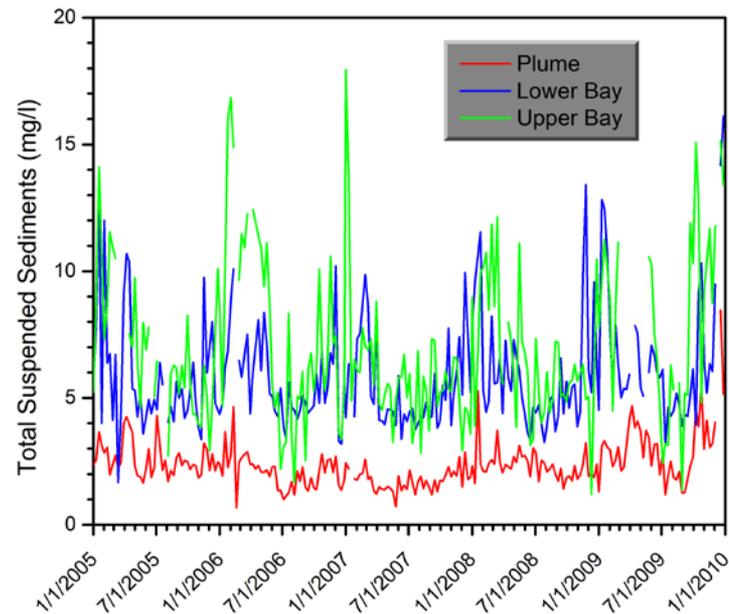
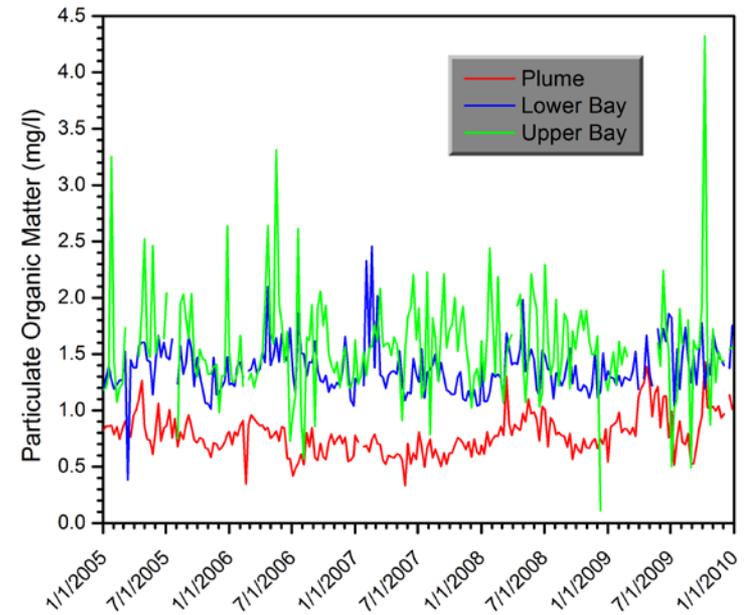
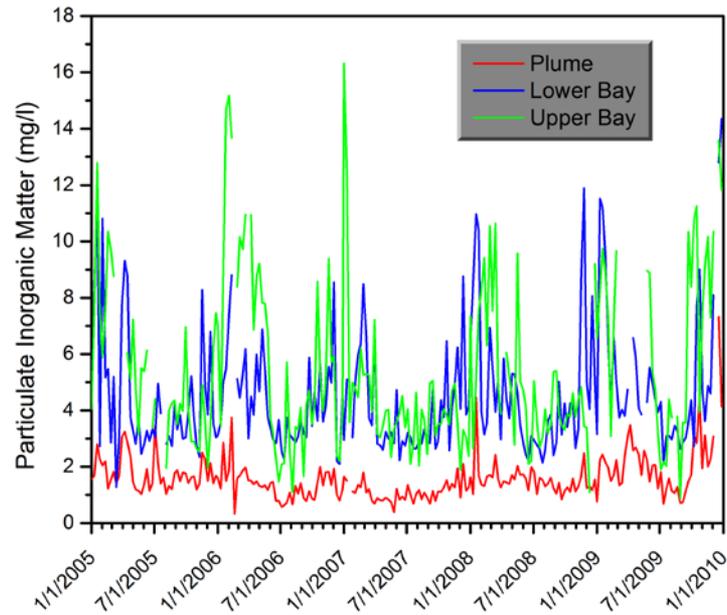
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Mobile Bay



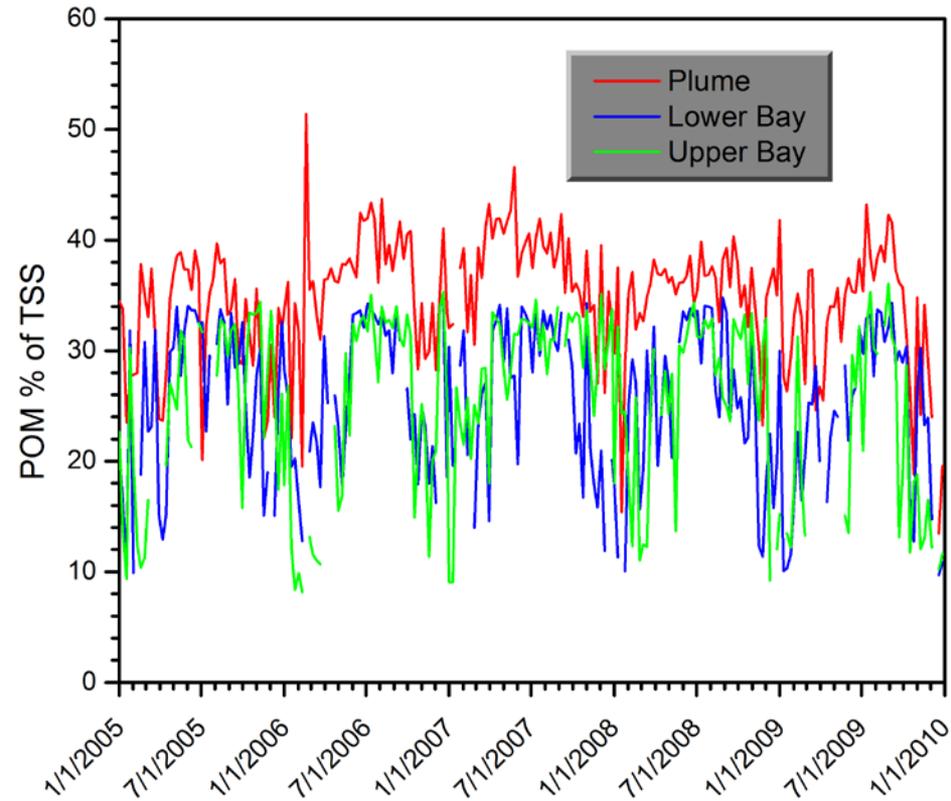
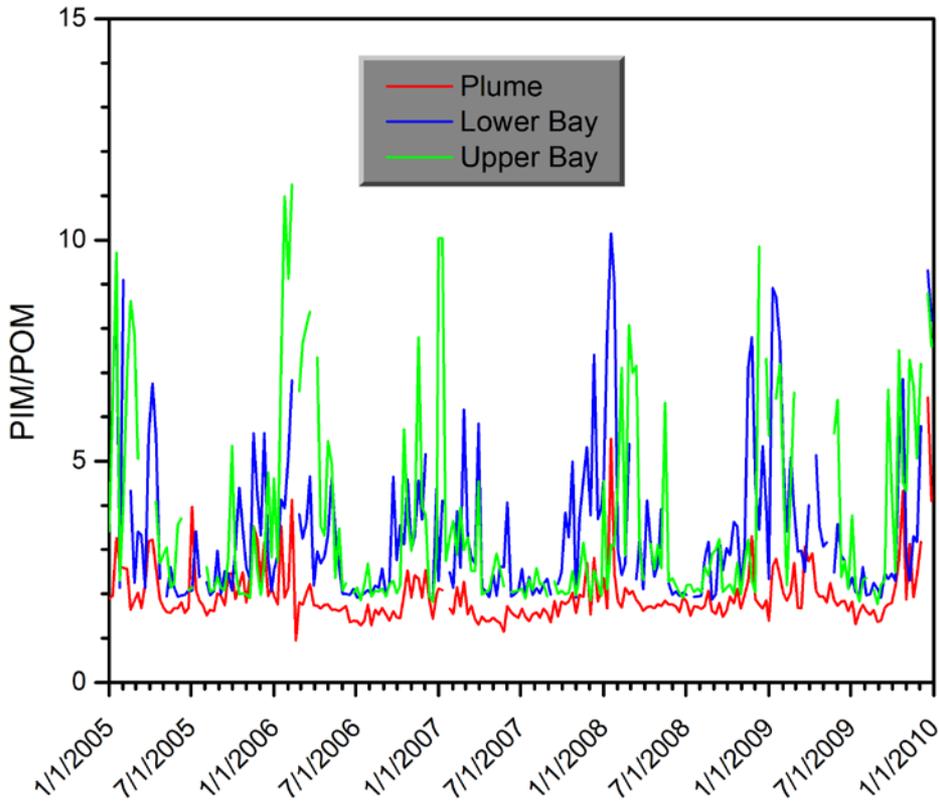
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Weekly Averages For 5 Years (1/1/05-12/31/09), Mobile Bay



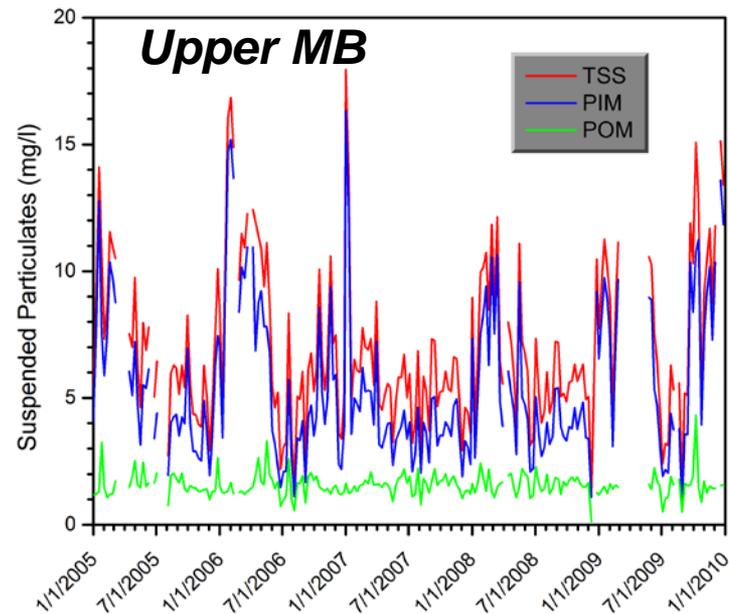
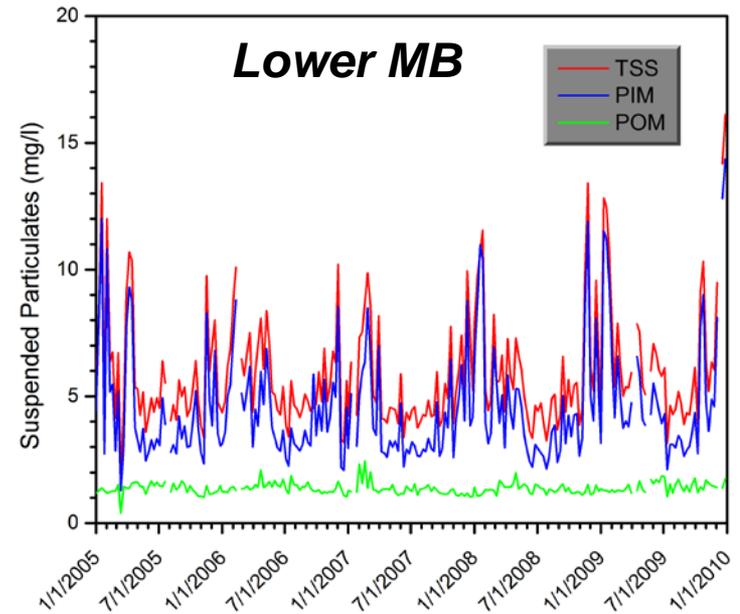
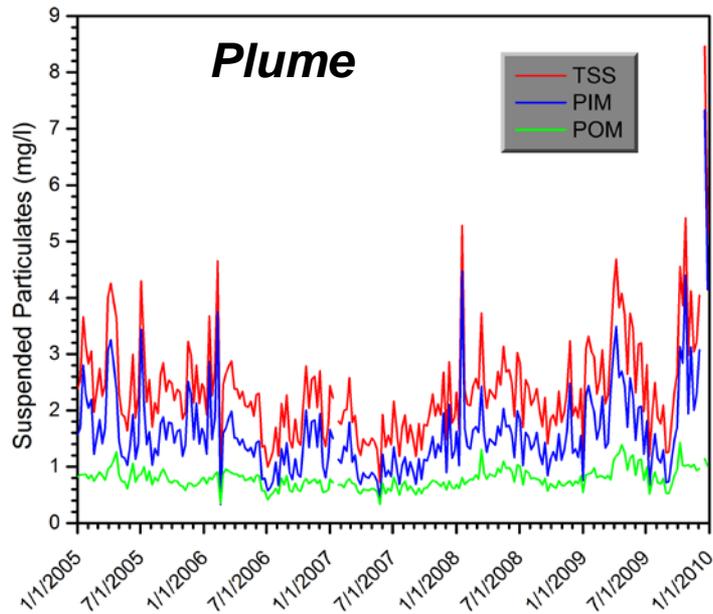
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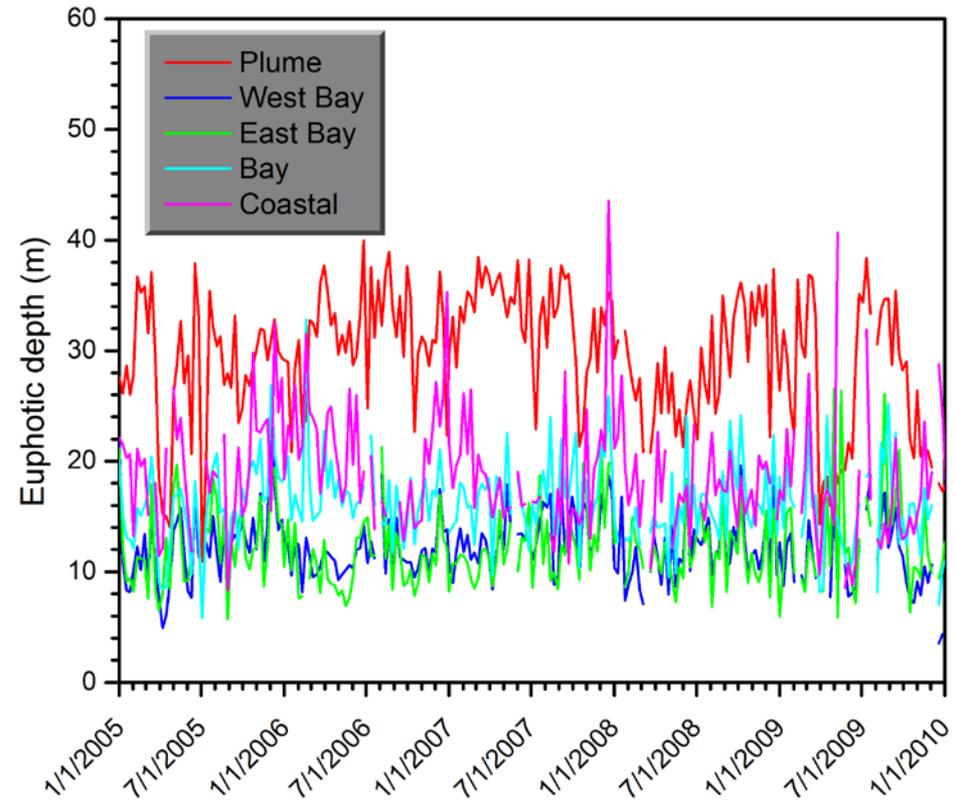
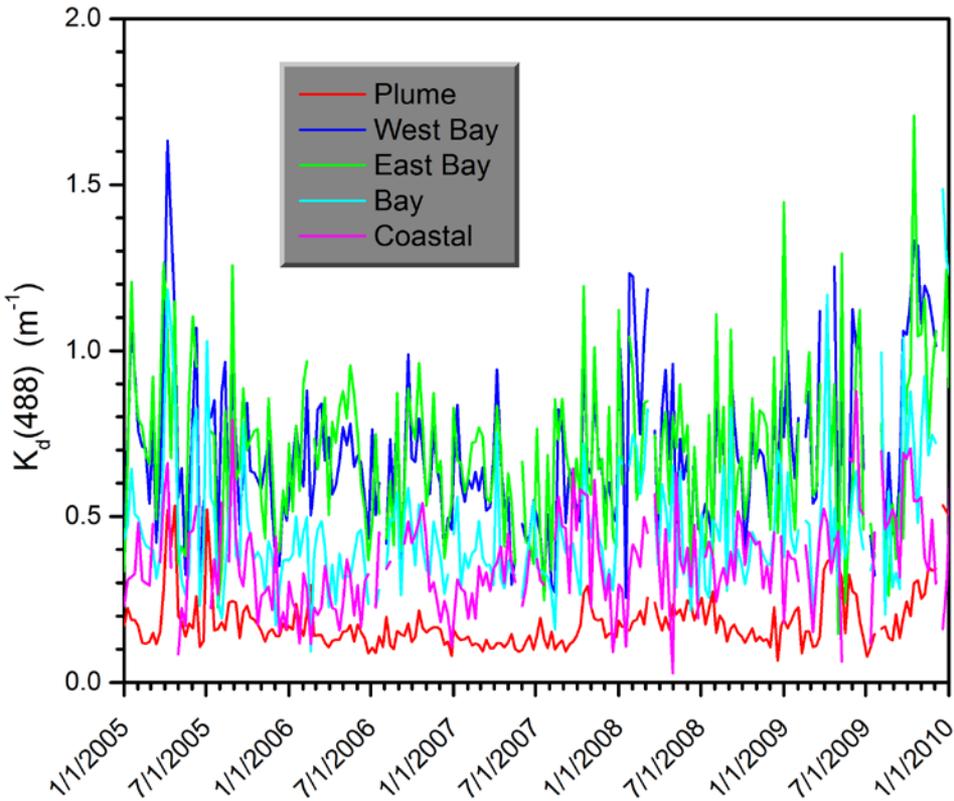
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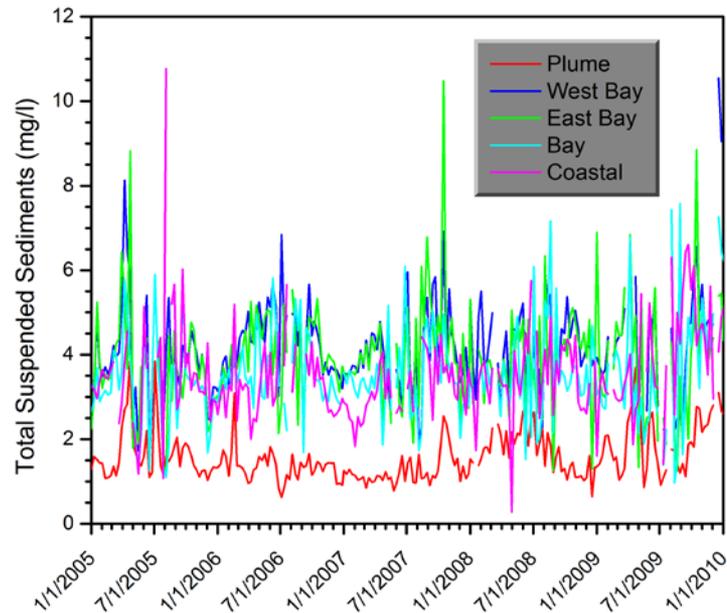
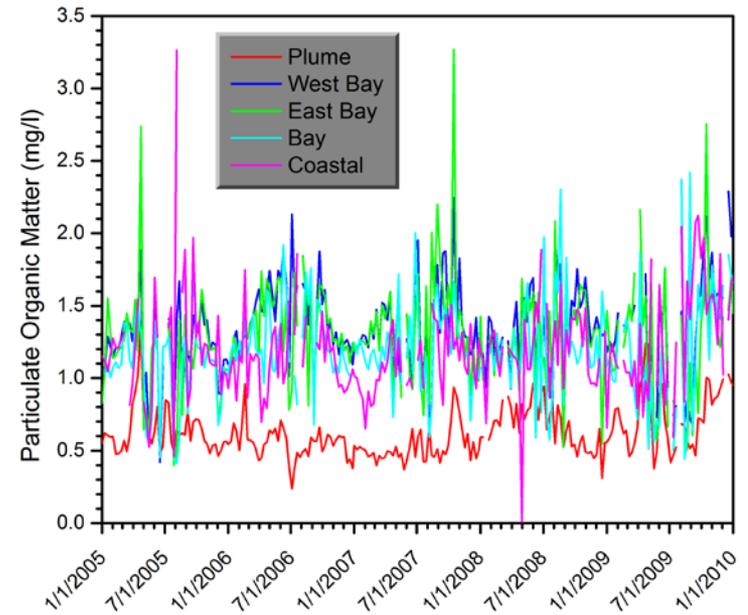
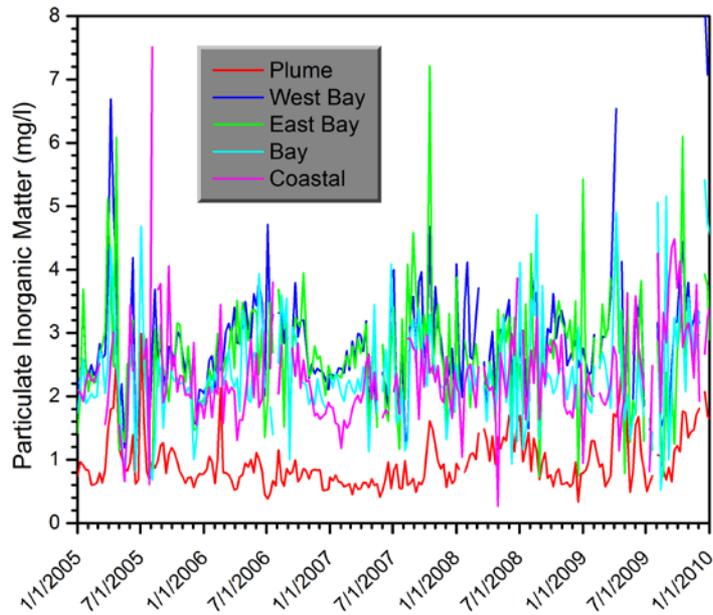
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Pensacola Bay



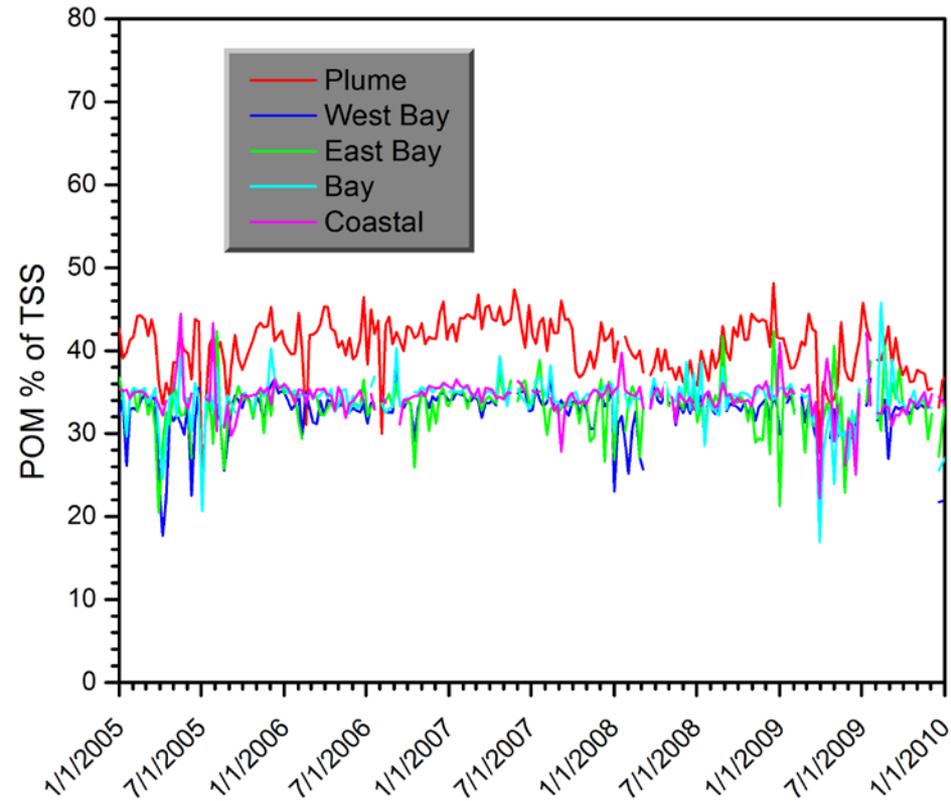
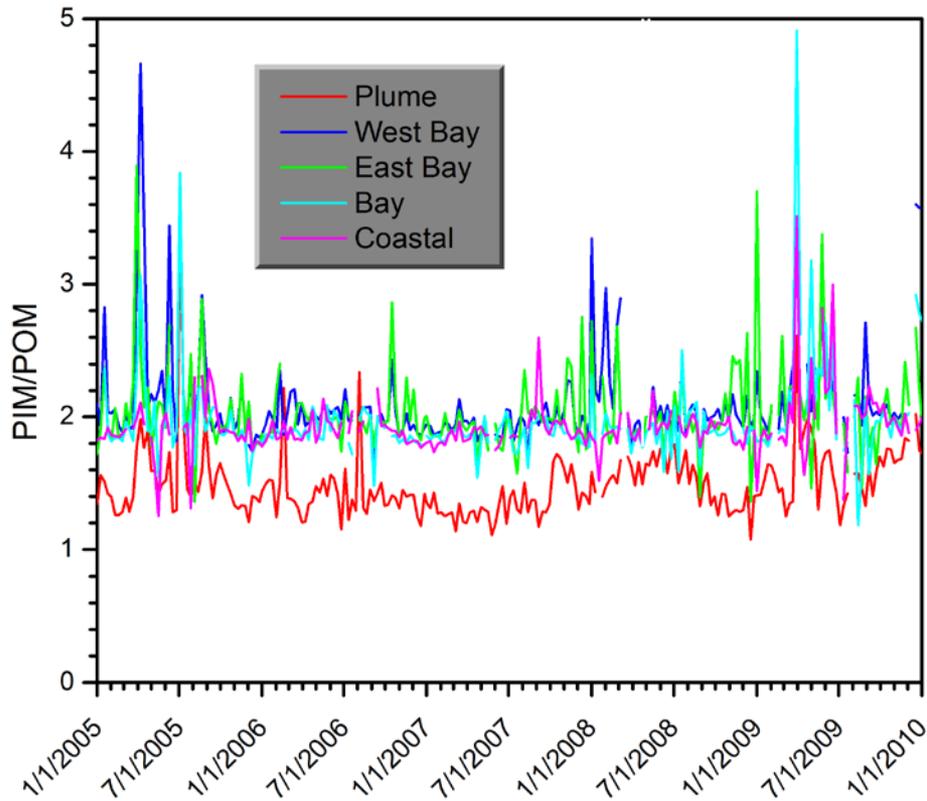
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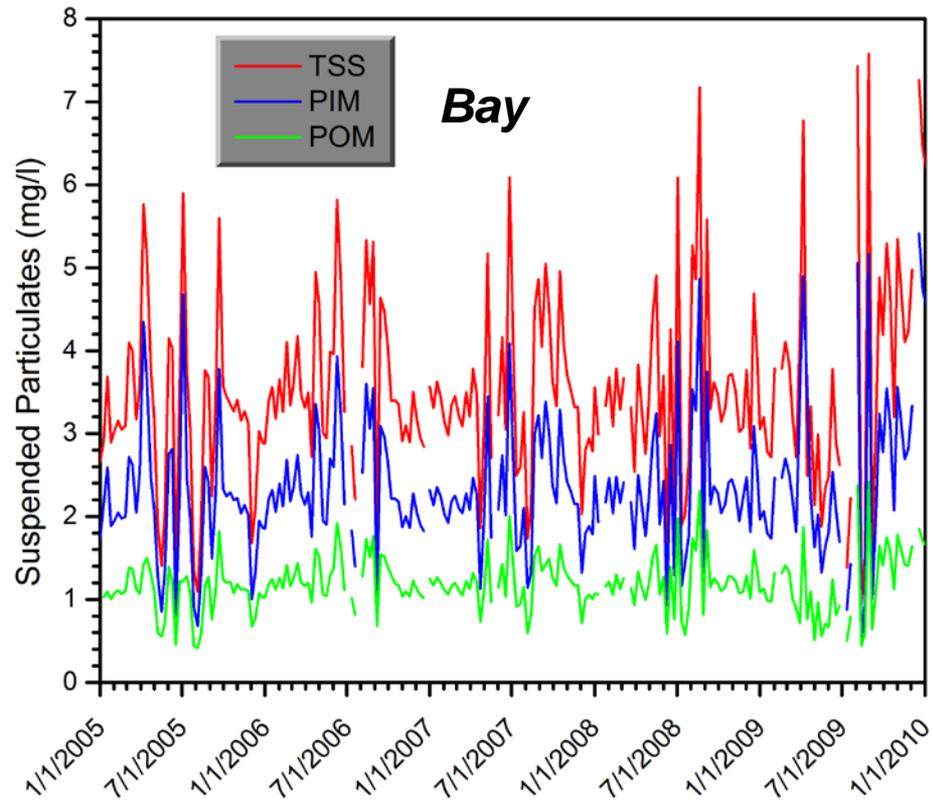
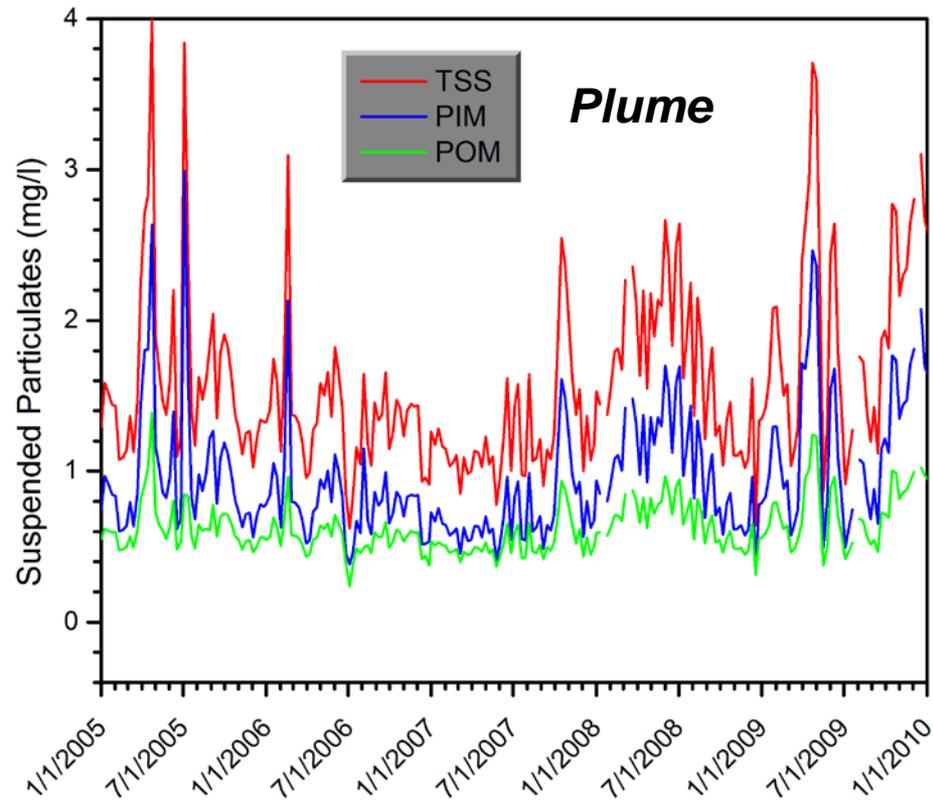
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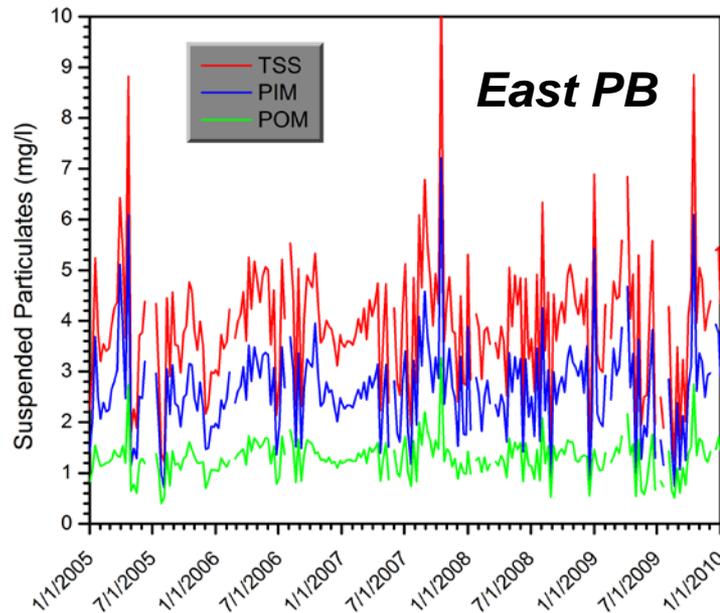
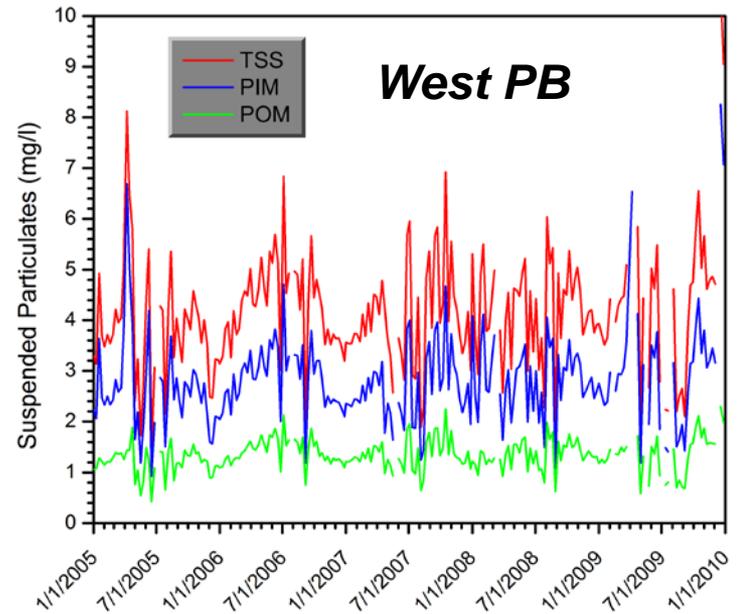
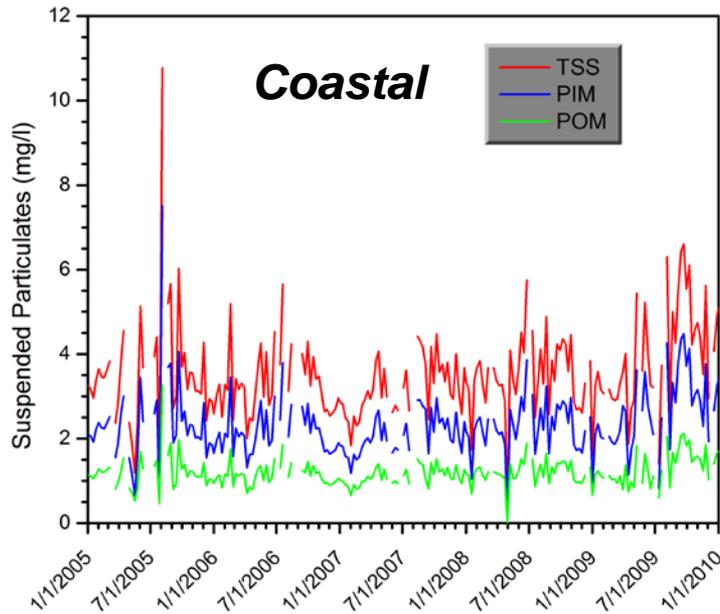
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Weekly Averages For 5 Years (1/1/05-12/31/09), Pensacola Bay



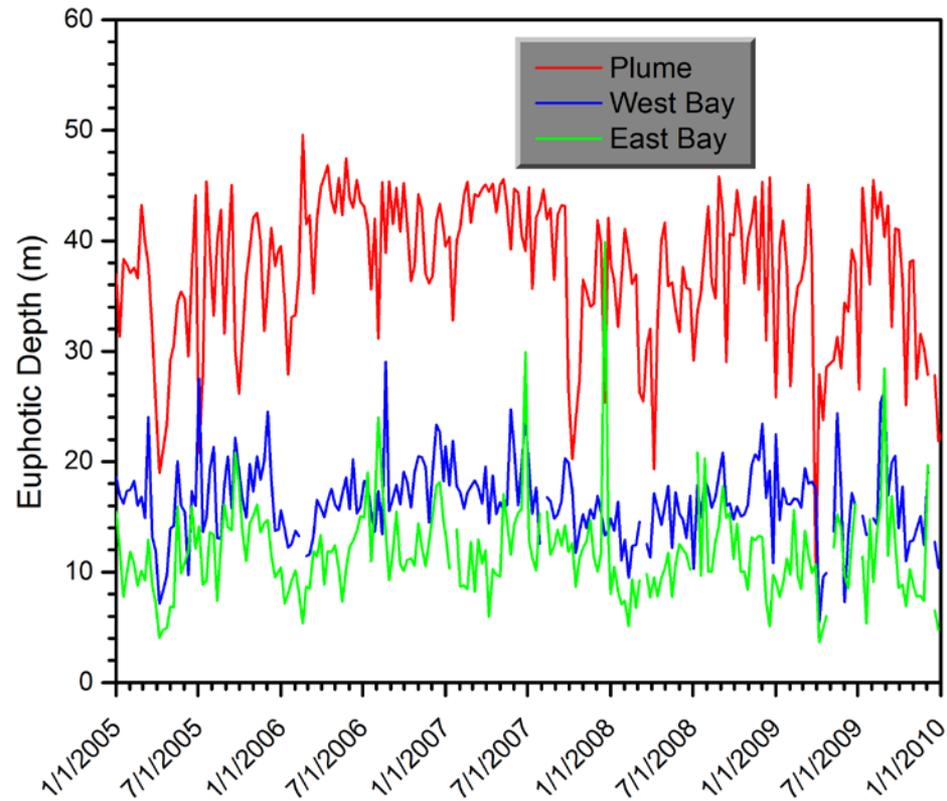
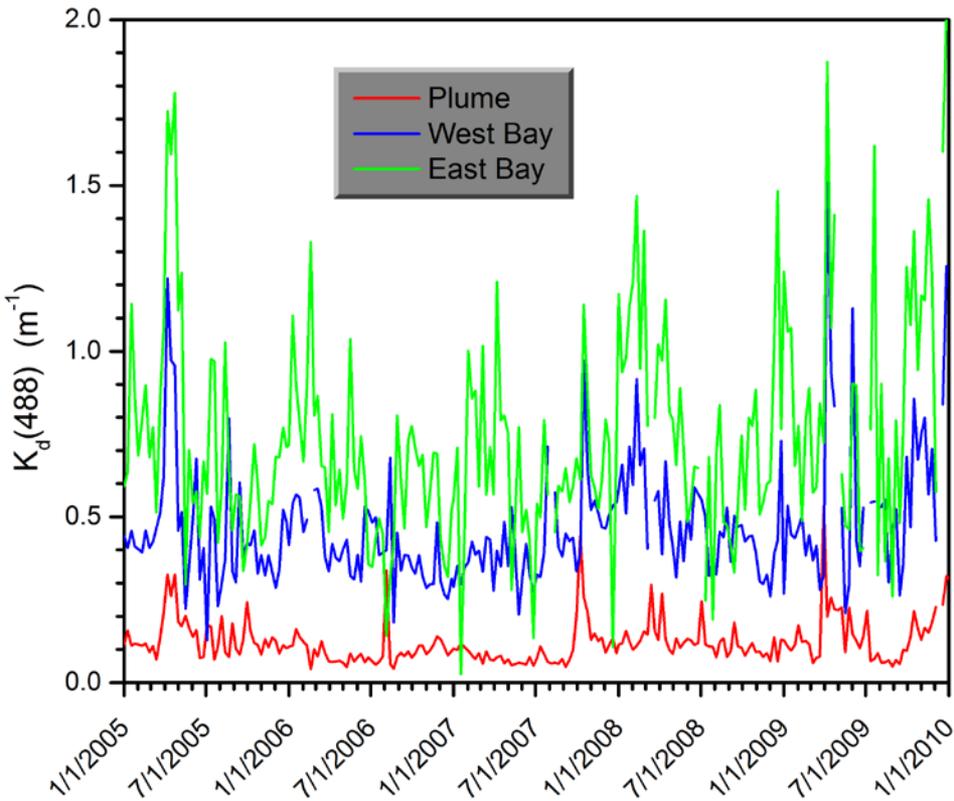
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Pensacola Bay



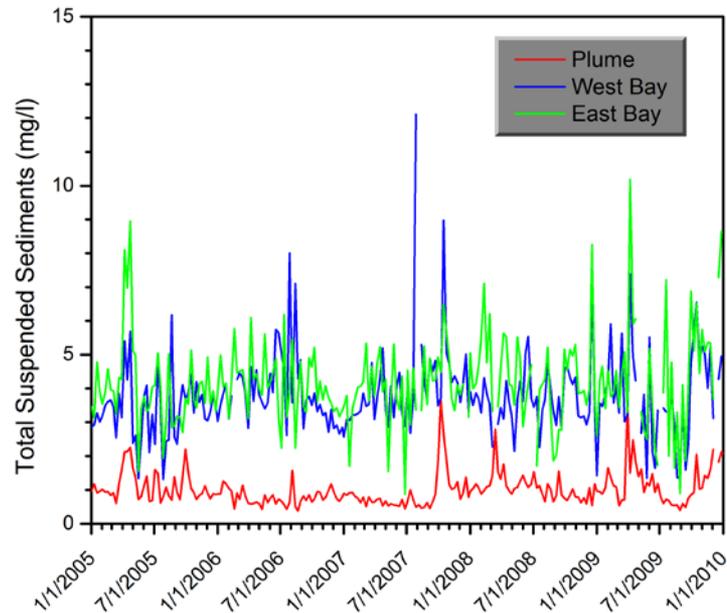
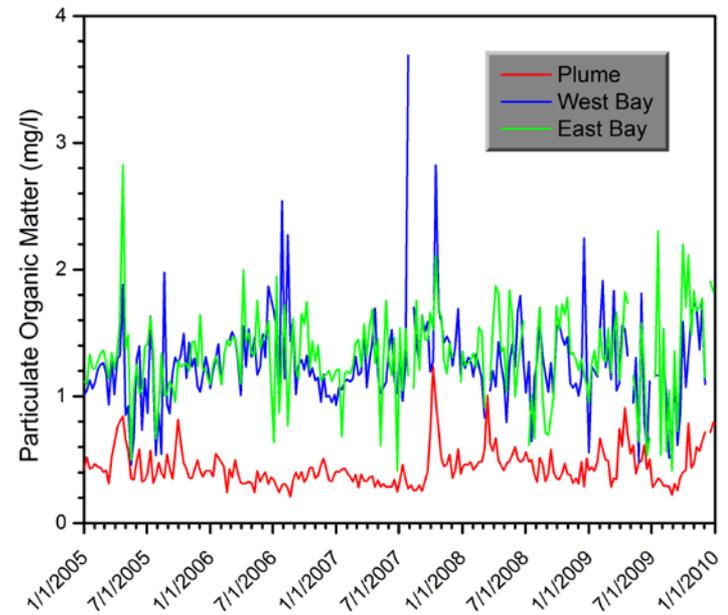
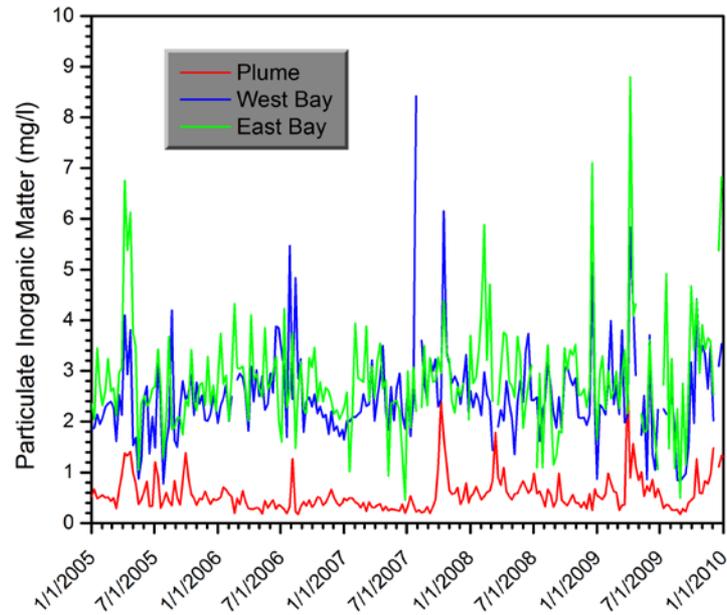
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Choctawhatchee Bay



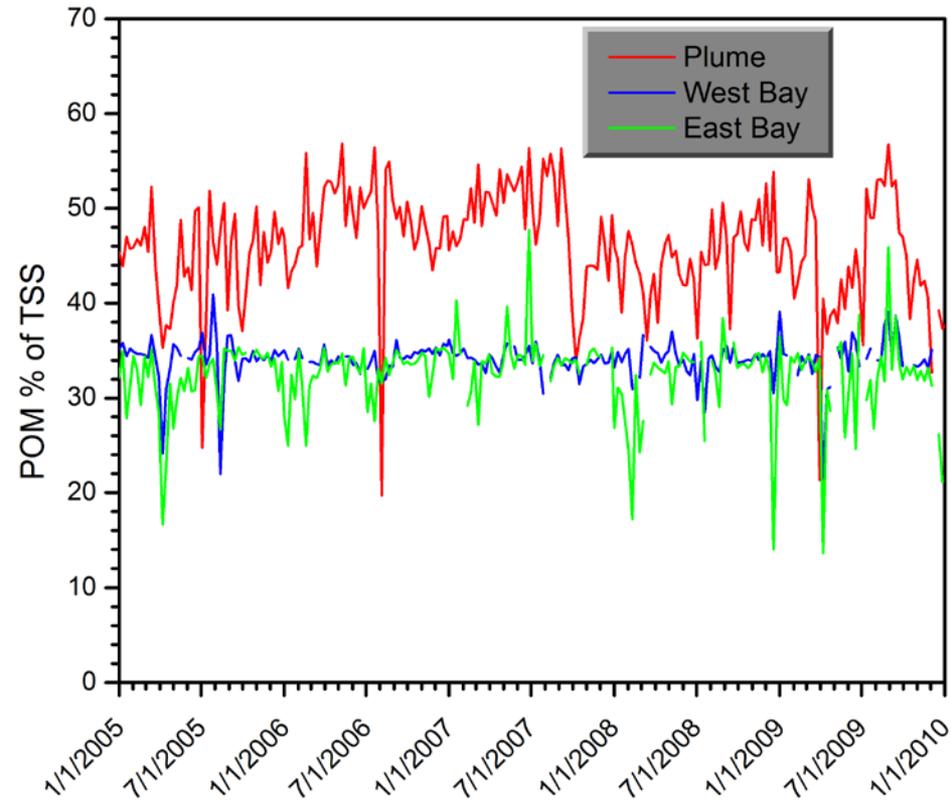
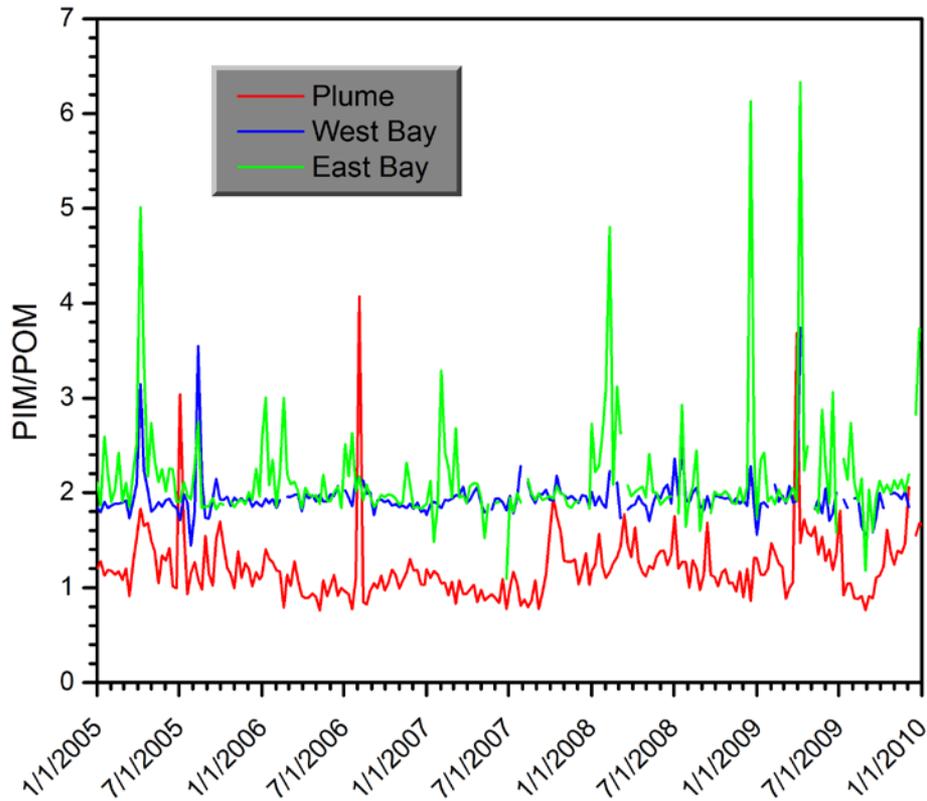
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Choctawhatchee Bay



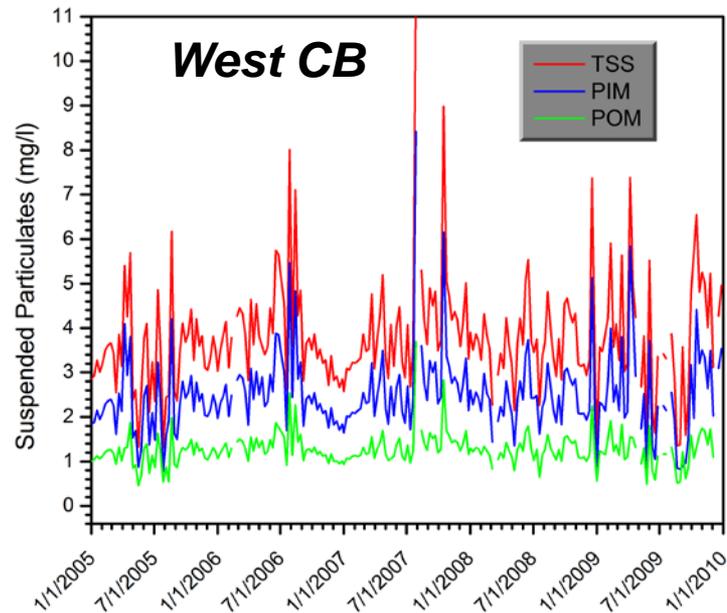
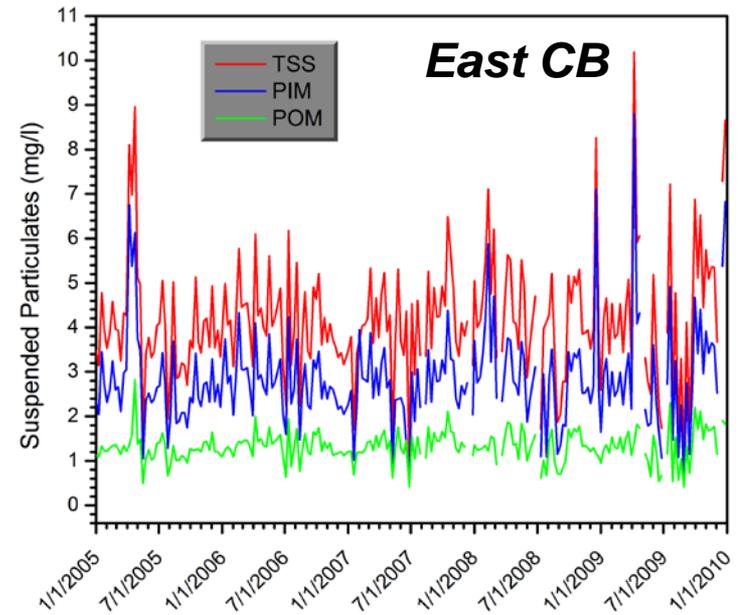
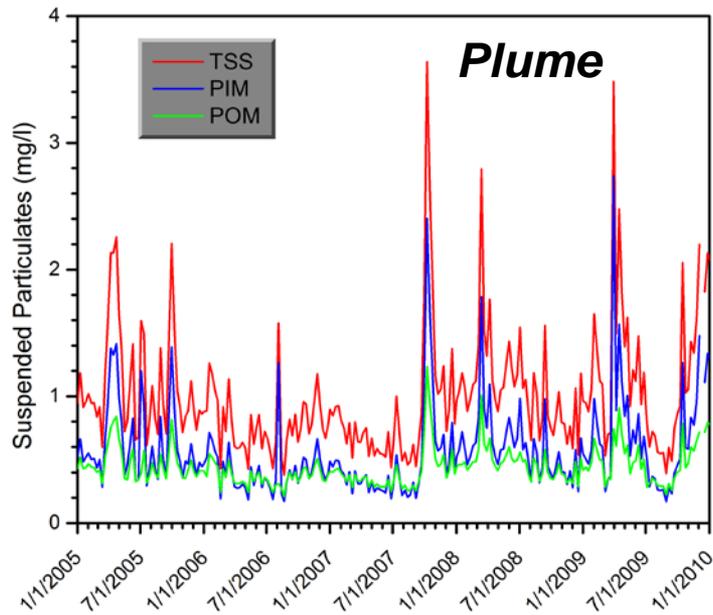
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Choctawhatchee Bay



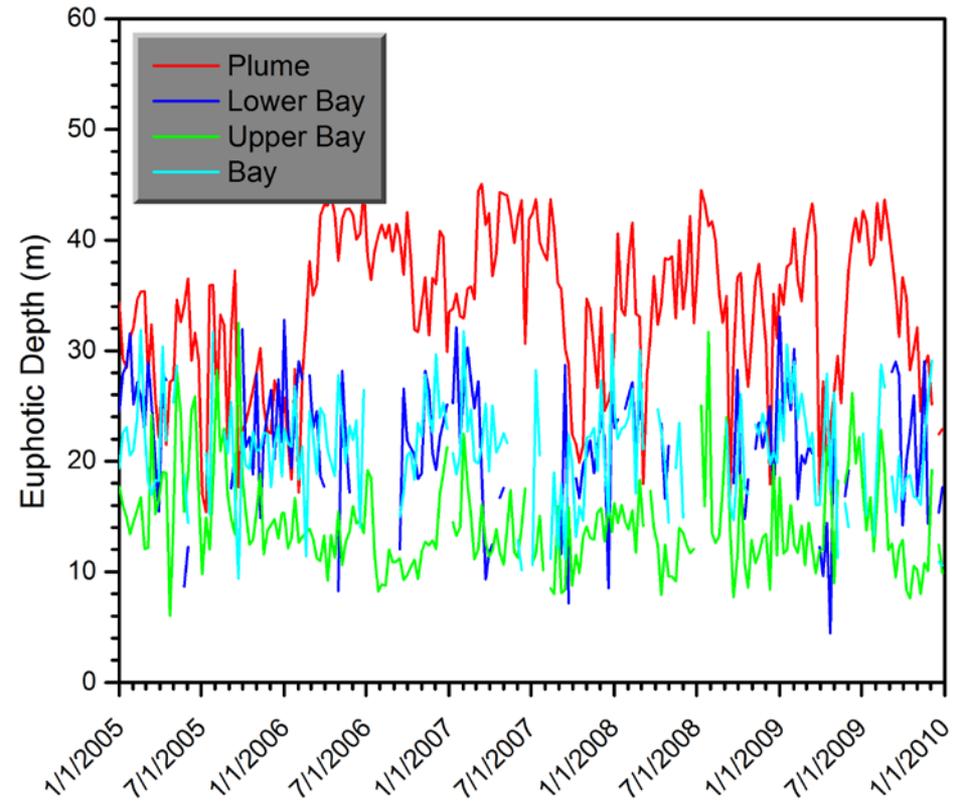
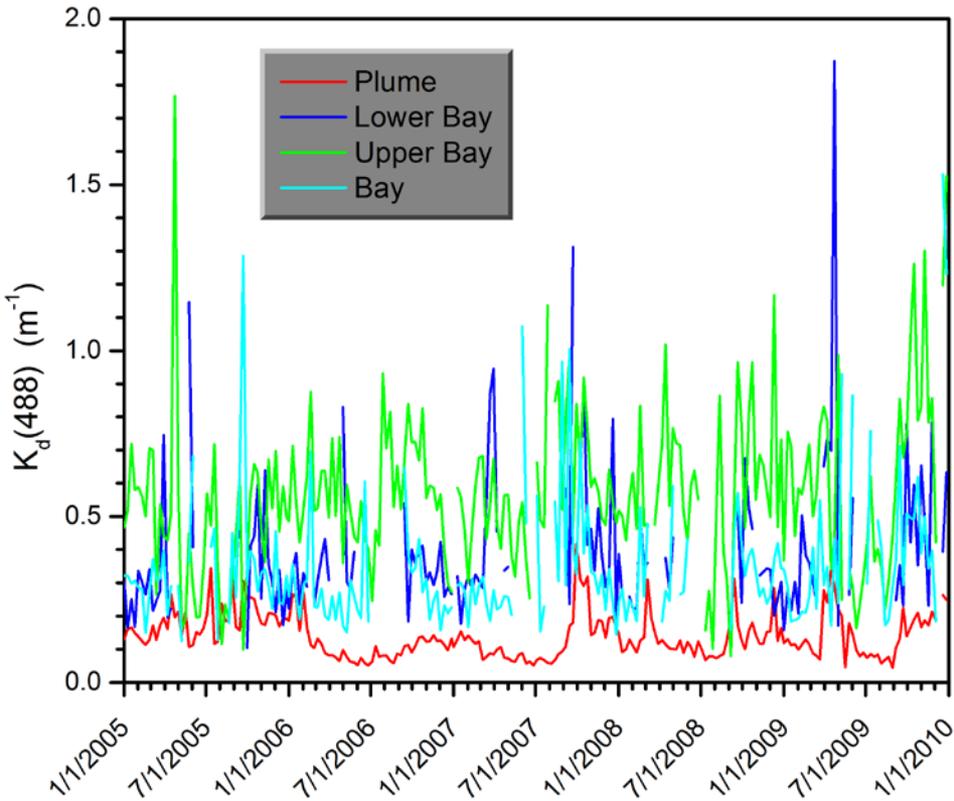
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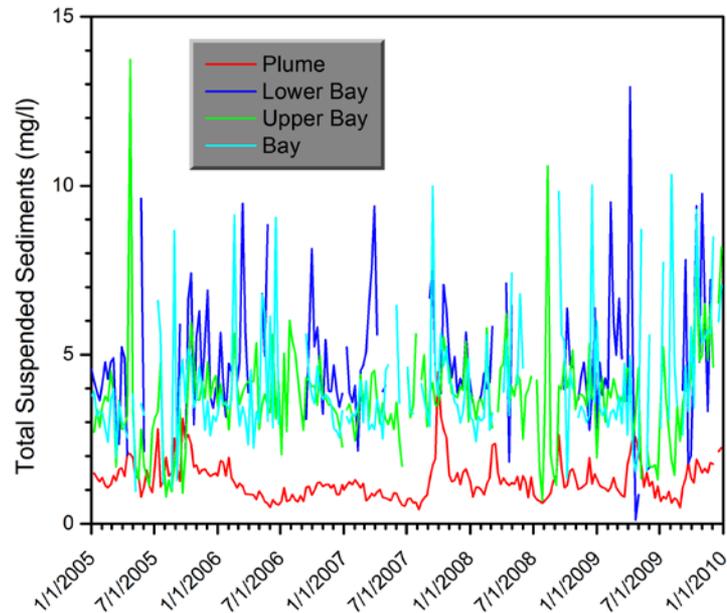
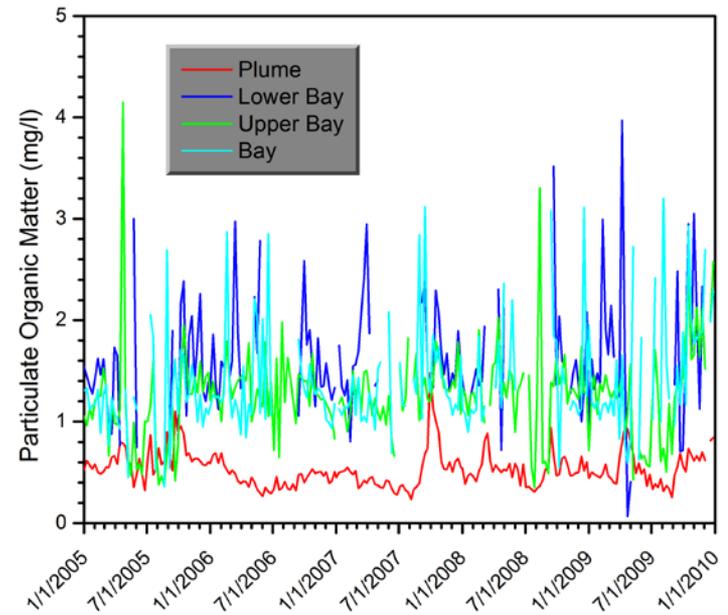
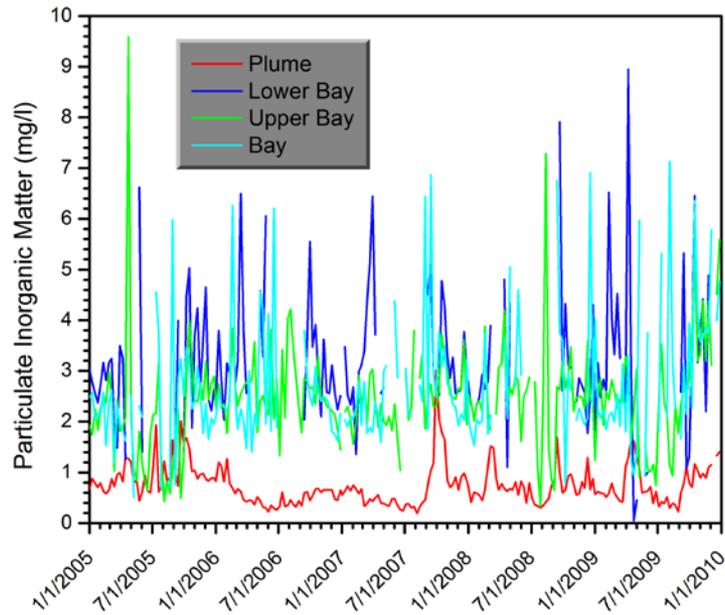
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Weekly Averages For 5 Years (1/1/05-12/31/09), St. Andrew Bay



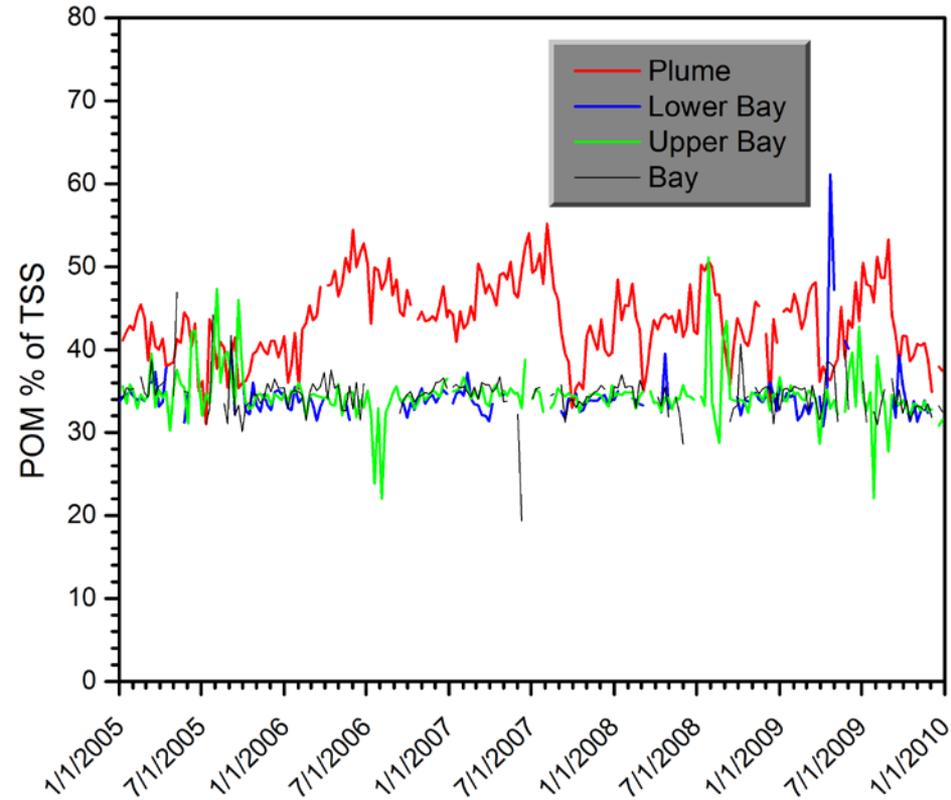
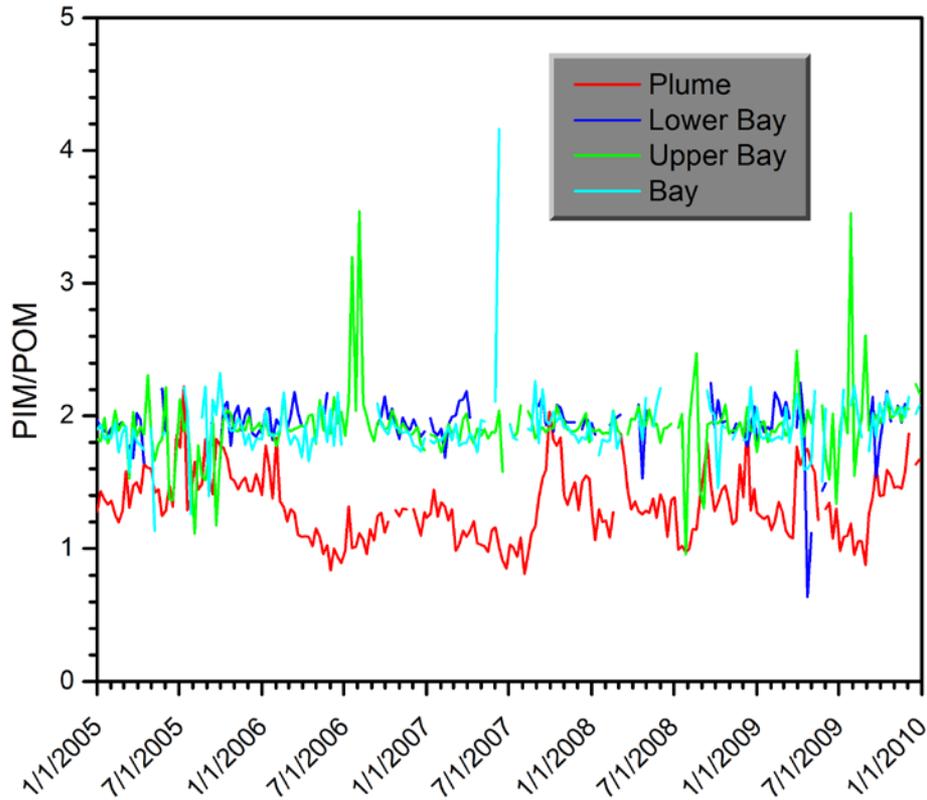
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), St. Andrew Bay



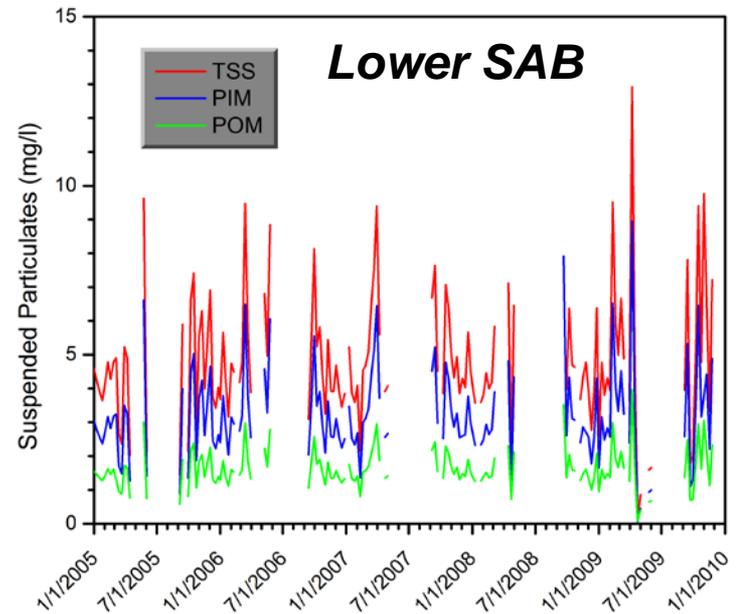
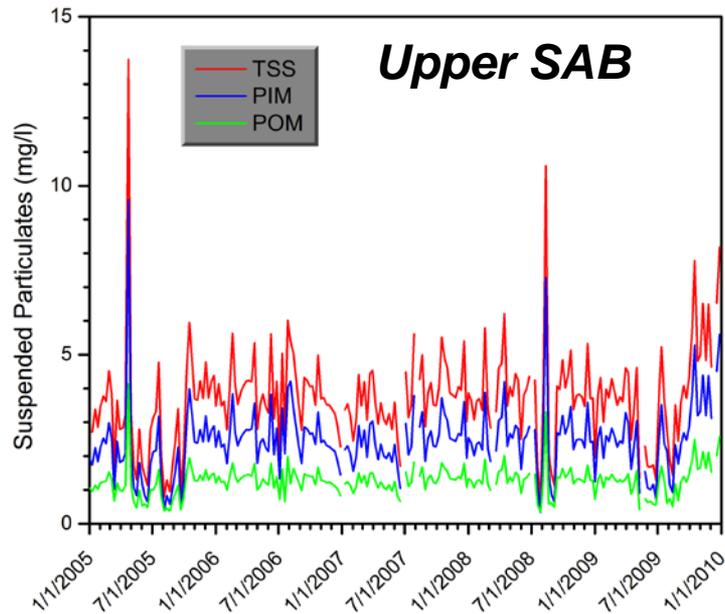
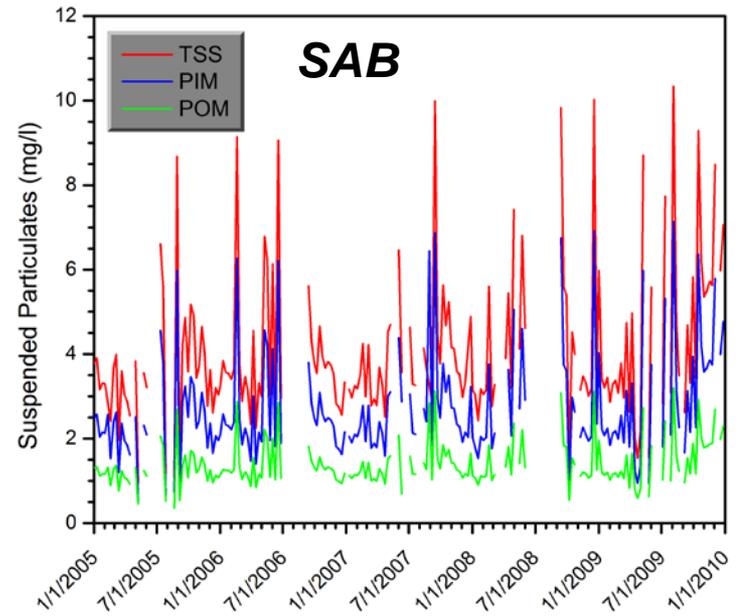
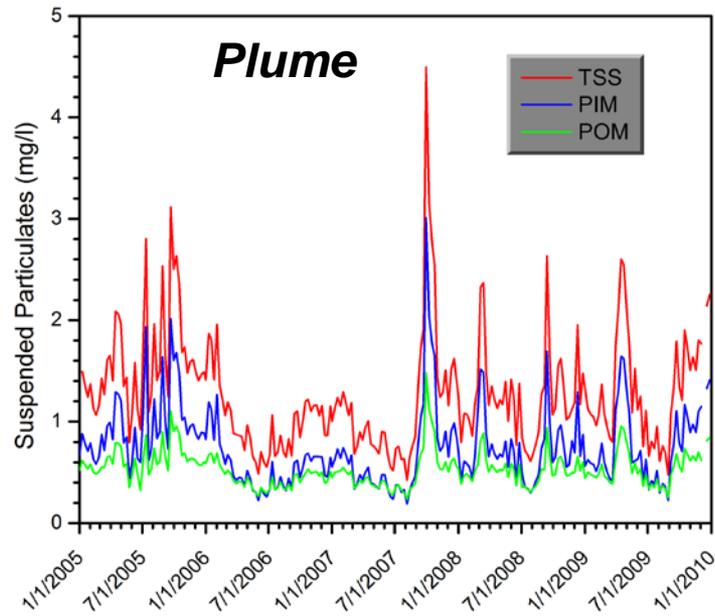
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), St. Andrew Bay



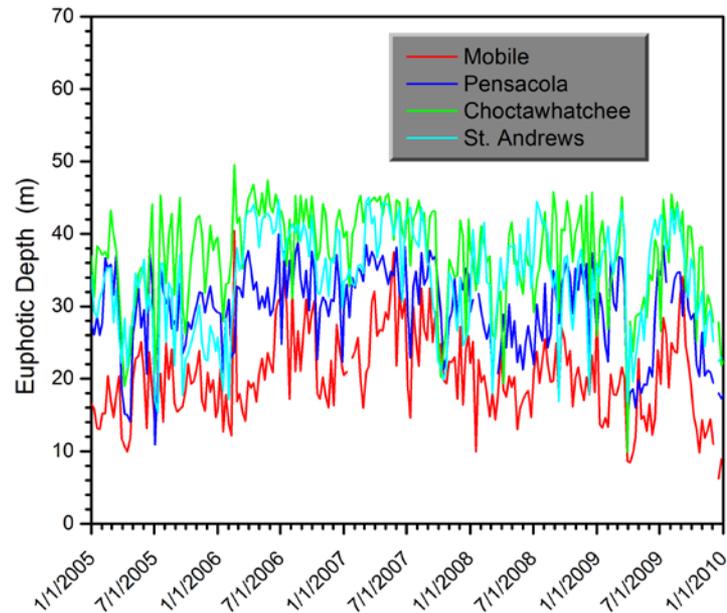
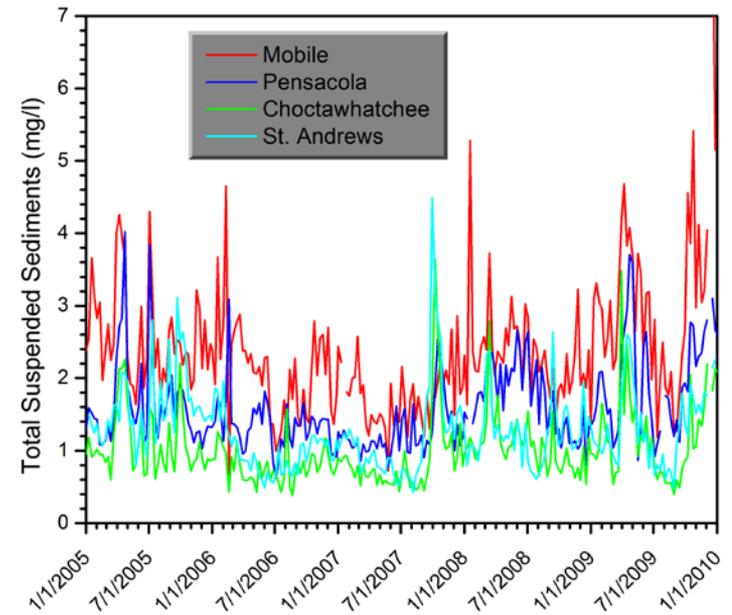
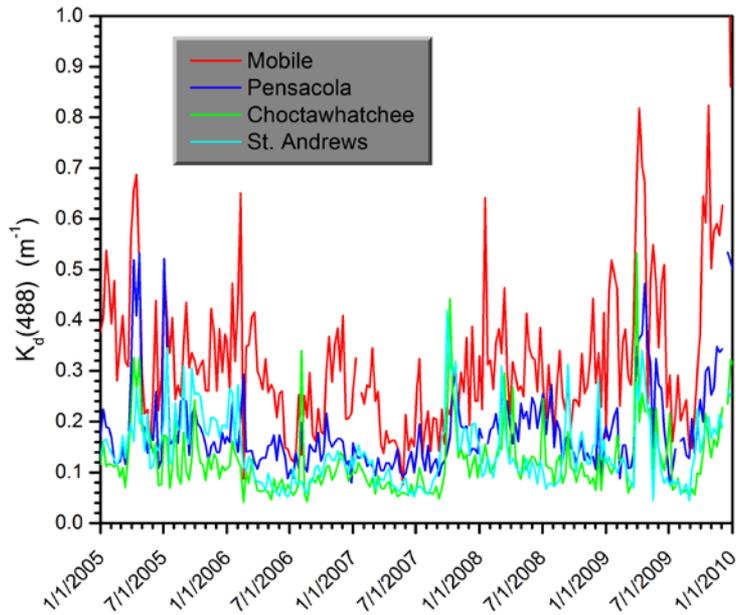
Time-Series Analysis – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), St. Andrew Bay



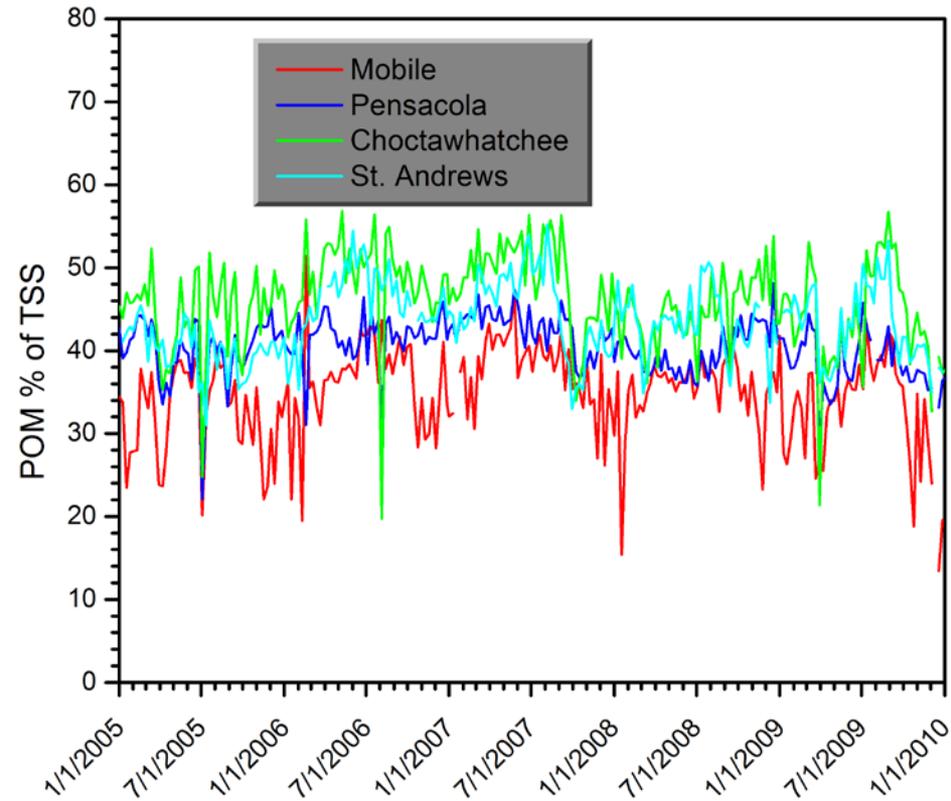
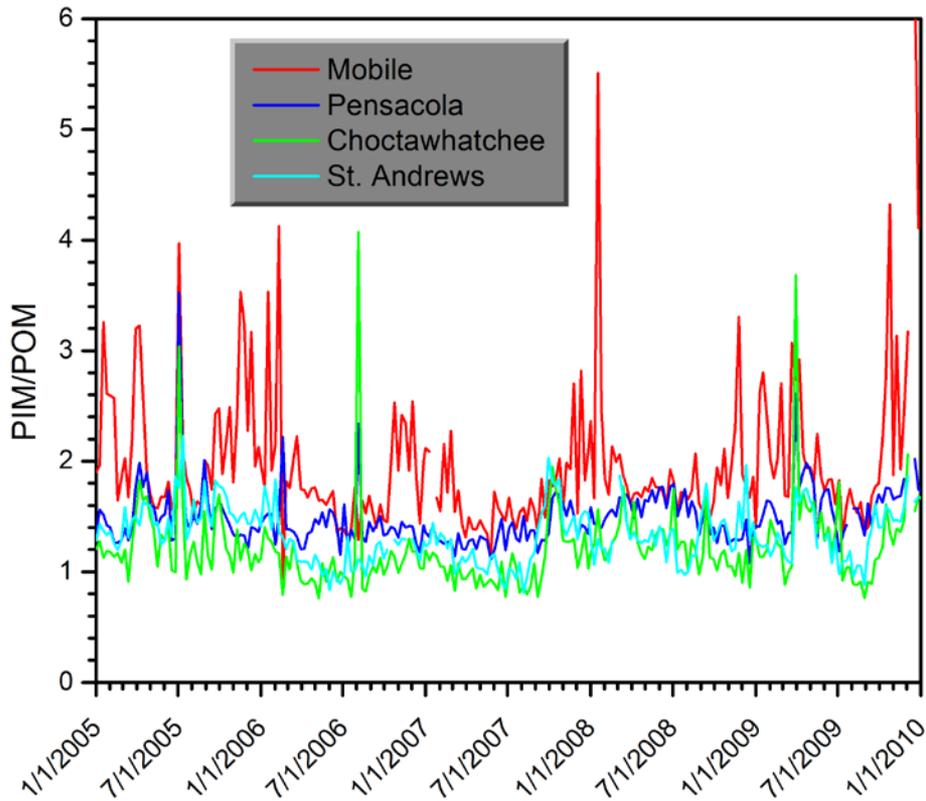
Time-Series Analysis – Between Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Plumes



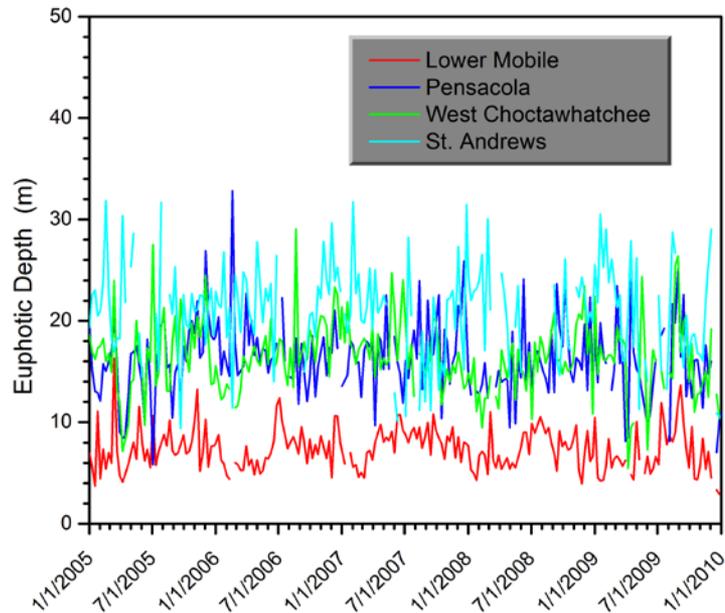
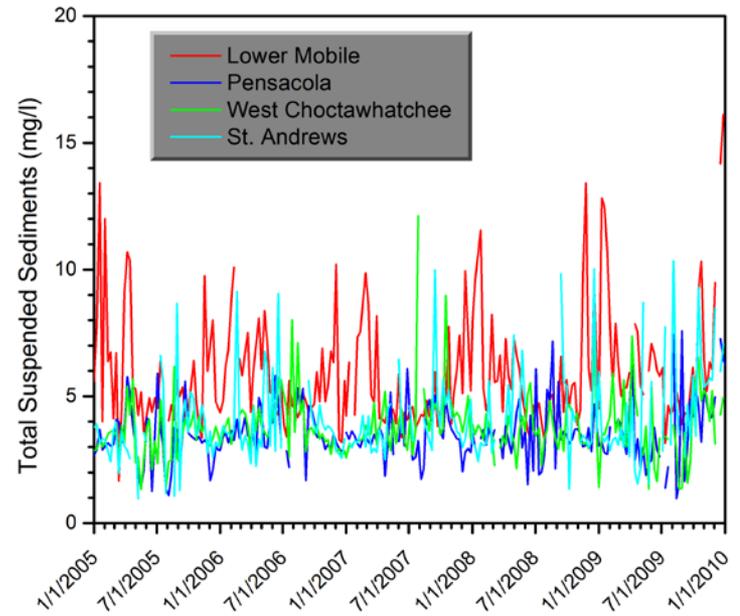
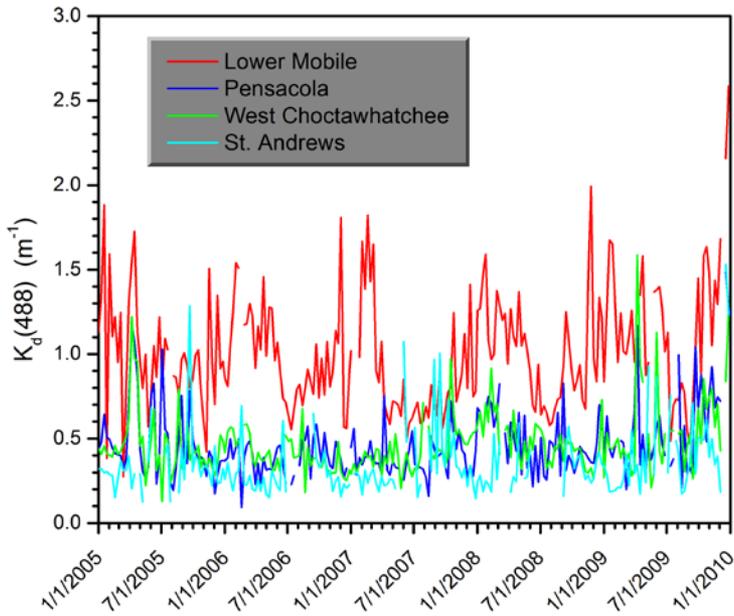
Time-Series Analysis – Between Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Plumes



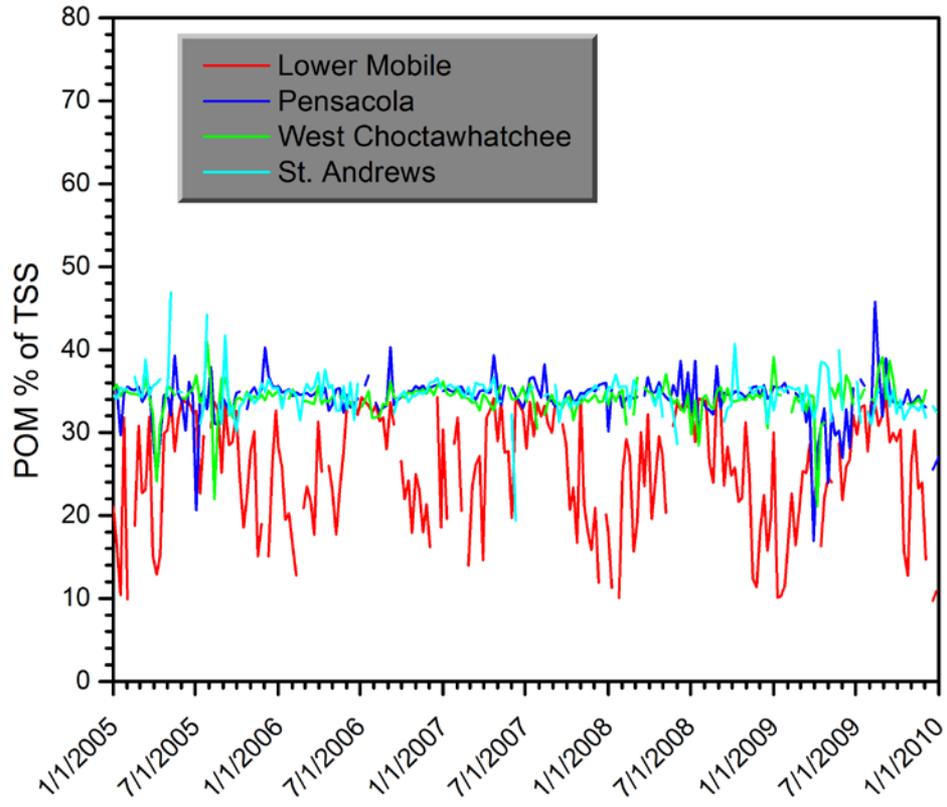
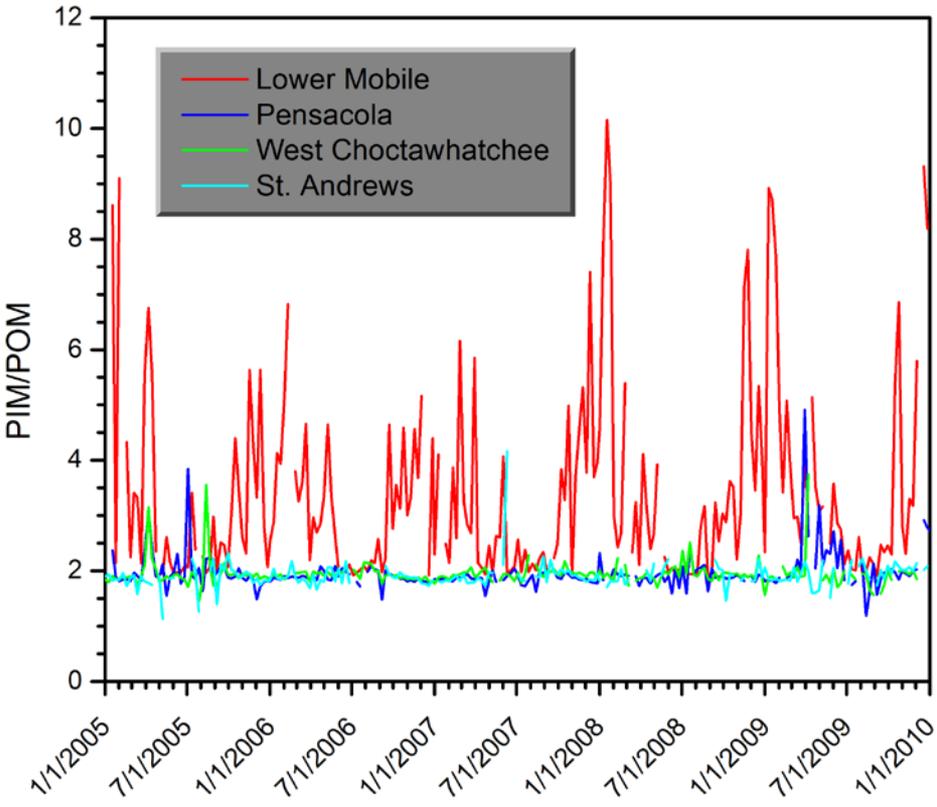
Time-Series Analysis – Between Bays

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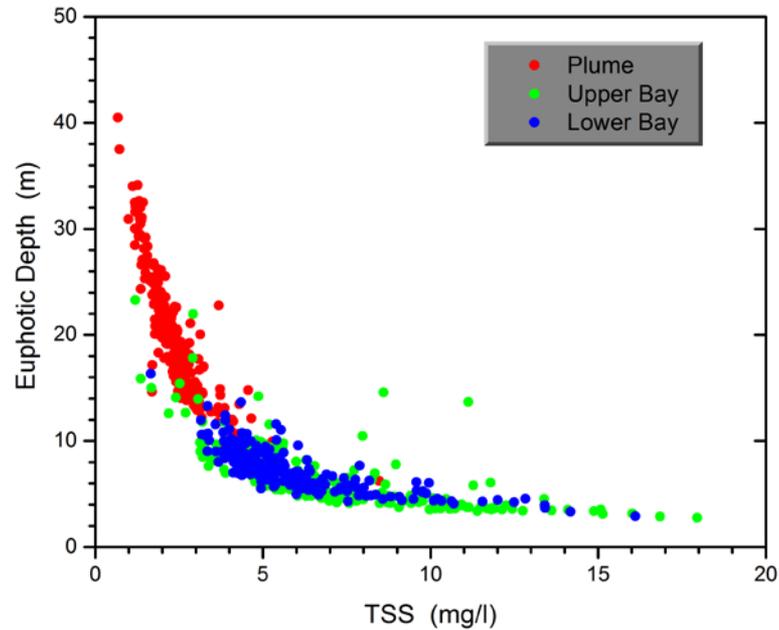
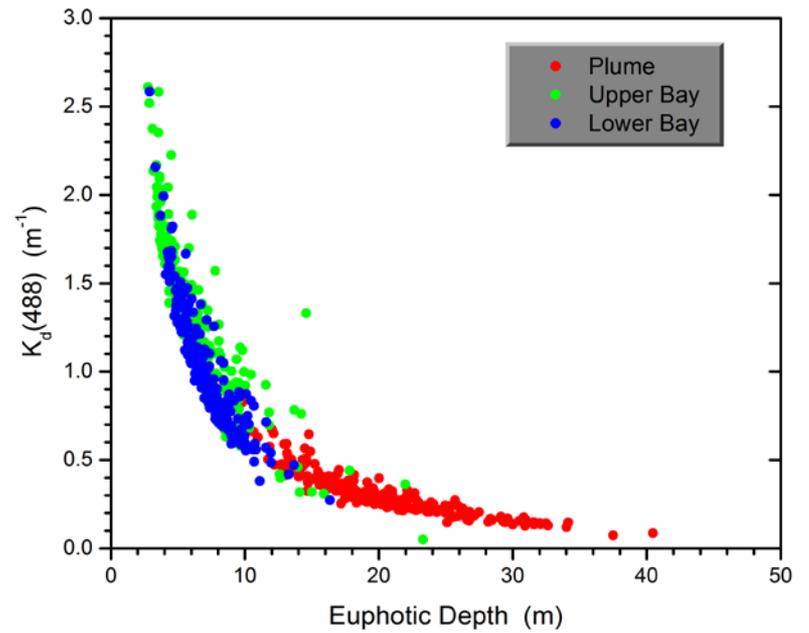
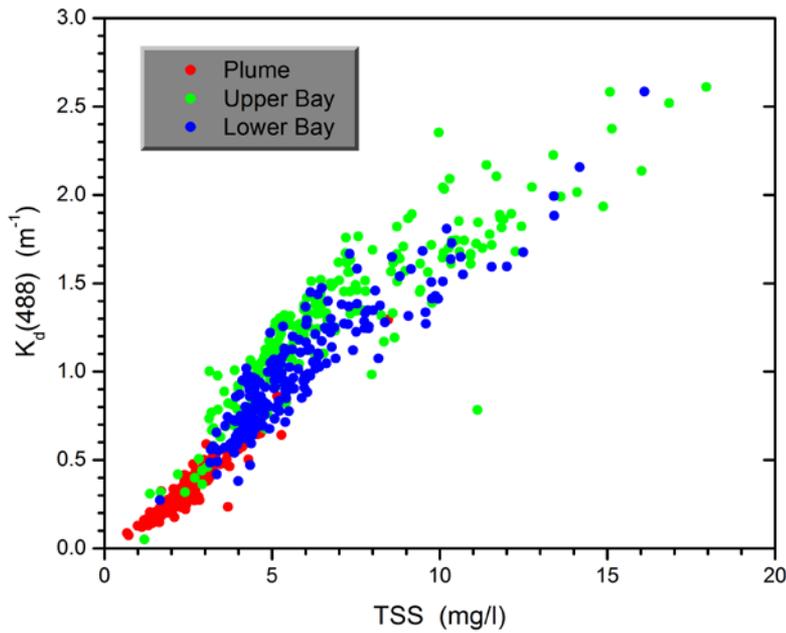
Time-Series Analysis – Between Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Bays



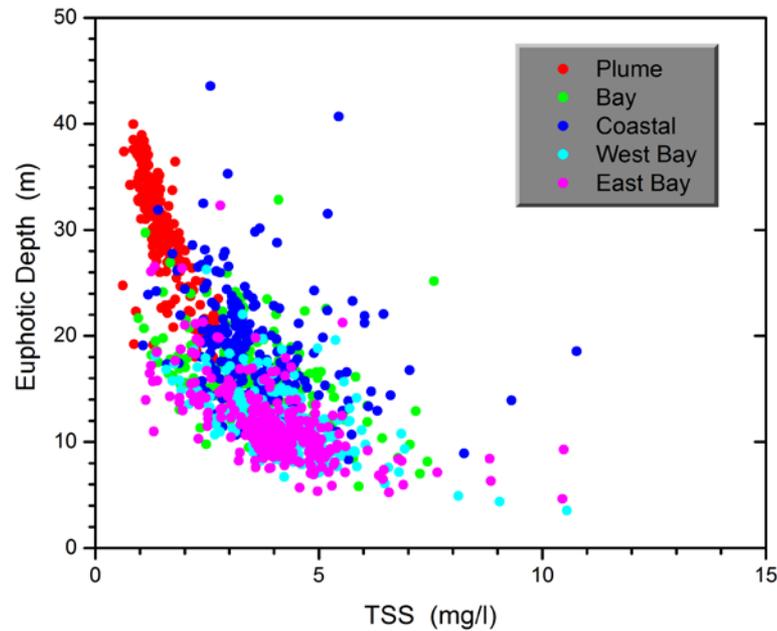
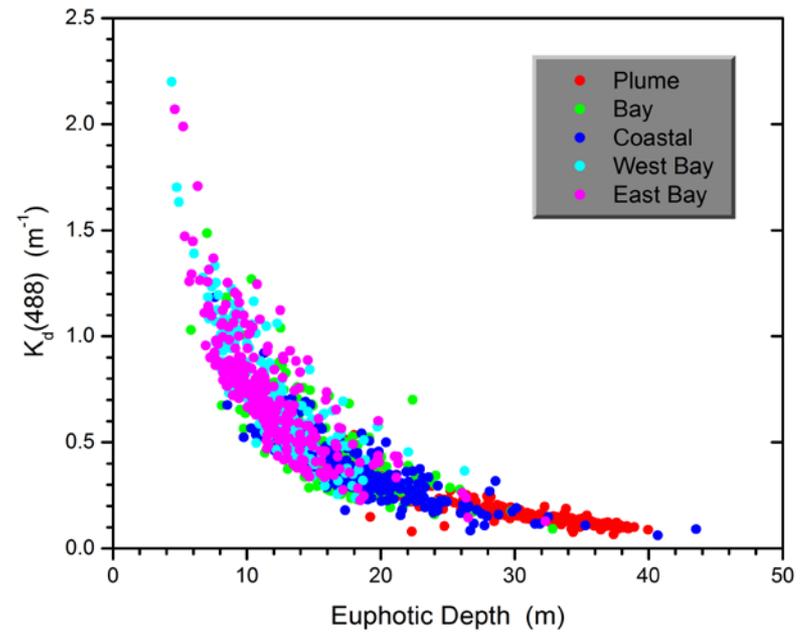
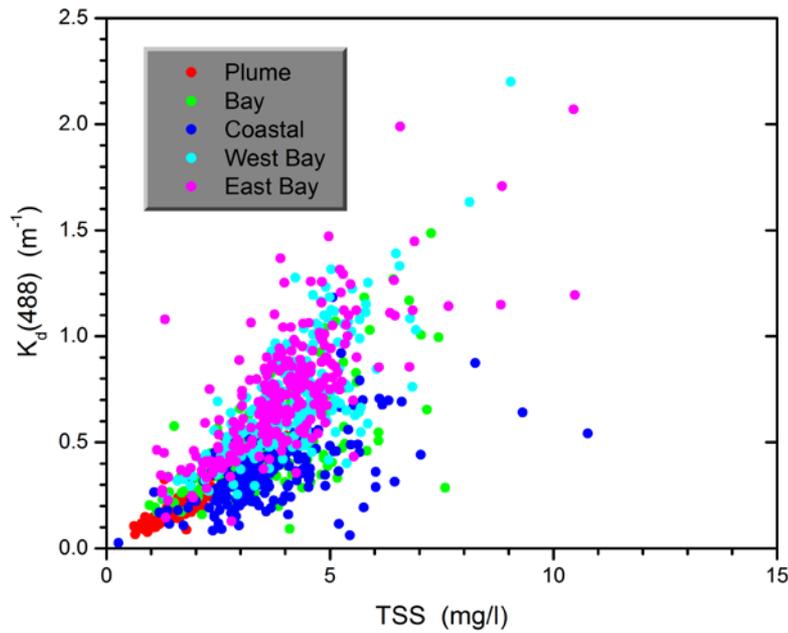
Bio-Optical Property Relationships – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Mobile Bay



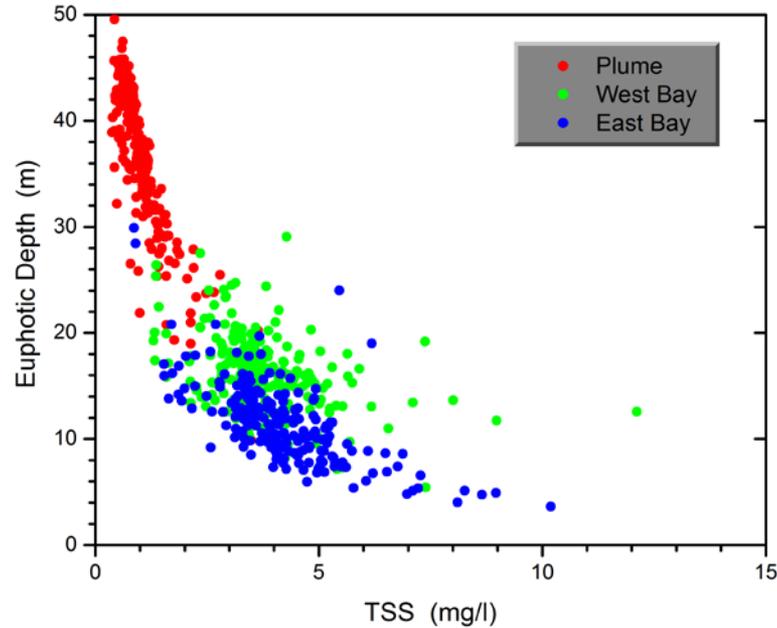
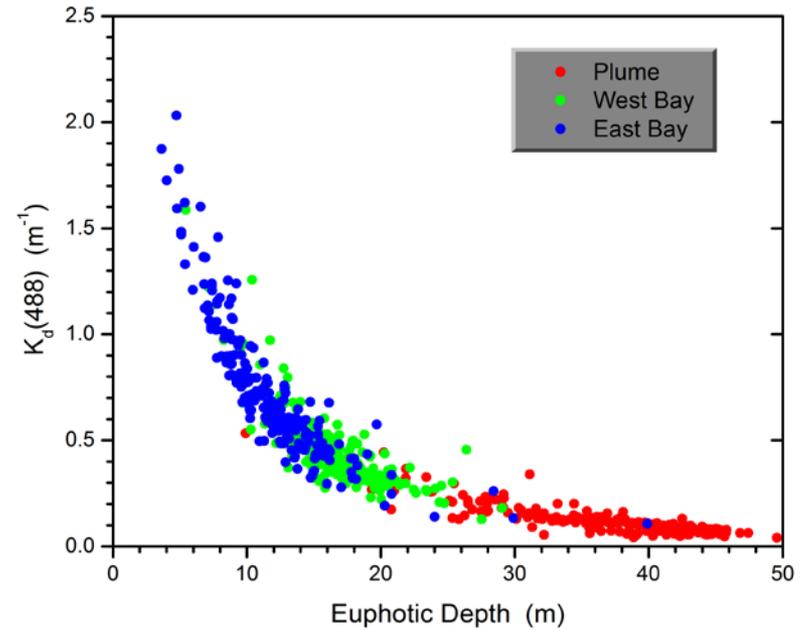
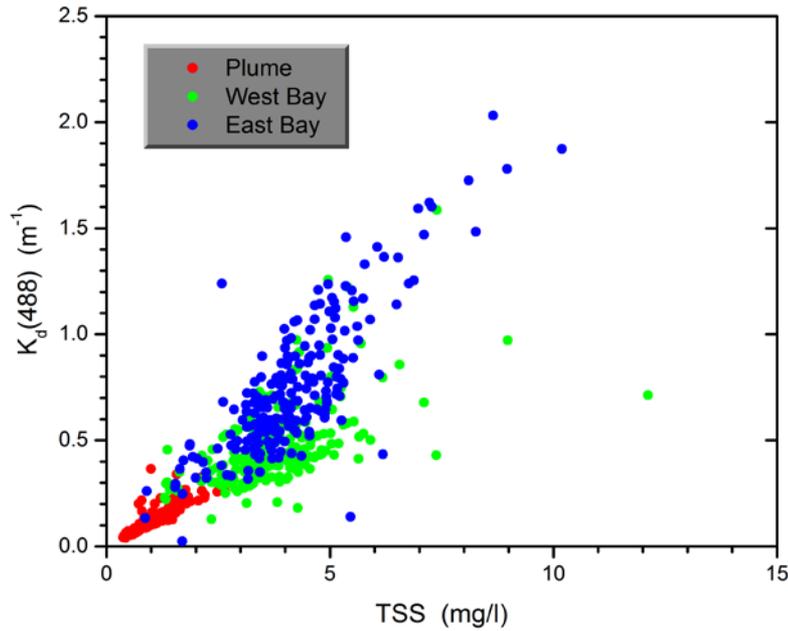
Bio-Optical Property Relationships – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Pensacola Bay



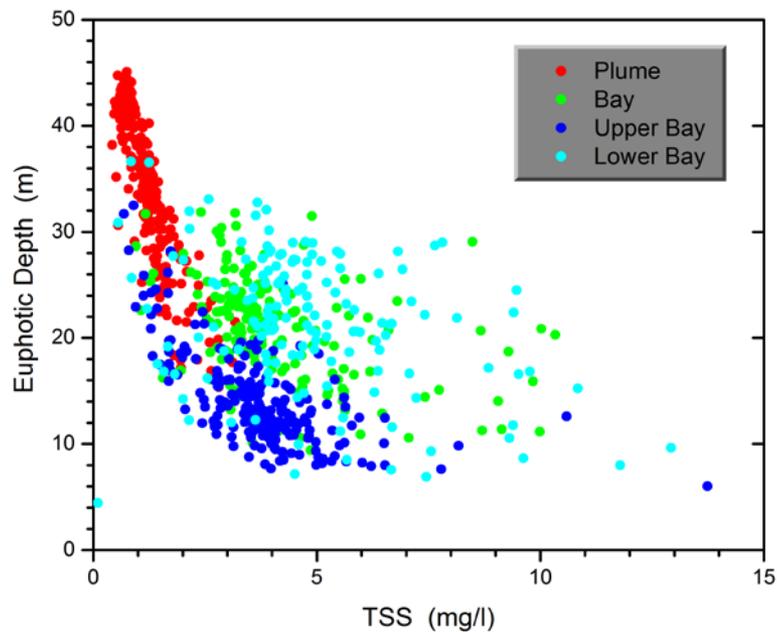
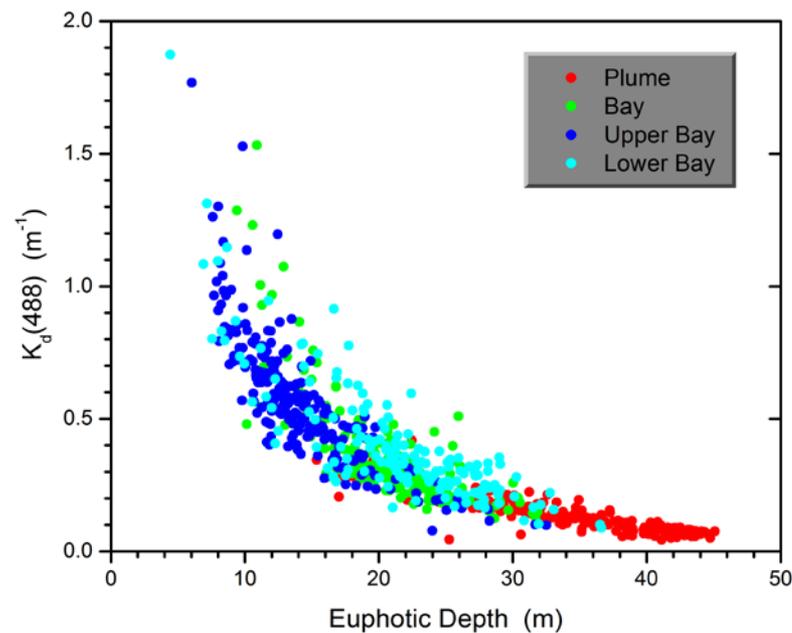
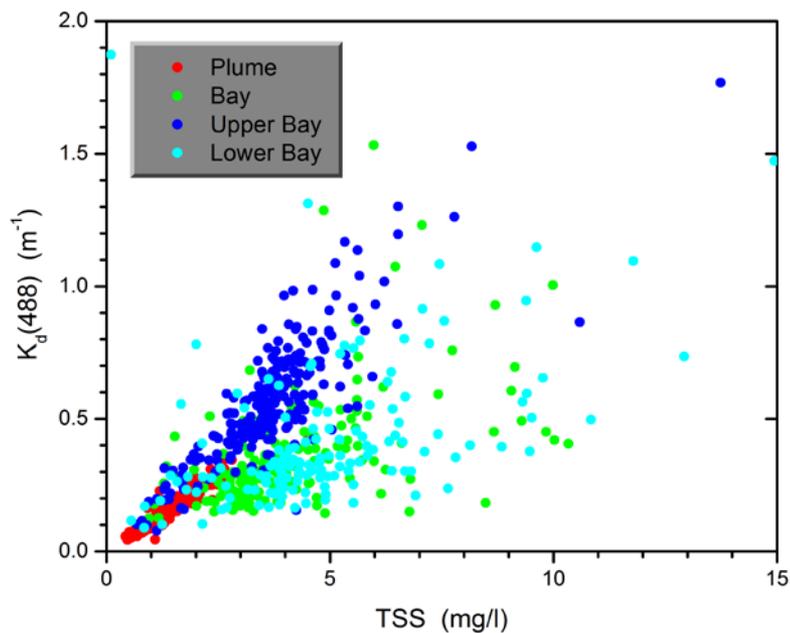
Bio-Optical Property Relationships – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), Choctawhatchee Bay



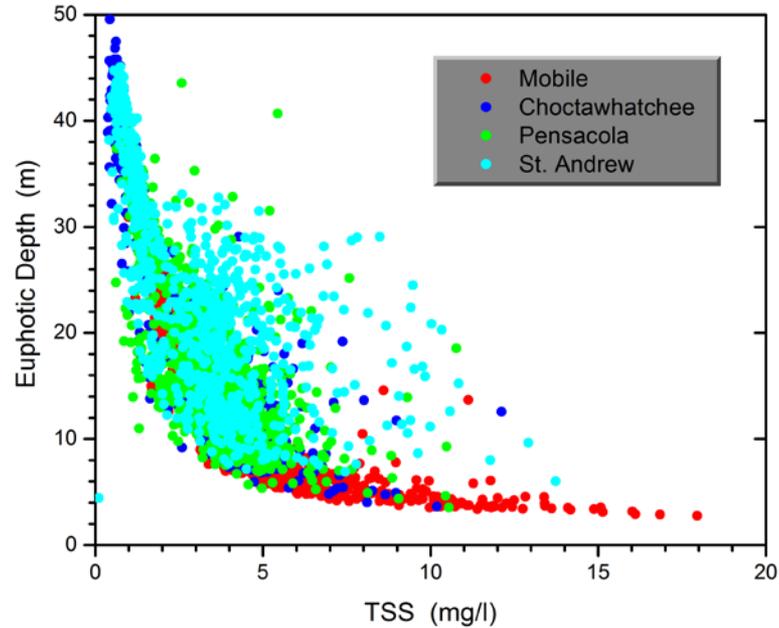
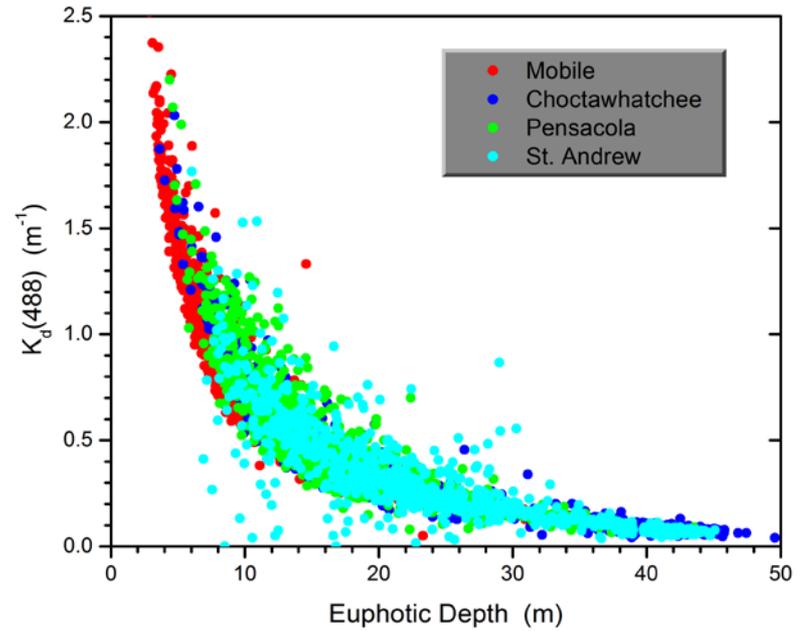
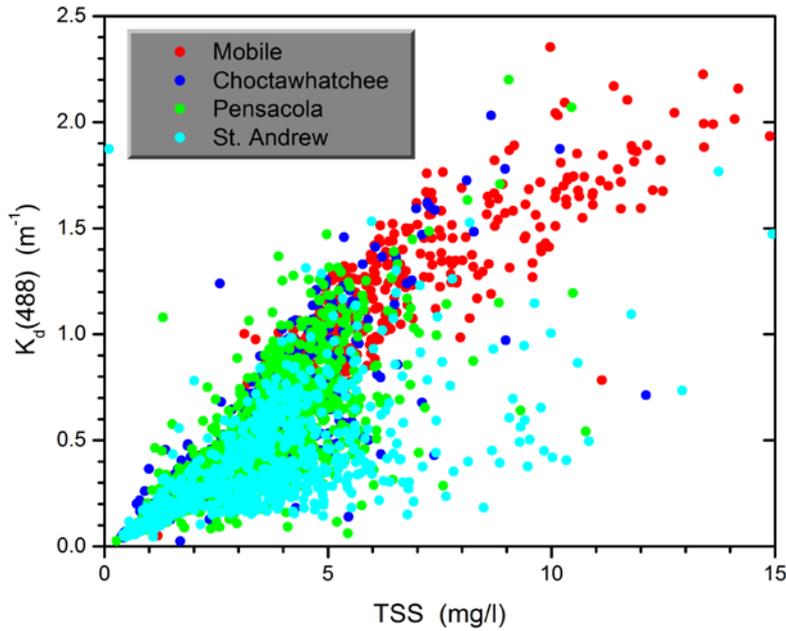
Bio-Optical Property Relationships – Within Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), St. Andrew Bay



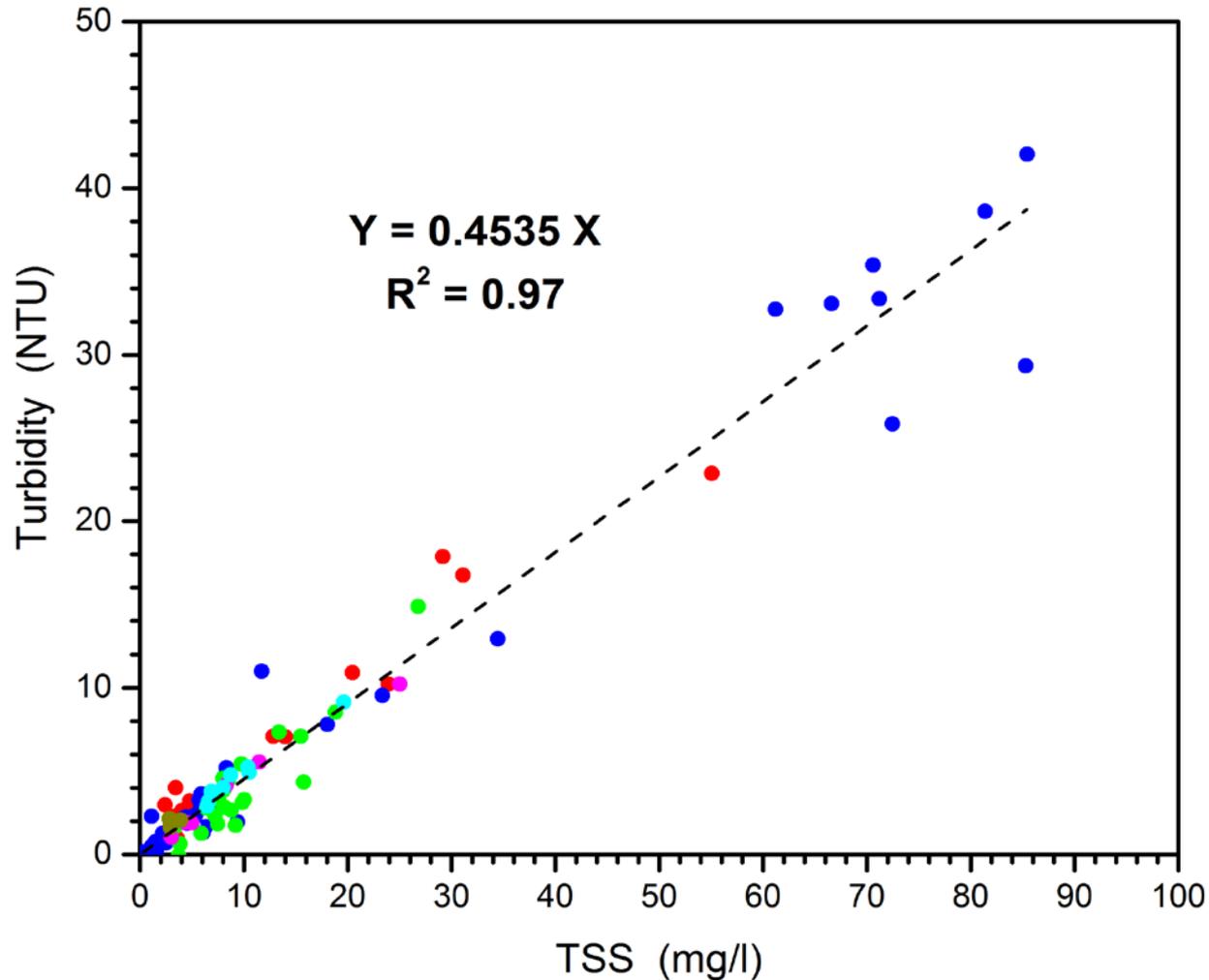
Bio-Optical Property Relationships – Between Bays

Weekly Averages For 5 Years (1/1/05-12/31/09), All Regions In Each Bay



Bio-Optical Property Relationships

Turbidity (NTU) vs. Total Suspended Sediments (TSS)

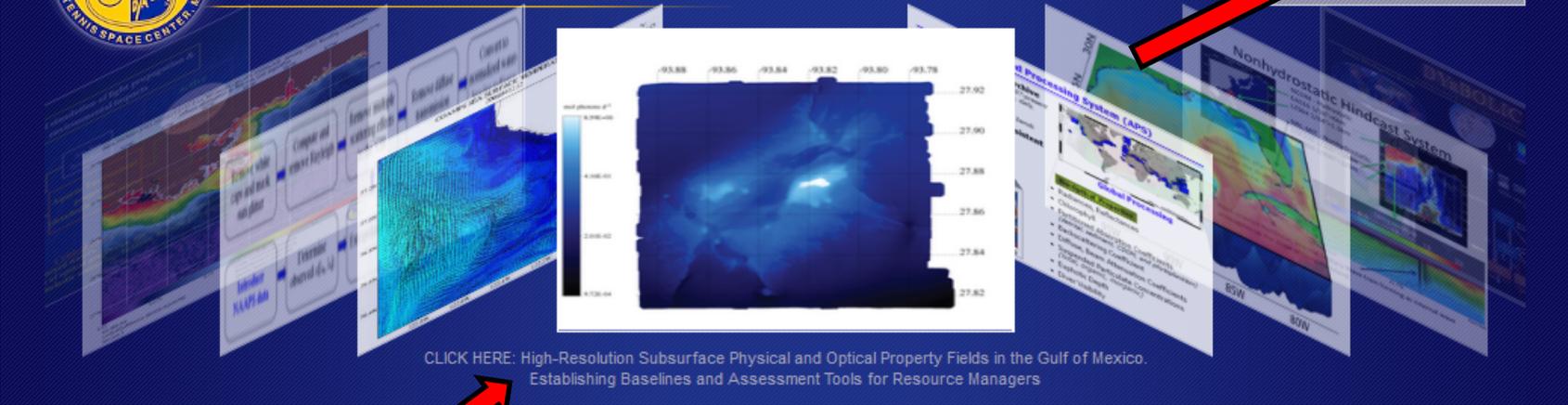


- *Multiple cruises (6)*
- *Mississippi Bight, Mobile Bay samples*
- *Gravimetric TSS, Turner Aquafluor turbidity (NTU)*



United States Naval Research Laboratory
Bio-Optical/Physical Processes and Remote Sensing Section

CURRENT PROJECTS
PUBLICATIONS



CLICK HERE: High-Resolution Subsurface Physical and Optical Property Fields in the Gulf of Mexico. Establishing Baselines and Assessment Tools for Resource Managers



Bio-Optical/Physical Processes and Remote Sensing Section Code 7331 Stennis Space Center, Mississippi 39529

As a team, members of the Bio-Optical/Physical Processes and Remote Sensing Section have broad experience and expertise in many aspects of remote sensing and coupled physical/ecological modeling. We conduct research to better understand oceanographic processes in coastal and open-ocean environments. Our overarching goal is to exploit this knowledge of the marine environment to address a wide variety of navy needs related to optical variability, underwater light penetration, and physical/optical forecasting. However, we also work closely with external agencies and universities to address a wide variety of oceanographic science questions. Our state-of-the-art facilities include satellite receiving and image processing/analysis systems, in situ and laboratory optical instrumentation, advanced physical and ecological models, and access to high-performance super computers. Recent instrumentation acquisitions include gliders (one with an Optical Plankton Discriminator), trawl-resistant physical/optical moorings, and a flow cytometer. Research interests within the section include ocean color algorithm



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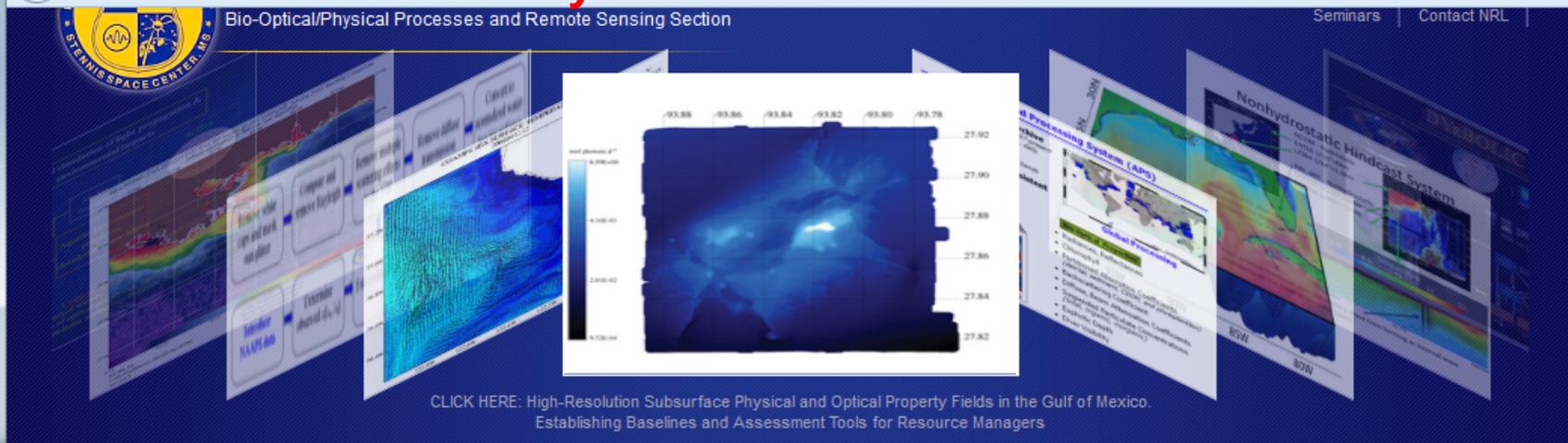
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 High-resolution (250m) baseline satellite bio-optical climatology developed for bays in northern Gulf of Mexico (CLICK HERE)

Tool developed to find and display current satellite imagery on a mobile device (See Mobile Image Tool link)



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High-Resolution Subsurface Physical and Optical Property Fields in the Gulf of Mexico: Establishing Baselines and Assessment Tools for Resource Managers

Objective: We propose to provide a database of subsurface physical and optical property fields for specific local areas within the Gulf of Mexico using a blend of data assimilative ocean modeling tools and ocean color remote sensing products. These three-dimensional property fields are needed to inform the decision-making process of resource managers, with particular emphasis on (i) habitat identification and characterization, (ii) assessment of the environmental impact of various permitted activities, such as dredging, and (iii) water quality assessment. Accordingly, we have identified two specific decision-making processes within the Gulf of Mexico that will be aided by the establishment of our proposed database. First, the Flower Garden Banks National Marine Sanctuary (FGBNMS) works with the Sanctuary Advisory Council, constituents, and users to conduct periodic management reviews of current regulations. The FGBNMS is currently going through a review, and potential boundary expansion has been identified as a priority management issue. The boundary expansion proposals and deliberations would be significantly aided by knowledge of baseline environmental conditions, such as light, temperature, and salinity, for benthic biological communities that may be ecologically linked to the presently protected areas. Second, the natural variability of coastal turbidity (suspended sediment load) is not known for local areas where the United States Army Corps of Engineers (USACE) are required to monitor during their dredging, flood protection, and coastal restoration activities. Knowledge of this natural variability would provide a baseline against which data from their monitoring activities may be assessed. With the expressed support of FGBNMS-NOAA and USACE, we will provide high-resolution and three-dimensional light, temperature, salinity, and current field estimates, and surface maps of suspended sediment load, made from a combination of satellite remote sensing and ocean modeling. By providing both a regional context and local-scale details, these products will help resource managers make more informed decisions.

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