

# Remote Sensing of Turbidity and Water Temperature in the Columbia River Estuary

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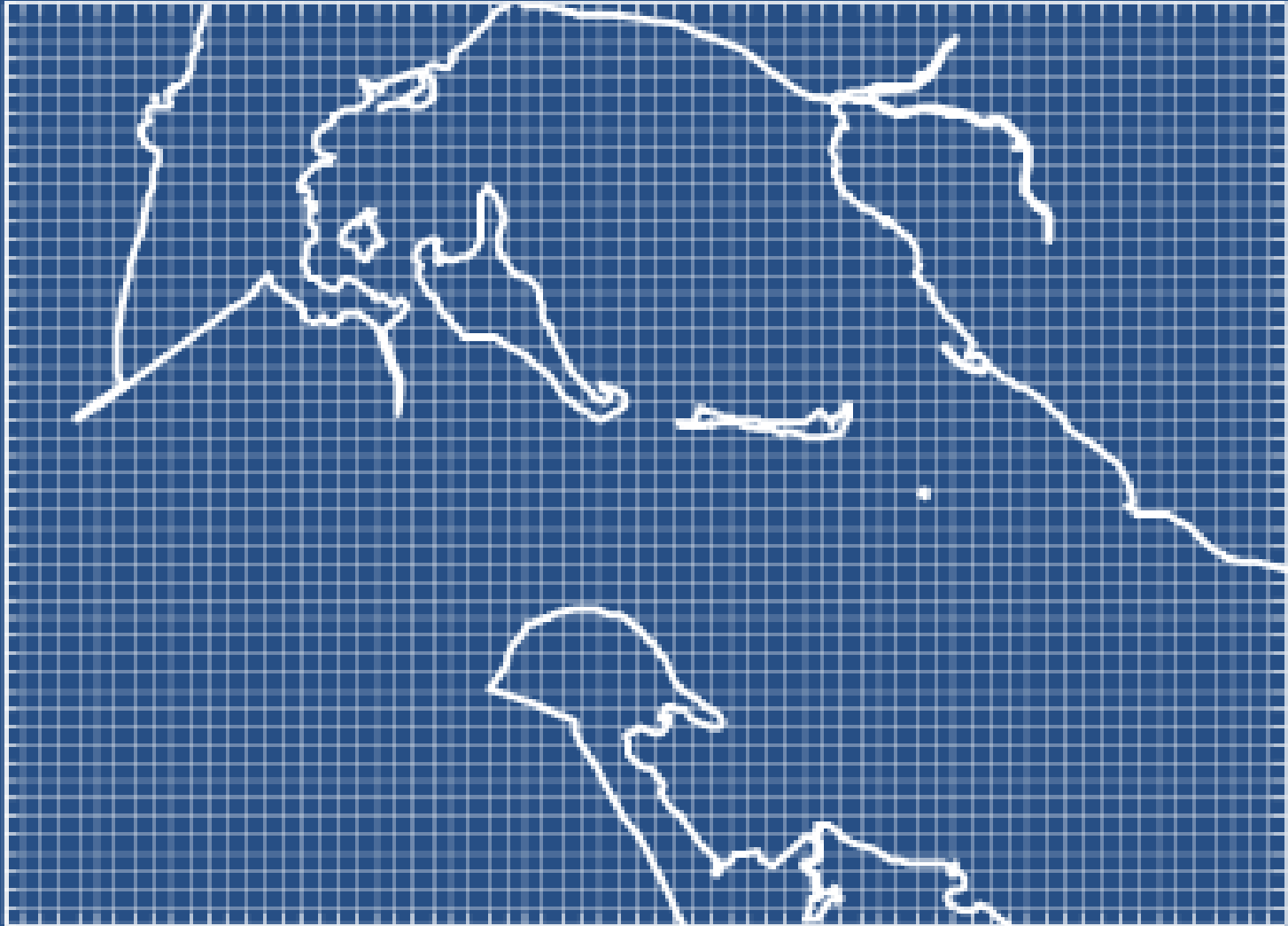
# Objective

- Characterize degree to which satellite–based measurements agree with *in situ* data in the Columbia River Estuary (CRE).
- Explore the story this data tells us about turbidity dynamics in the CRE.

# MODIS Instrument

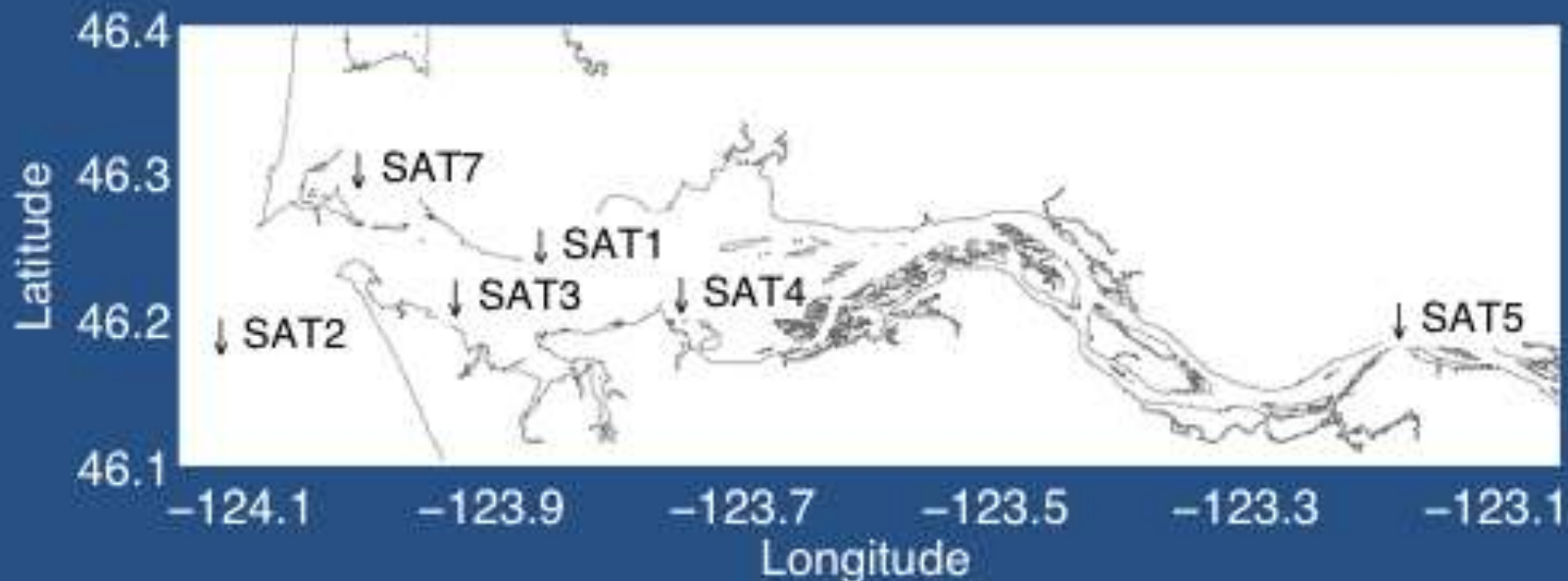
- Moderate Imaging Spectroradiometer (MODIS)
- Measures in 36 spectral bands and 3 spatial resolutions (250m, 500m, 1km)
- Samples the CRE ~twice daily aboard the AQUA and TERRA satellites

# MODIS Instrument



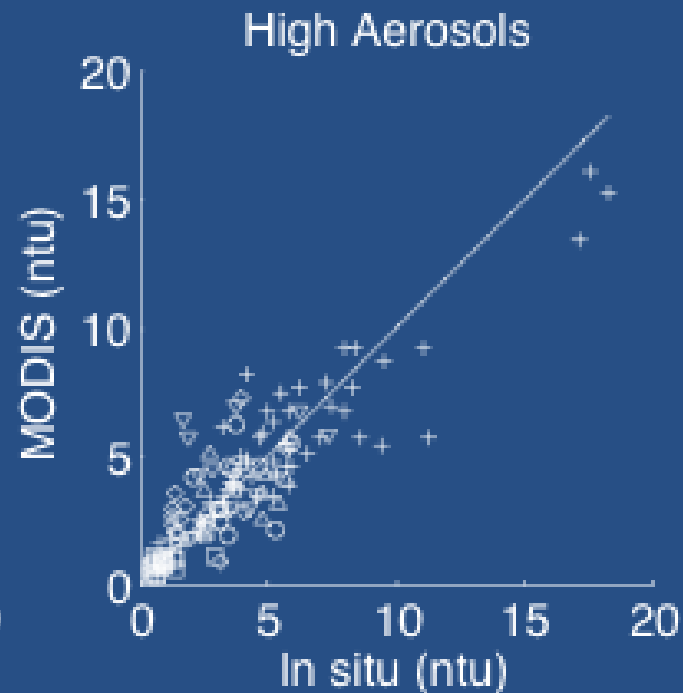
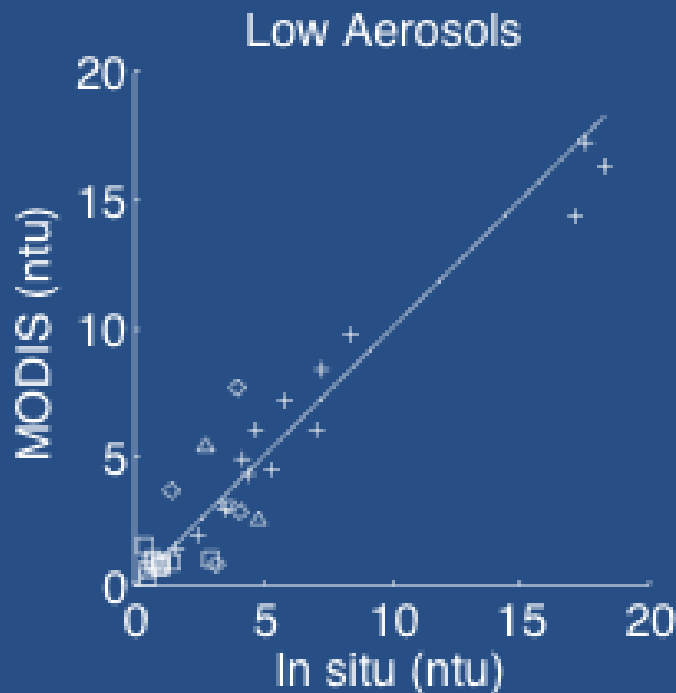
# Regression

- MODIS data from 2000-2013 <http://ladsweb.nascom.nasa.gov/>
- *In situ* measurements derived from 6 stationary buoys [http://www.stccmop.org/datamart/observation\\_network](http://www.stccmop.org/datamart/observation_network)
- All measure within 2.5 meters of the surface
- Buoy data were recorded from 2008-2013

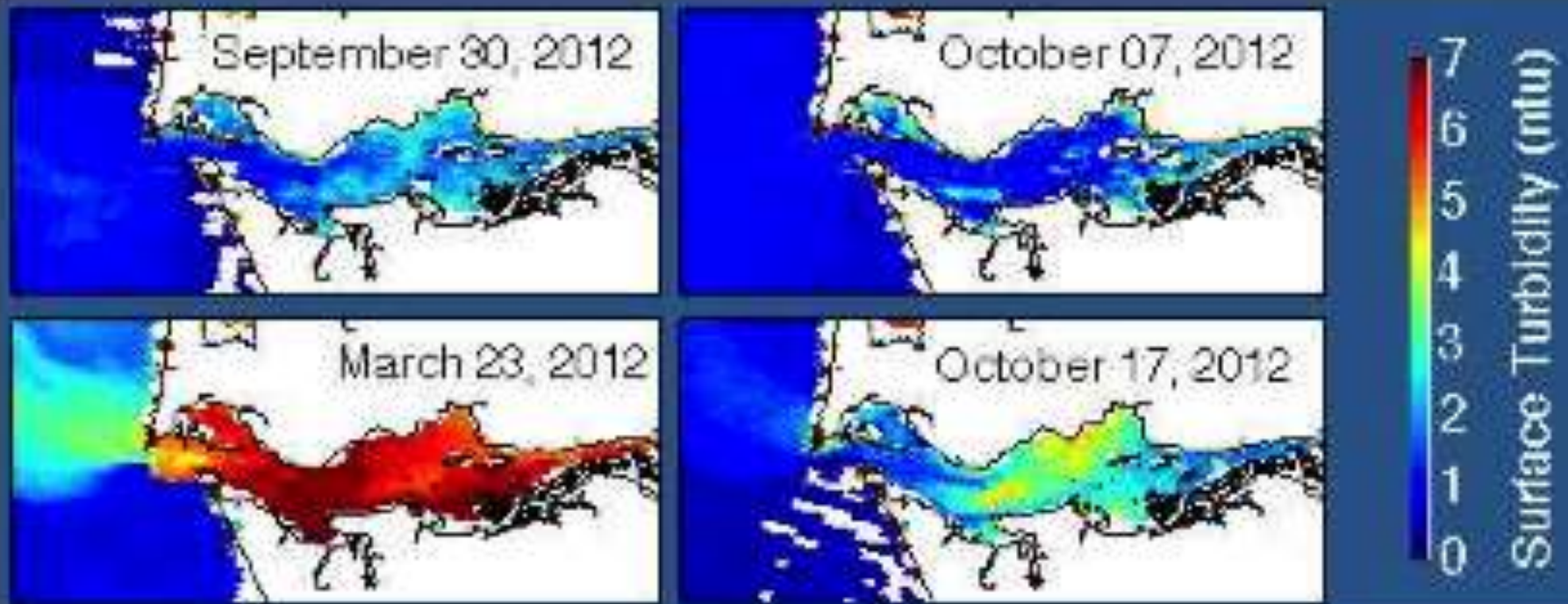


# Regression

	$R^2$	Sample Size	Equation
<b>Low Aerosol</b>	0.92	46	$y = 141x + 0.17$
<b>High Aerosol</b>	0.82	187	$y = 130x + 0.32$

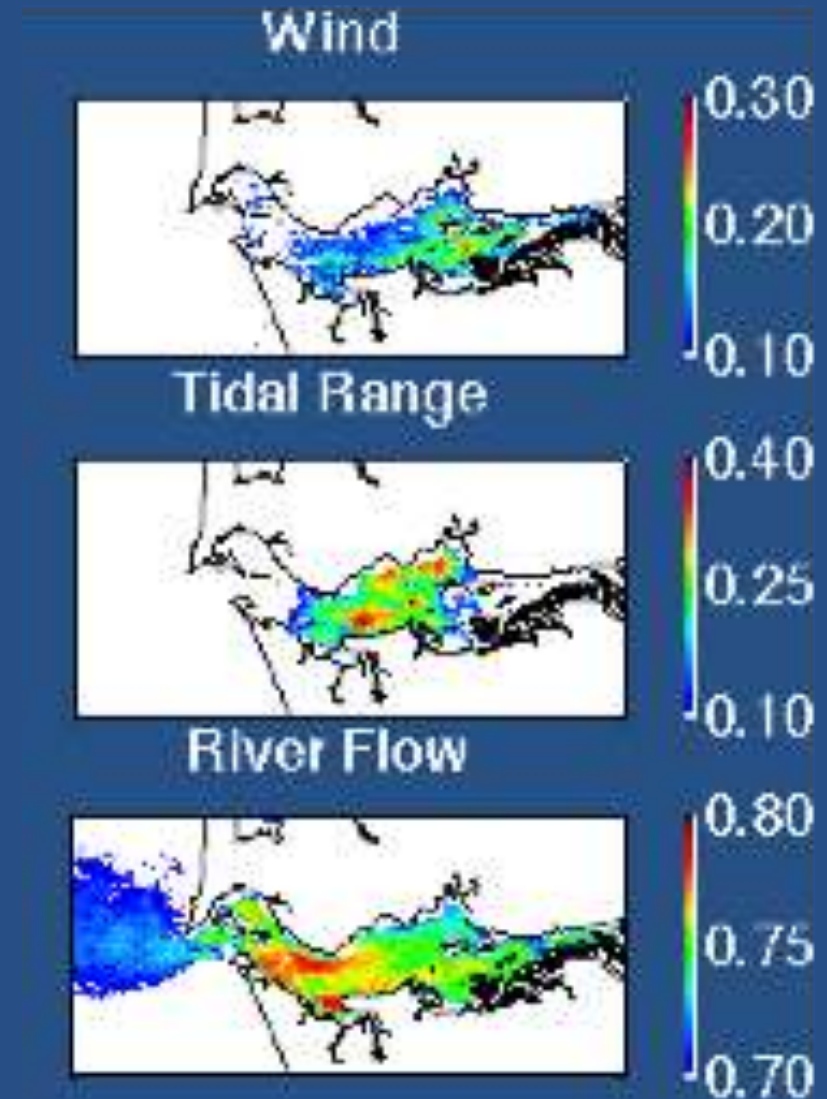


# Turbidity Distribution



# Turbidity Distribution

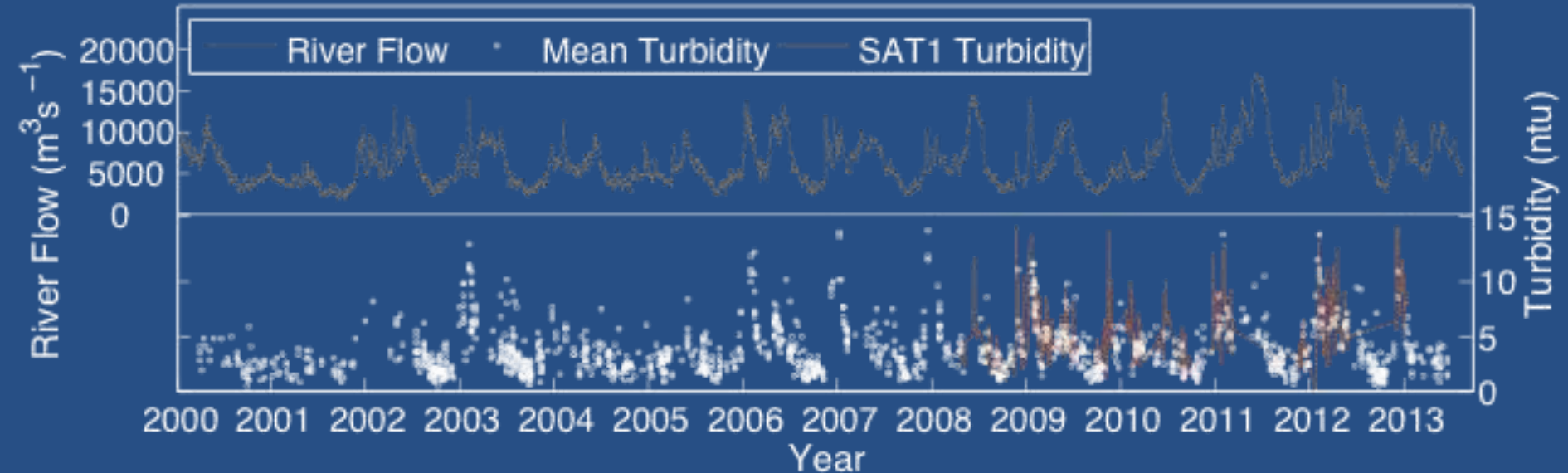
- Turbidity concentration can be influenced by many different processes.
- River Flow is the leading order forcing that drives variance in CRE.



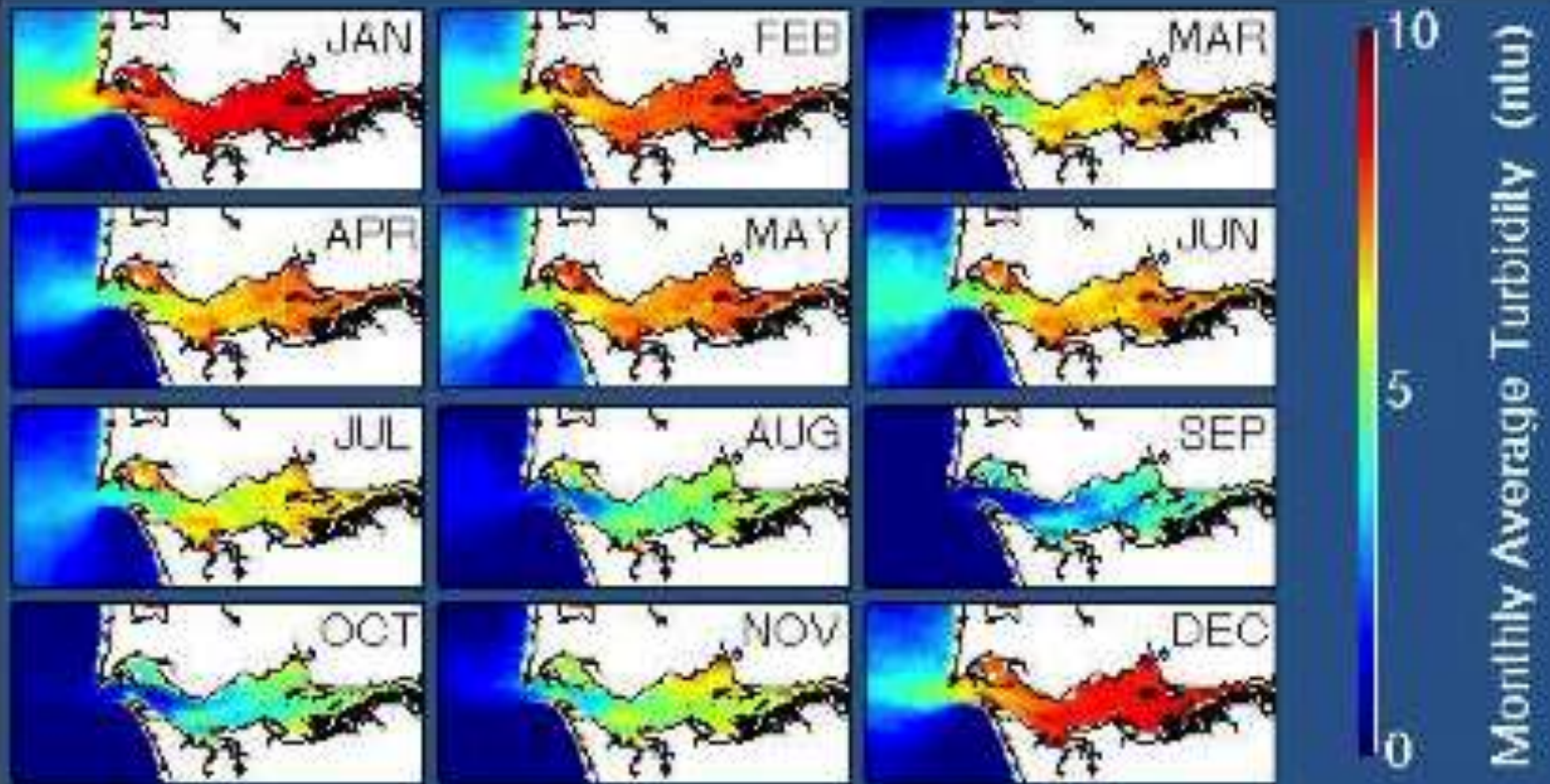


# Seasonal Variability

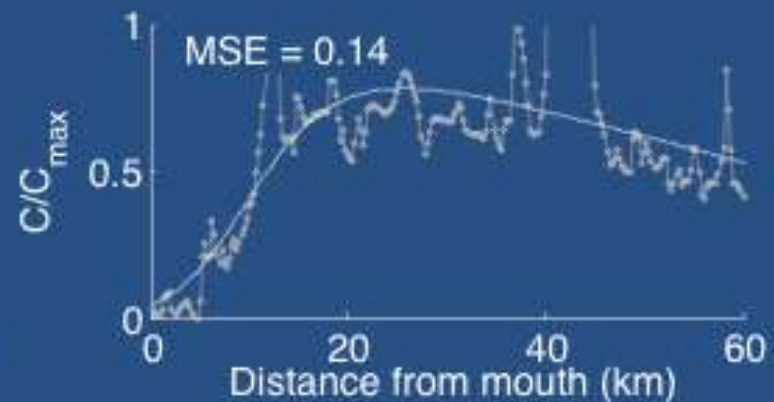
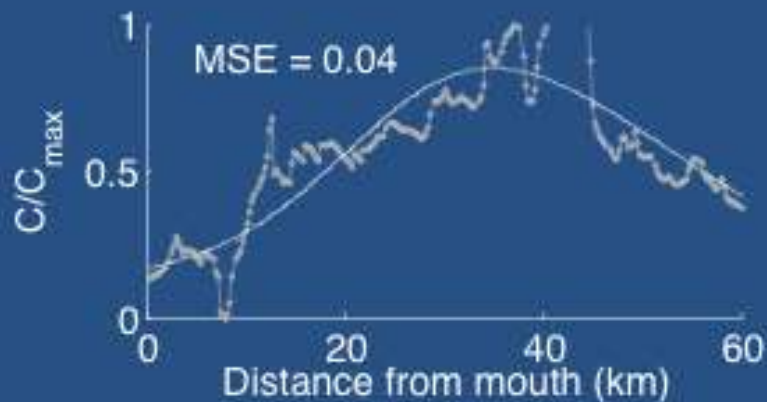
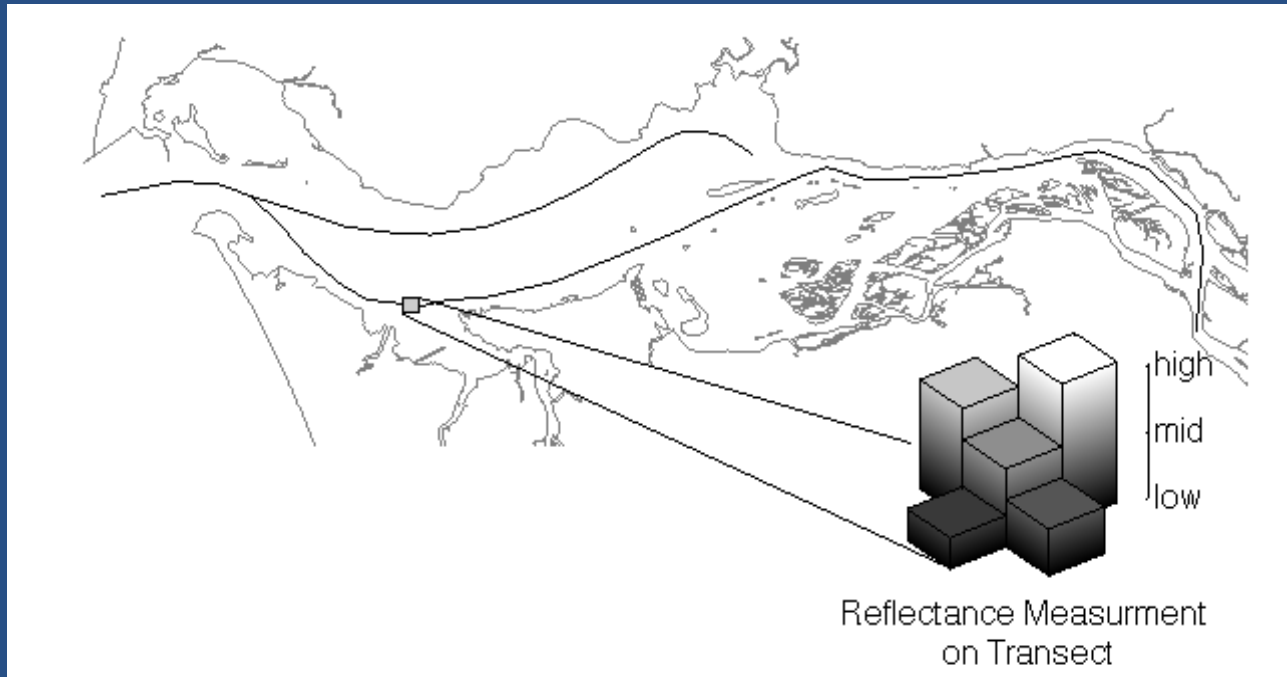
- Turbidity concentrations follow hydrograph.
- Positively correlated with river flow.



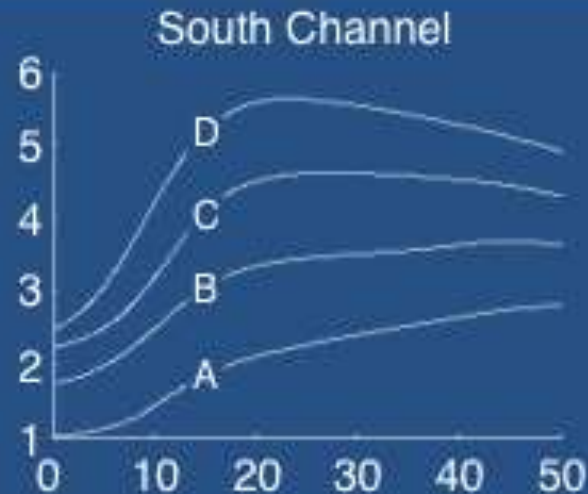
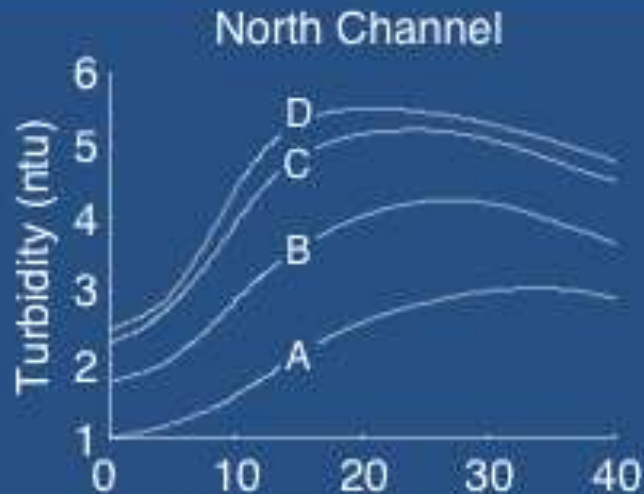
# Seasonal Variability



# Turbidity Transects



# Turbidity Transects



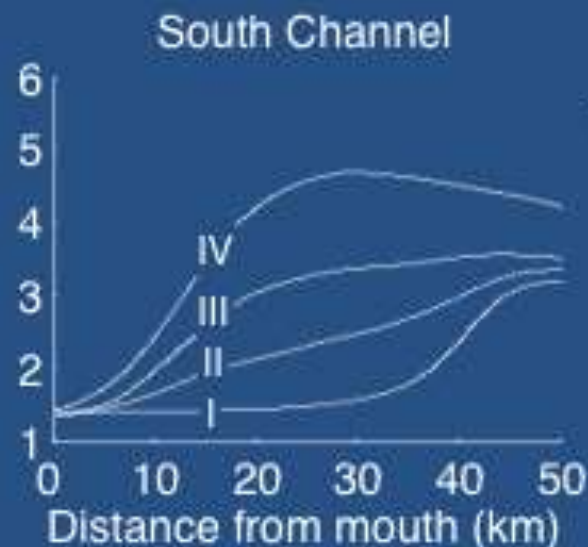
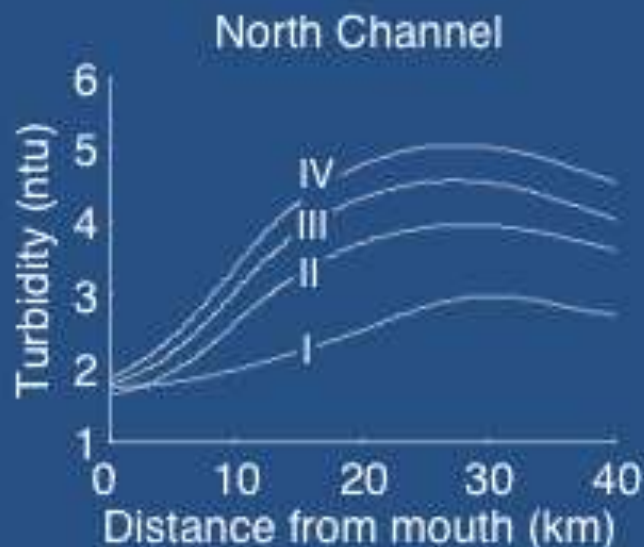
Flow Rate:

A = 3000m<sup>3</sup>/s

B = 4500m<sup>3</sup>/s

C = 7000m<sup>3</sup>/s

D = 9500m<sup>3</sup>/s



Tidal Range:

I = 2.0m

II = 3.0m

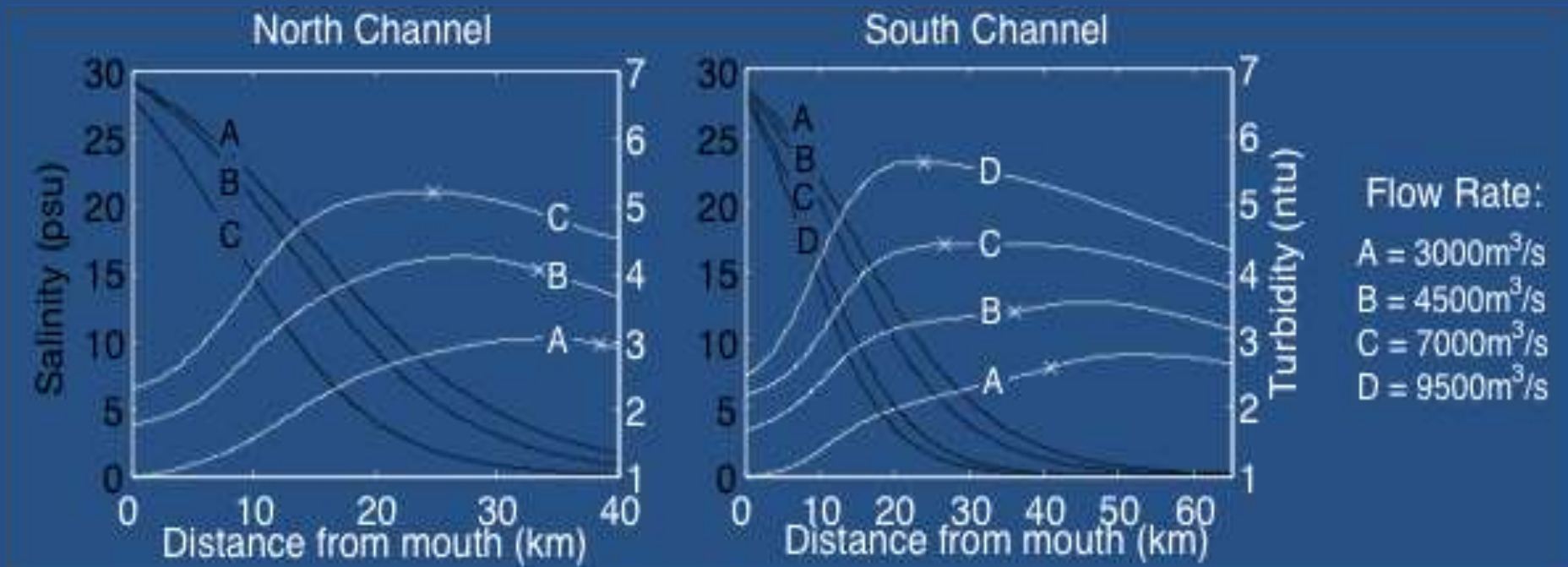
III = 3.25m

IV = 3.5m



# Turbidity Transects

- Along-channel distribution agrees with salinity intrusion estimates:

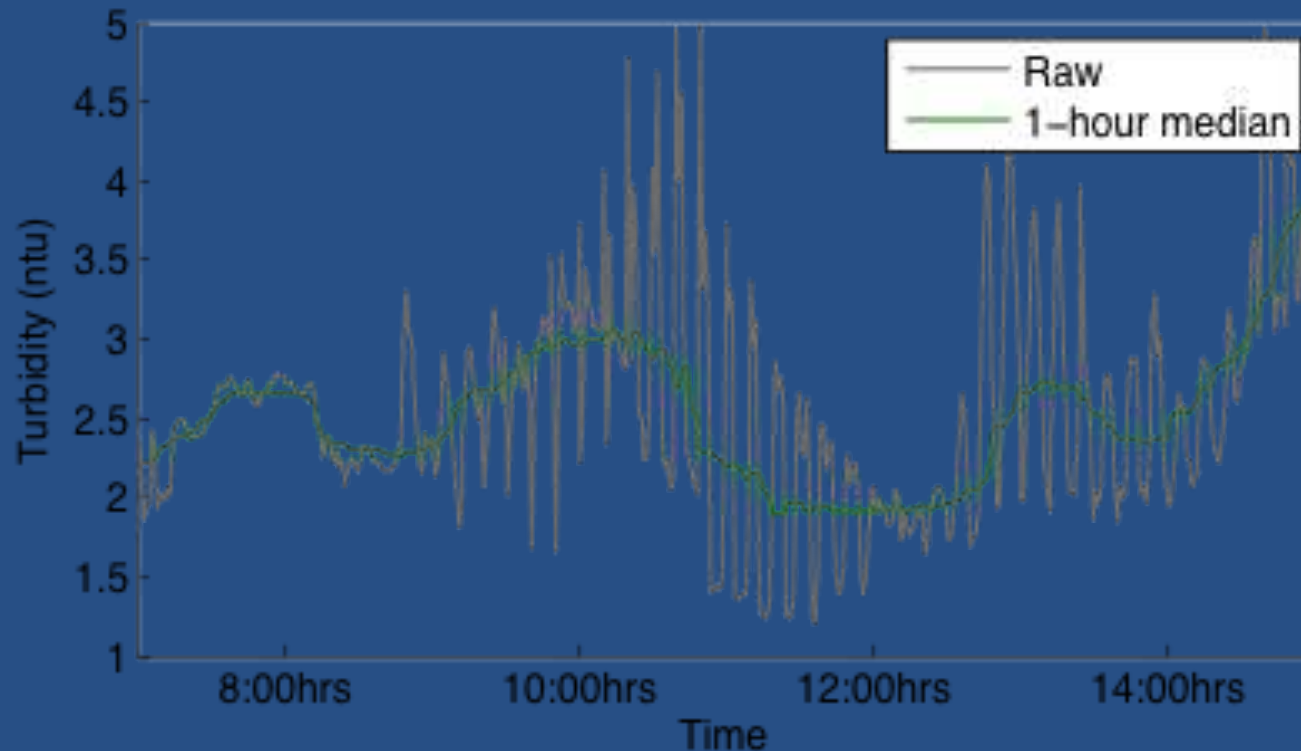


# Conclusions

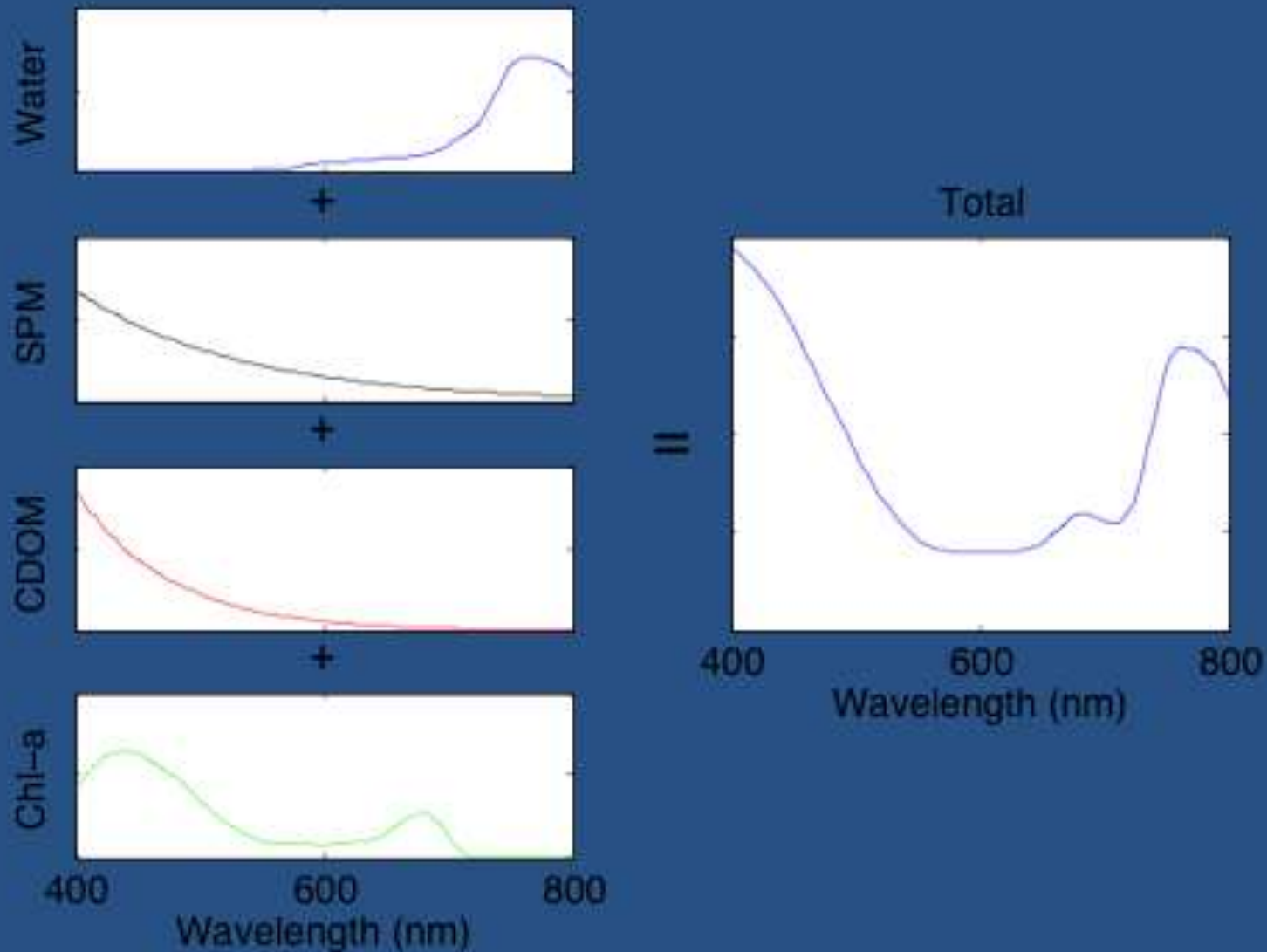
- MODIS is a robust platform to monitor turbidity (and other scalars?), and to study estuarine circulation.
- Turbidity distributions exhibit large seasonal and spatial variability in the CRE.
- River flow and tides are the dominant processes driving turbidity concentrations in the CRE
- Topography has a significant effect on the transport of sediment—and other particulates—in estuaries.

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# Measuring Turbidity



# Measuring Turbidity





# Measuring Temperature

