

Employing Remote Sensing Techniques to Quantify Sediment Supply and Evaluate Marsh Vulnerability in the Plum Island Estuary

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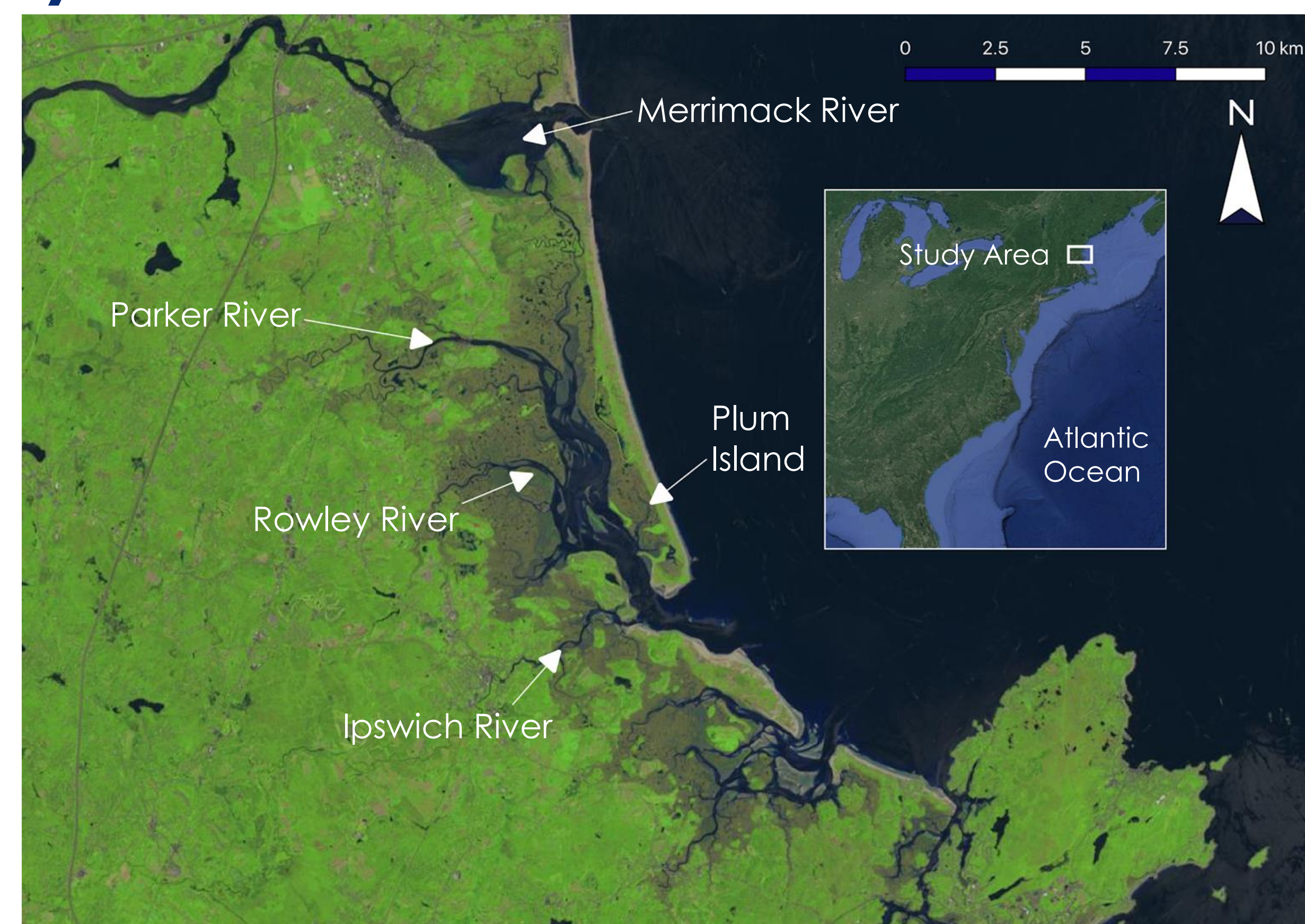


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Objectives

- **Develop** an algorithm to estimate suspended sediment concentration (SSC) in PIE from remote sensing reflectance
- **Observe** SSC along a transect in the estuary's main channel
- **Generate** a time-series from 2013 to 2108 of total suspended sediment
- **Quantify** sediment flux and potential sources of sediment to PIE using the Delft3D hydrodynamic model

Study Area



Earth Observations



Landsat 8 OLI
► 16 day revisit time
► 30 m resolution



Sentinel-2 MSI
► 10 day revisit time
► 10 m resolution

Project Partners

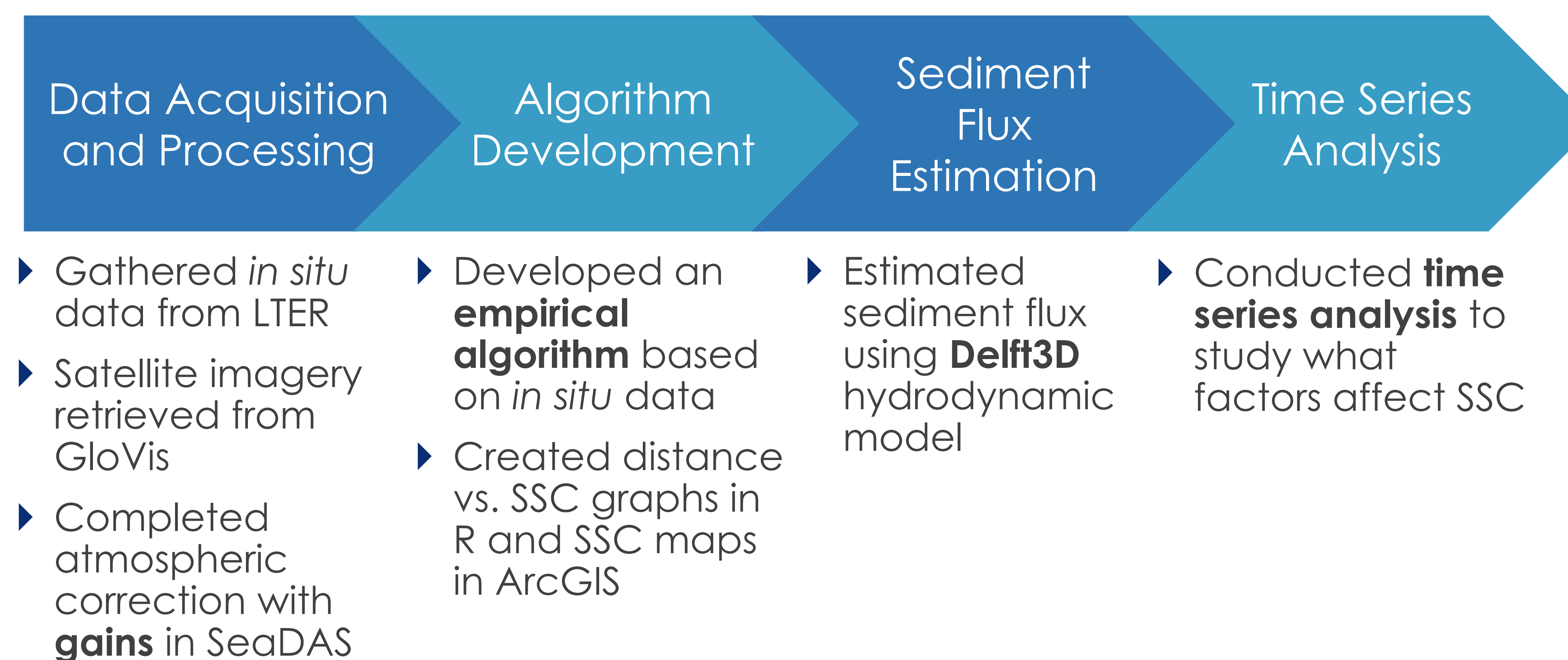
US Geological Survey Woods Hole Coastal and Marine Science Center
Long Term Ecological Research Network Plum Island Ecosystems LTER
US Fish and Wildlife Service Parker River National Wildlife Refuge



Abstract

The Plum Island Estuary (PIE) in Massachusetts is New England's largest salt marsh. This dynamic ecosystem plays an important role in the surrounding communities by providing ecosystem and social services, acting as a center for education, research, and recreation. However, marshes around the world are threatened by sea level rise. As the equilibrium between sediment supply, erosion rates, and vegetation growth is unbalanced by rising waters, marshes are liable to recede, or even drown. Because sediment is so crucial, researchers use sediment budgets as a metric to assess Plum Island Estuary's vulnerability to rising seas; however, established data collection methods are limited in scope. The project employed five years of imagery from Landsat 8 Operational Land Imager (OLI) and three years of imagery from Sentinel-2 Multispectral Instrument (MSI), in conjunction with *in situ* data, to generate and refine a local algorithm that derives suspended sediment concentration from remote sensing reflectance. This information was applied to a flux model to analyze transport patterns and possible sediment sources, particularly the Merrimack River. The use of remote sensing techniques will provide our partners at the US Geological Survey, US Fish and Wildlife Service, and Plum Island Ecosystems Long Term Ecological Research Network with higher spatial and temporal resolution data, which will allow for the development of more effective management practices.

Methodology

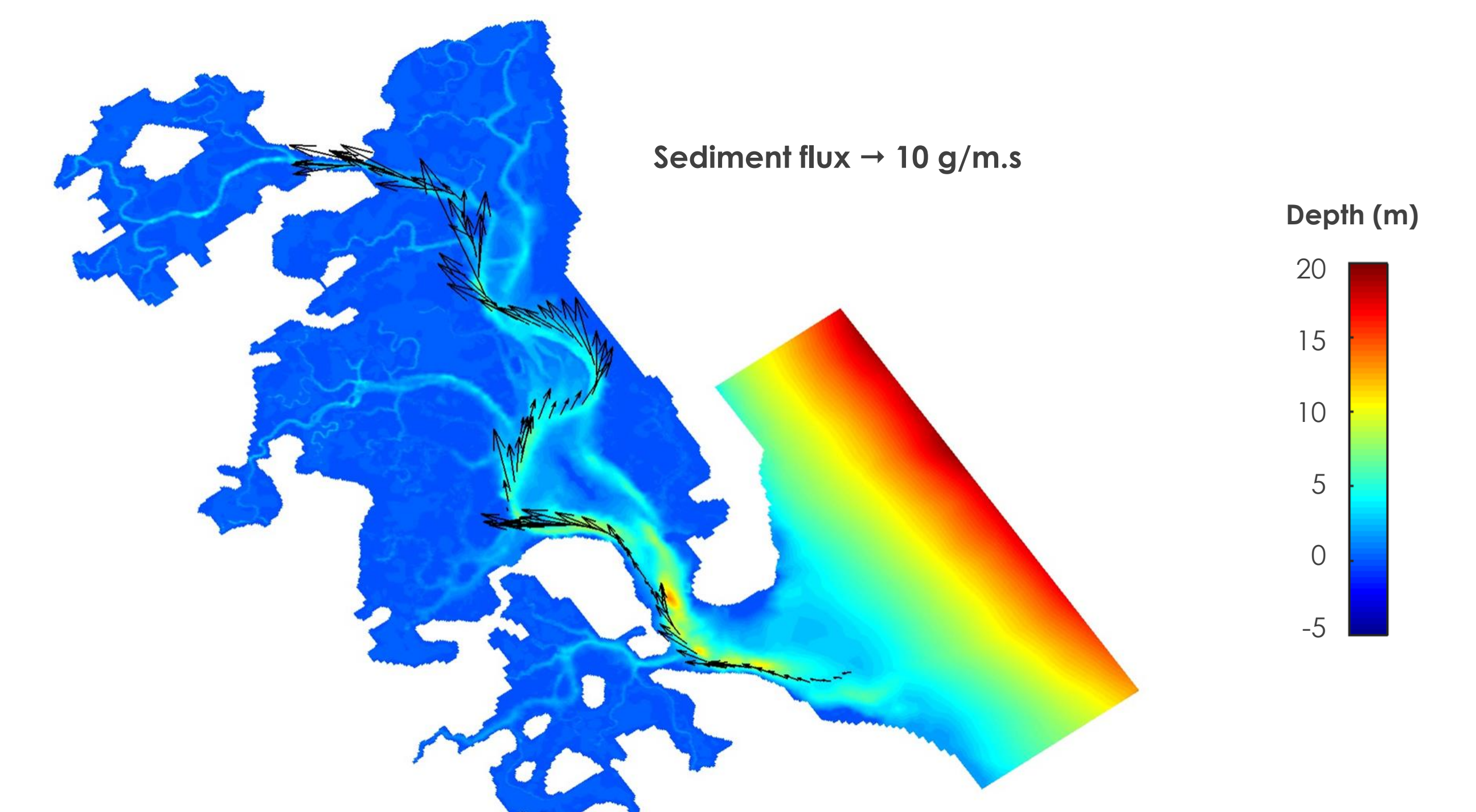
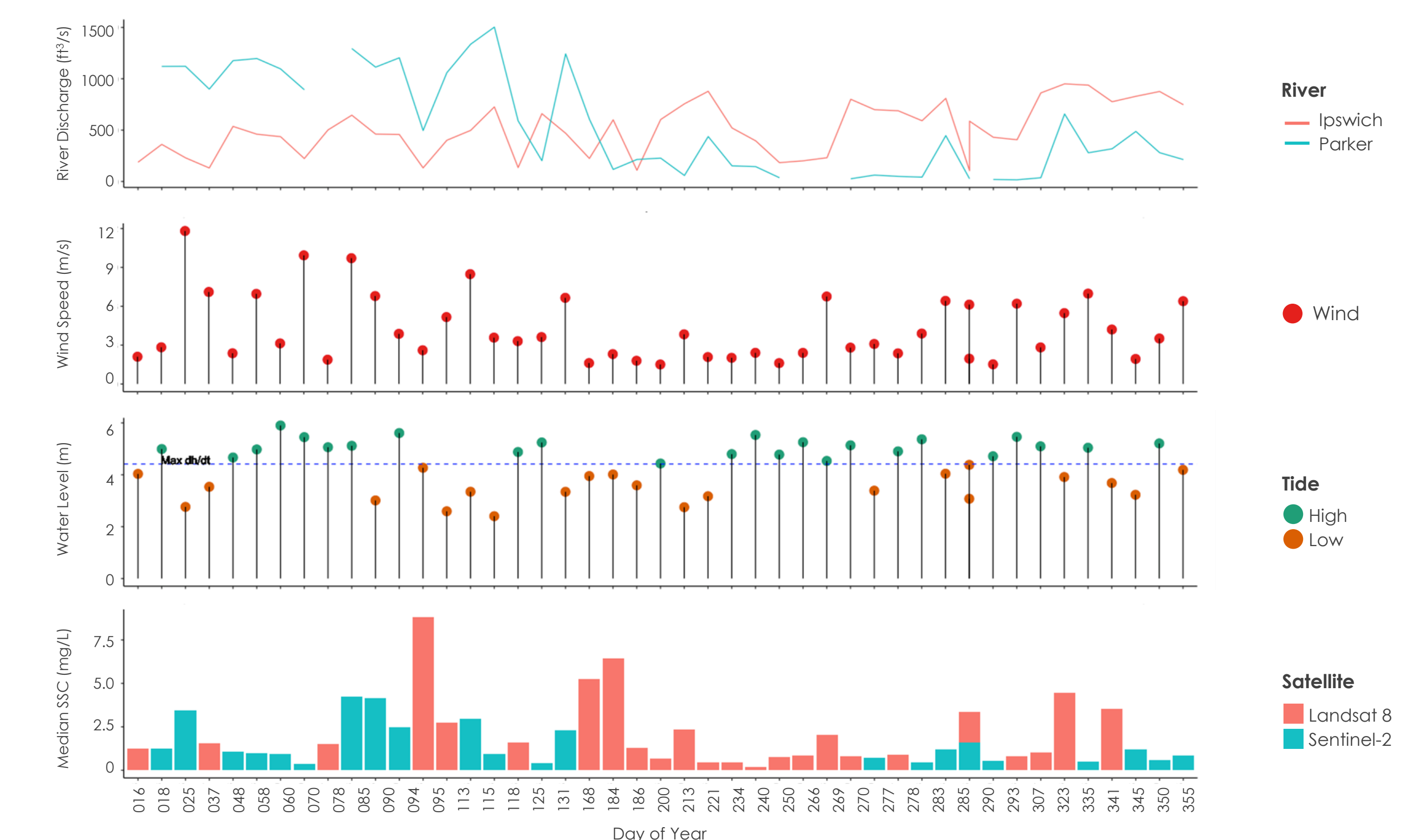
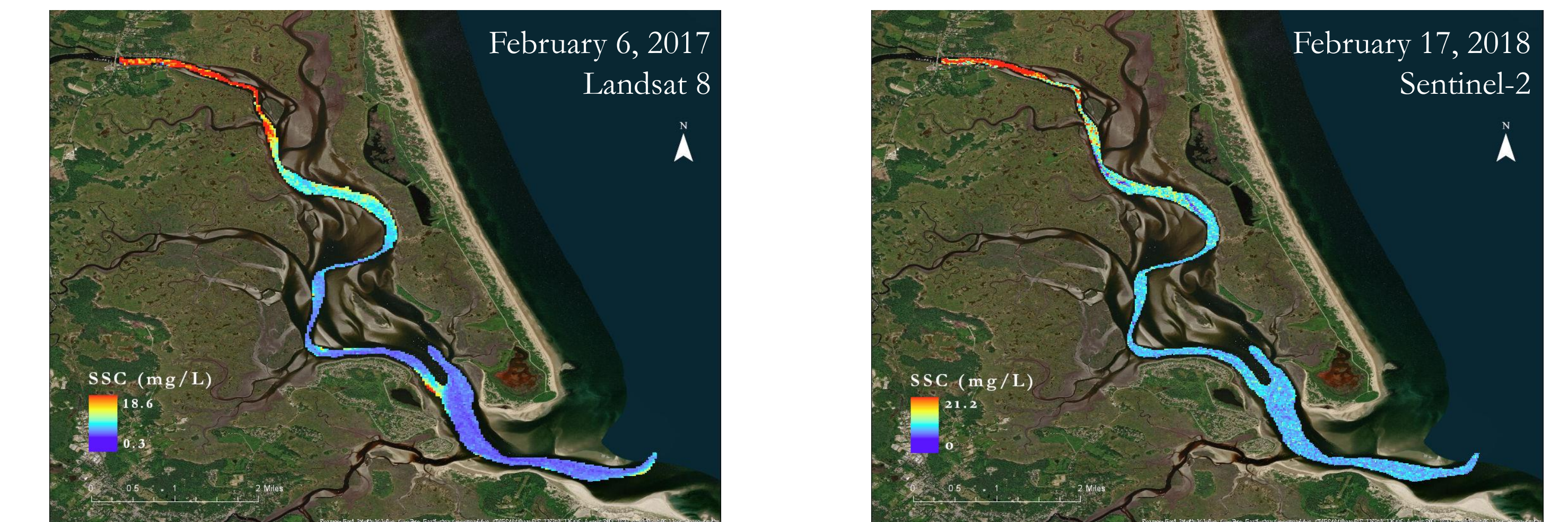


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- Xiaohe Zhang, Boston University

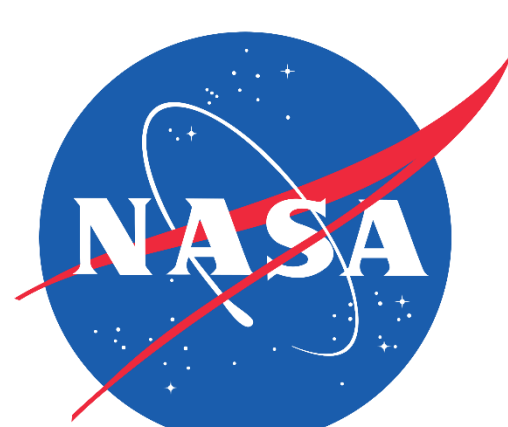
This material contains modified Copernicus Sentinel data (2017-2018), processed by ESA.

Results



Conclusions

- SSC is higher and more variable towards the top of the estuary.
- SSC is primarily influenced by river discharge and tidal level. Wind speed may affect SSC at the mouth of the estuary, but was not significant overall.
- A local algorithm relating turbidity to Rrs outperformed an established general turbidity algorithm for this area.
- A high number of *in situ* data points and a refined bathymetry mask allow for consistent retrieval of SSC through the applied algorithm.
- The relationship between SSC and Rrs differs in the Merrimack River.



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Project Video



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#AGU18

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Questions?

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