USGS
science for a changing world

Sediment fluxes to wetland complexes: Inferring trajectory through sediment budgets

Neil K. Ganju
U.S. Geological Survey
Coastal and Marine Geology Program
Woods Hole Coastal and Marine Science Center

U.S. Department of the Interior
U.S. Geological Survey

Role of sediment fluxes in wetland trajectory

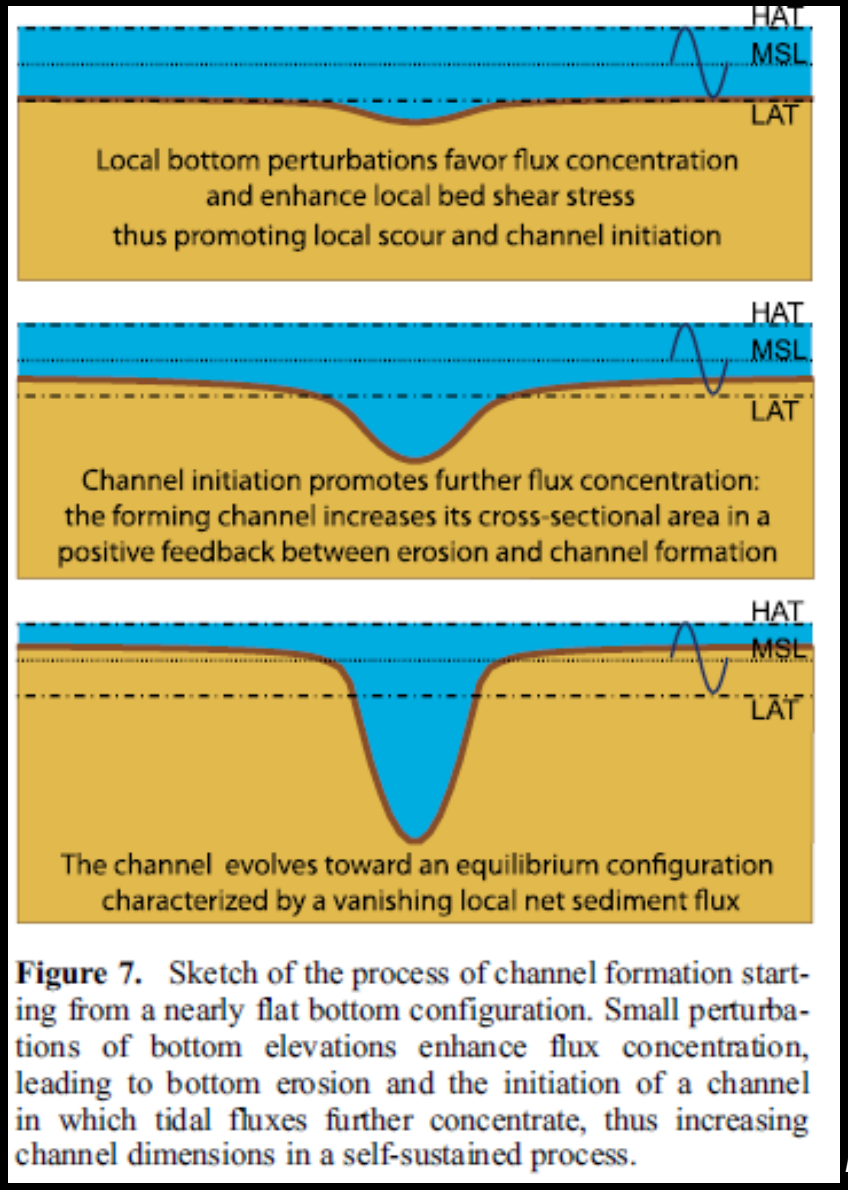
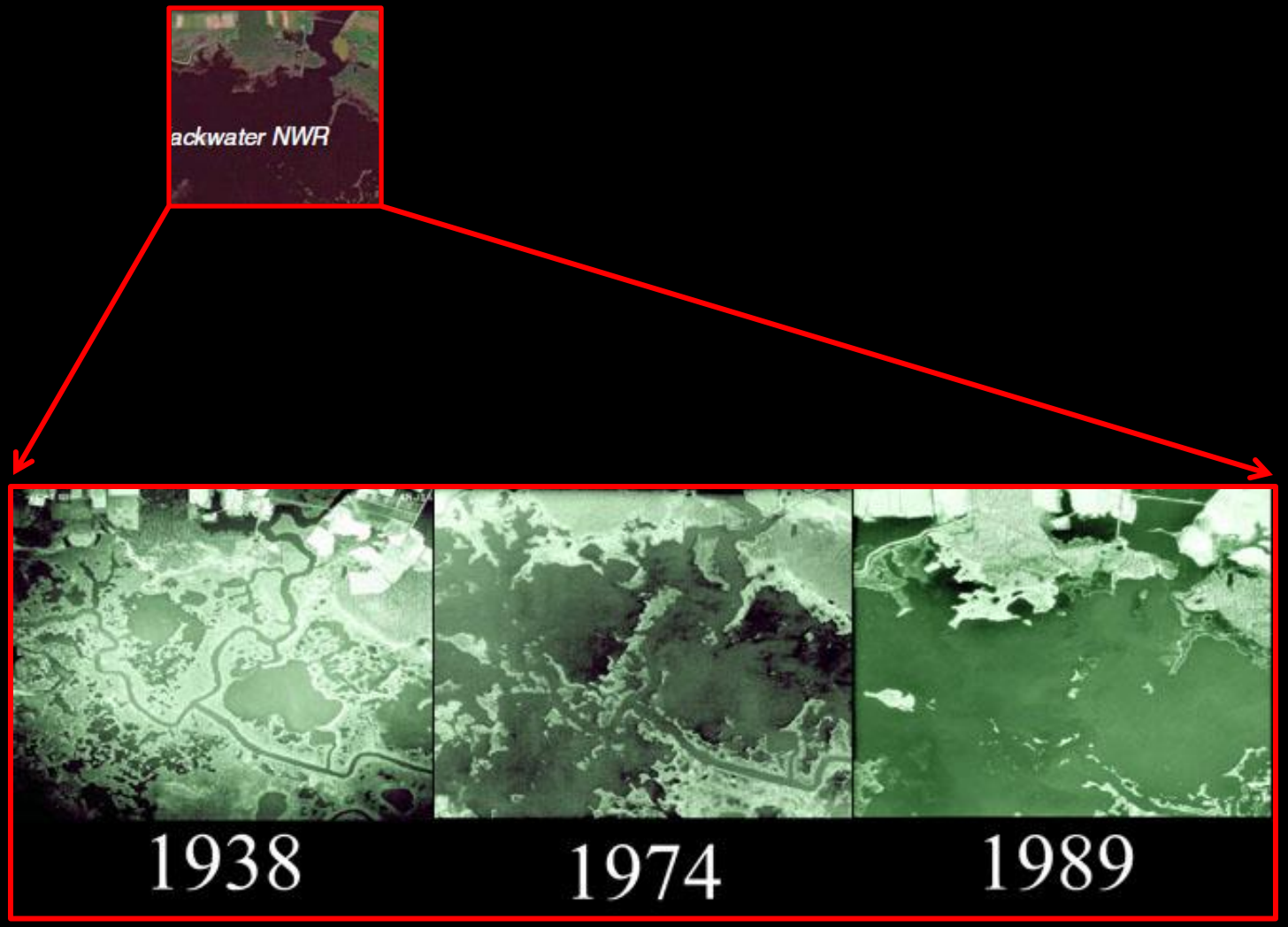


Figure 7. Sketch of the process of channel formation starting from a nearly flat bottom configuration. Small perturbations of bottom elevations enhance flux concentration, leading to bottom erosion and the initiation of a channel in which tidal fluxes further concentrate, thus increasing channel dimensions in a self-sustained process.

- Channel the main conduit for sediment flux to wetland complex
- Stability of entire geomorphic planform a function of sediment flux
- Under conditions of SLR, wetland complexes must import sediment to maintain structure of planform
- Identifying sediment flux mechanisms and budget tells us about trajectory

Fagherazzi et al., 2012

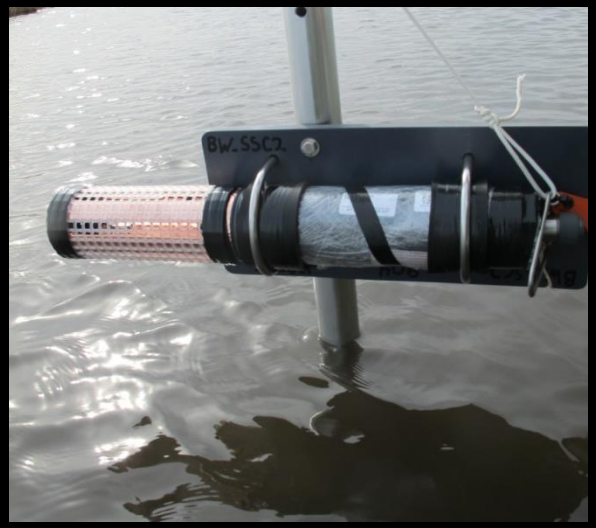
Blackwater NWR: poster child for wetland instability



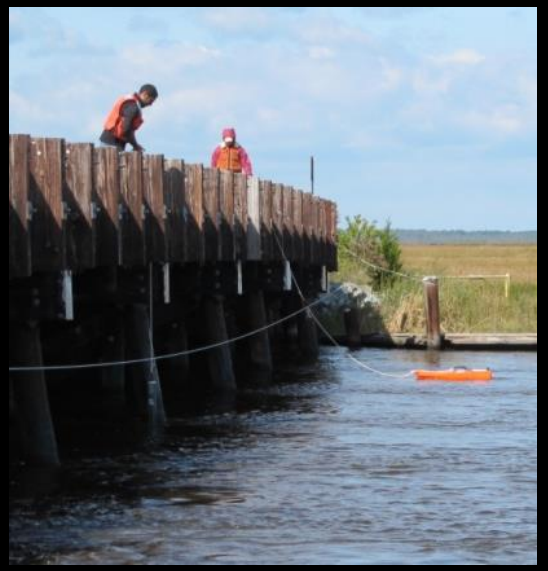
USGS

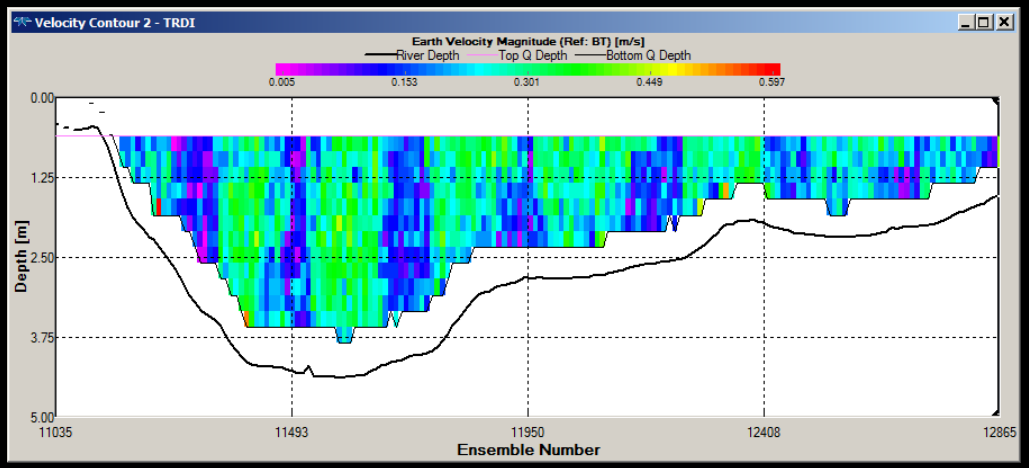
Measuring sediment fluxes

Continuous data: velocity, turbidity

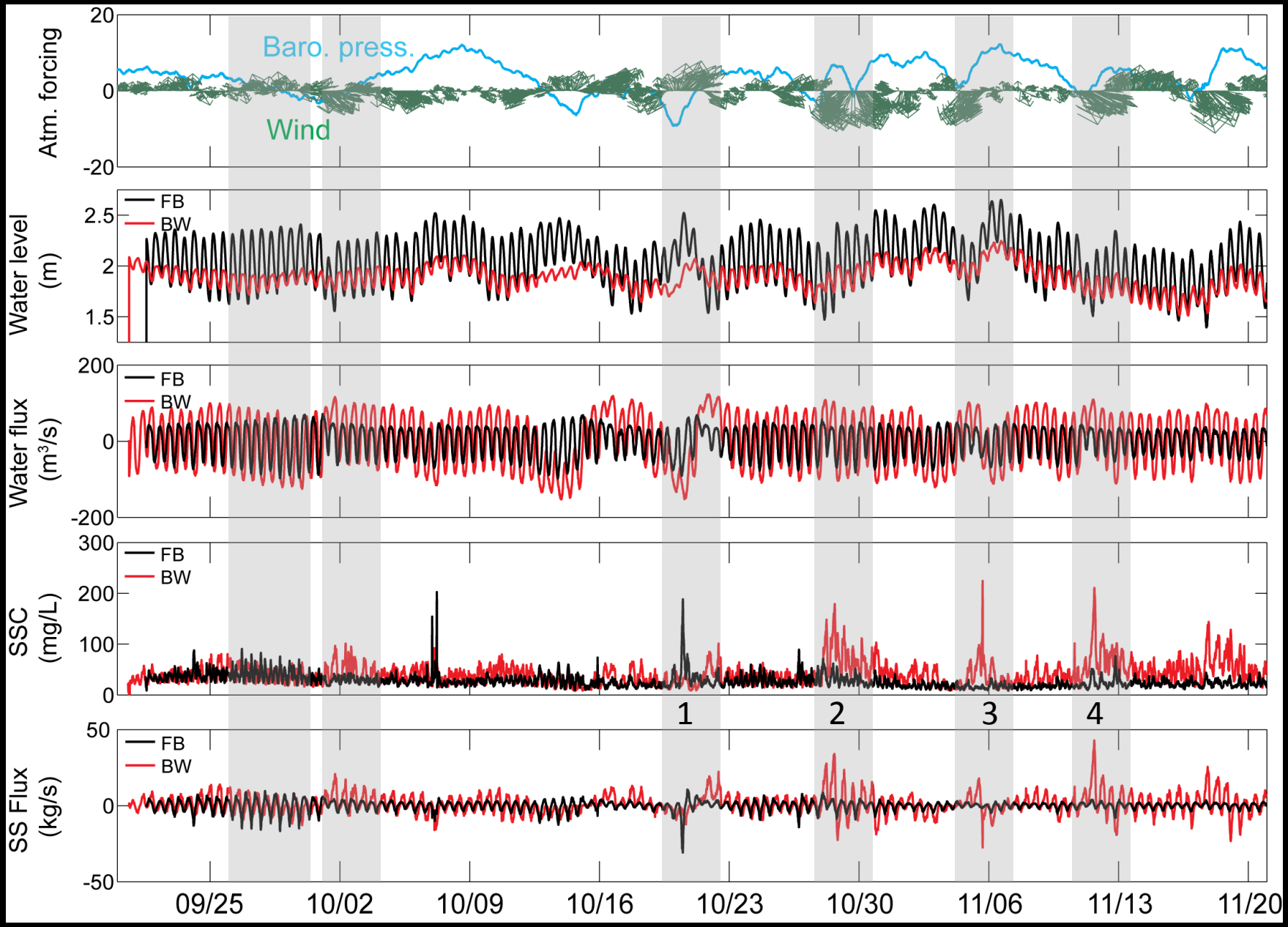


Cross-sectional data: discharge, SSC

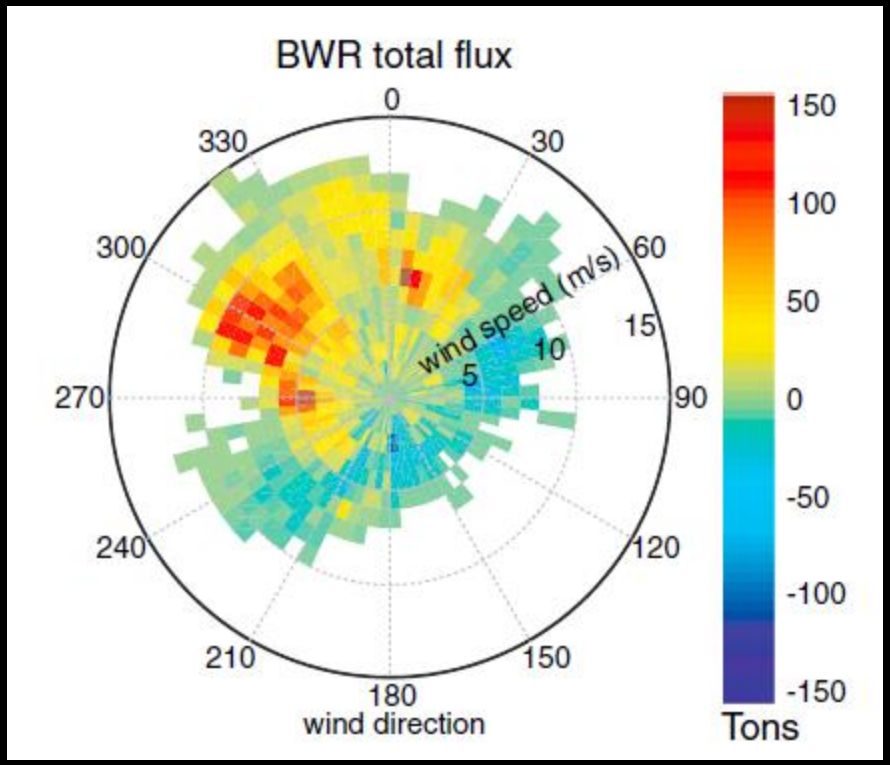


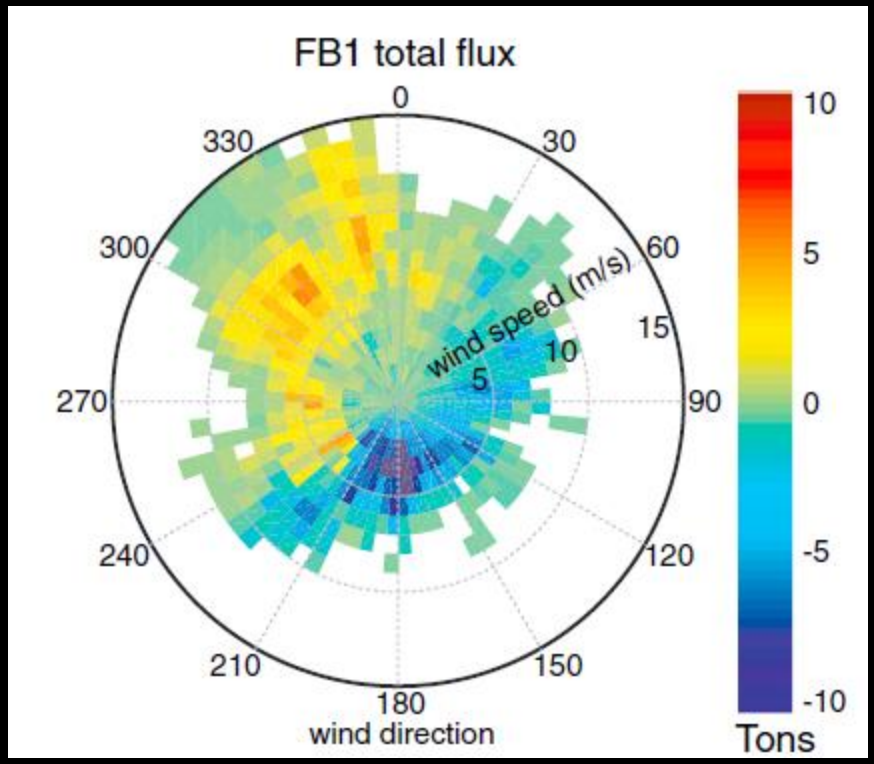


Time-series of forcing and flux: positive flux = seaward



Sediment flux response to wind: positive=seaward





Most export during periods of NW winds: resuspension and seaward export of water

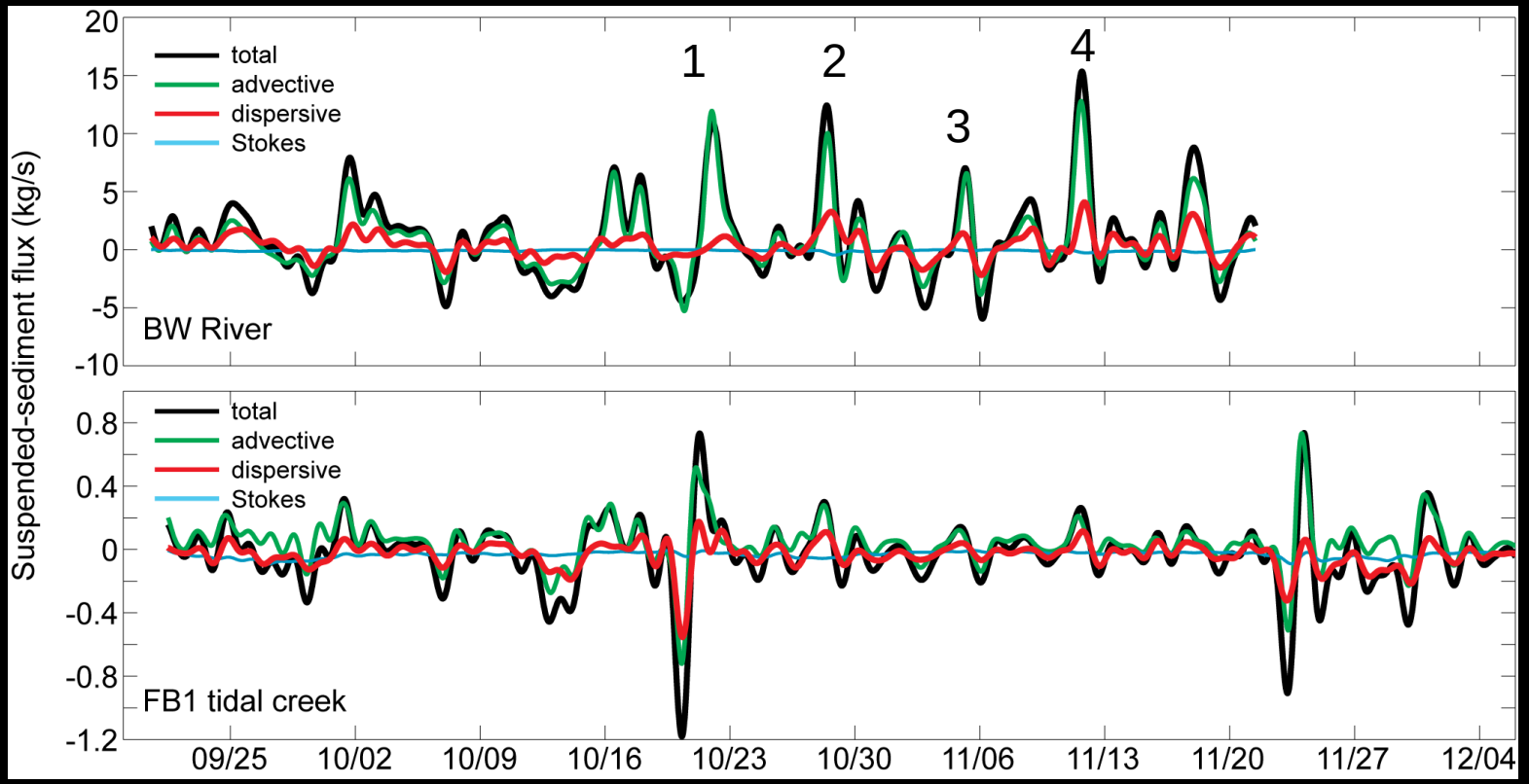
Minor import during weak SW-SE winds

Some export during periods of NW winds

Most import during weak S winds: supply from Fishing Bay

USGS

Time-series of flux: positive is seaward export



	BW River	FB1 tidal creek
Advective	+0.82 (out)	+0.042 (out)
Dispersive	+0.31(out)	-0.034(in)
Stokes	-0.09(in)	-0.032 (in)
Total	+1.02 kg s^{-1} (out)	-0.03 kg s^{-1} (in)
Total/area	+1.29 kg m^{-2} y^{-1}	-0.95 kg m^{-2} y^{-1}

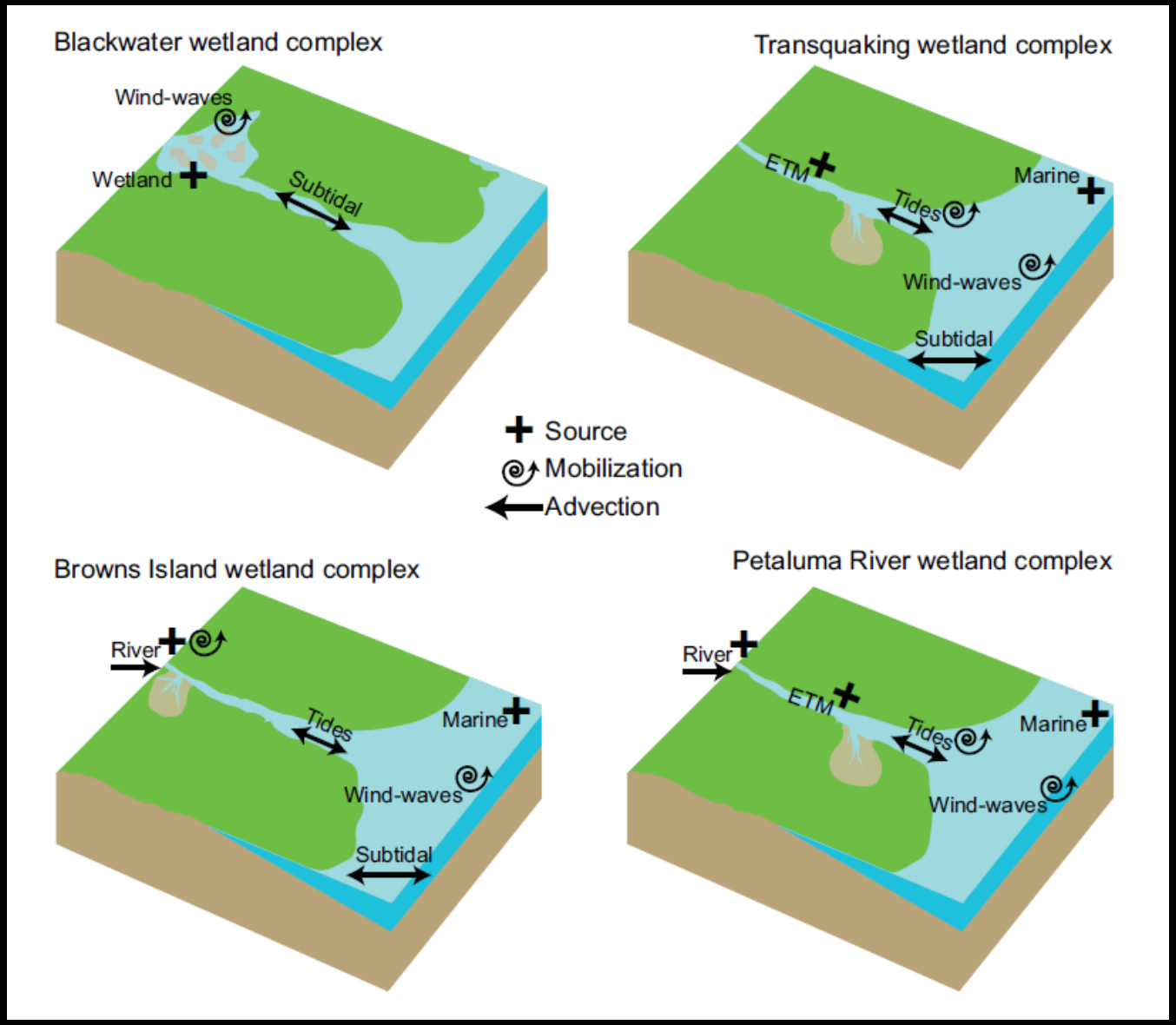
86 metric tons per day, or 172 m^3 per day, or 172 m of 1 m x 1 m shoreline @ bulk dens of 500 kg/m^3

~ 5 mm y^{-1} distributed over estimated drainage area: keeping up with SLR

Conceptual model: sediment portfolios and wetland stability

Chesapeake Bay

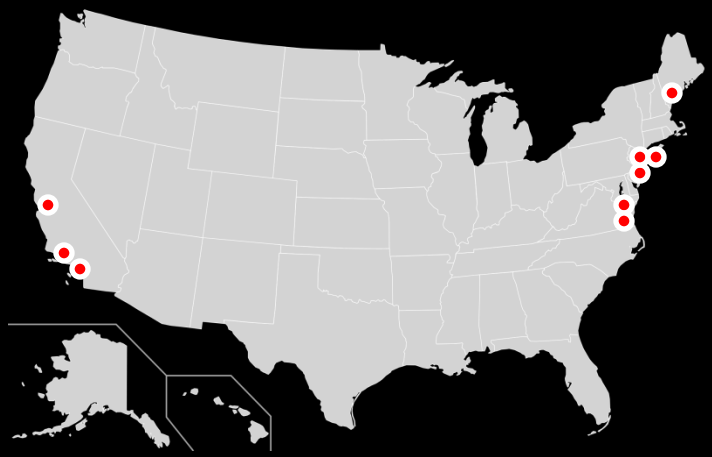
San Francisco Bay



USGS

Ganju et al., 2013

Other wetland flux sites



Potential for collaboration

- Role of sediment transport cannot be distilled into single value of SSC
- Understanding of transport mechanisms and magnitudes necessary
- We have extensive time-series data for water level, SSC, fluxes
- We have sediment budgets for several complexes
- Sediment transport data can be used to build probabilistic or deterministic models
- Willing to collaborate at new sites as available, assuming science goals are aligned

USGS