Journal of Geophysical Research—Oceans

Supporting Information for

Development of a Physically-based Sediment Transport Model for Green Bay, Lake Michigan

Bahram Khazaei[1,4], Hector R. Bravo[1], Eric J. Anderson[2], and Jeffrey V. Klump[3]

1- Department of Civil and Environmental Engineering, University of Wisconsin-Milwaukee

2- Great Lakes Environmental Research Laboratory, National Oceanic and Atmospheric Administration

3- School of Freshwater Sciences, University of Wisconsin-Milwaukee

4- Current position: Research Application Laboratory, National Center for Atmospheric Research

Contents of this file

Figures S1 to S8

Additional Supporting Information (Files uploaded separately)

Captions for Movie S1 to S3

Introduction

Figures included in this Supporting Information provide more details of the study area and support the performance of the hydrodynamic and sediment transport models. Animated movies are also included in the Additional Supporting Information to provide more details of thermal structure and sediment transport patterns in Green Bay.

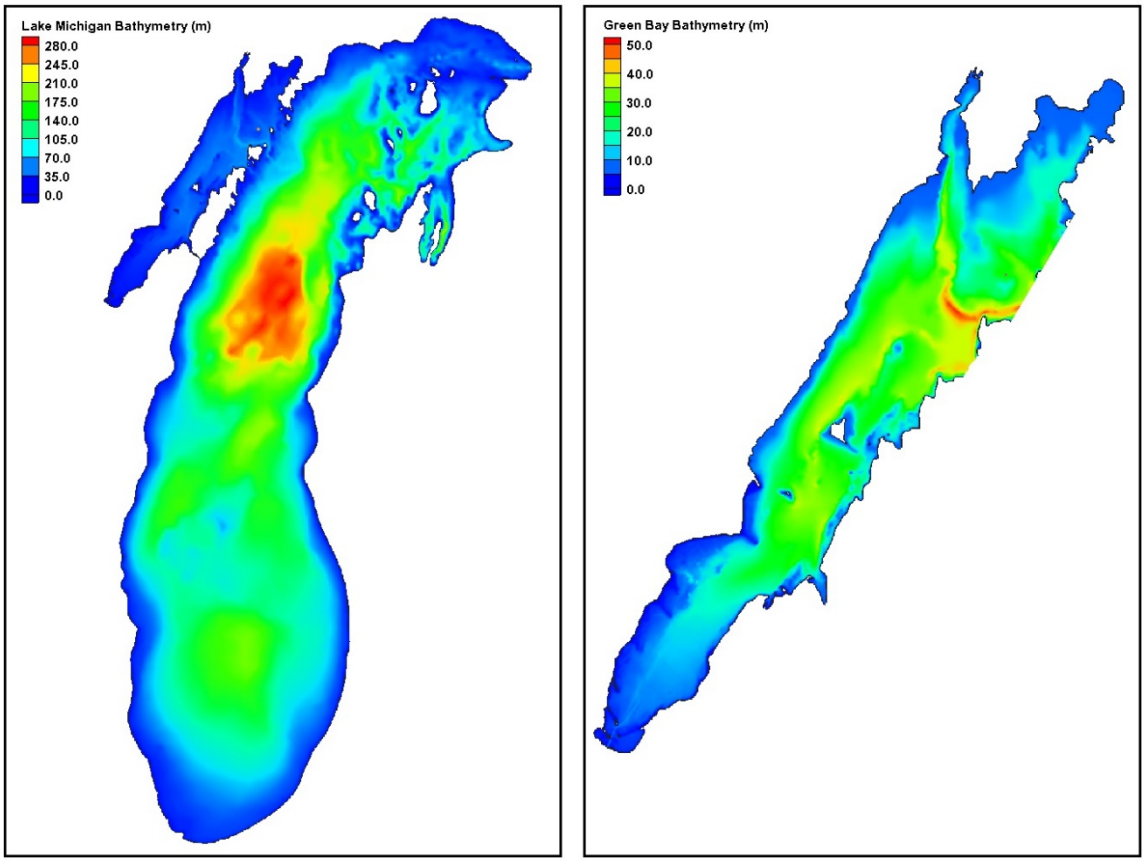

Figure S1. Bathymetry of Lake Michigan (left) and Green Bay (right).

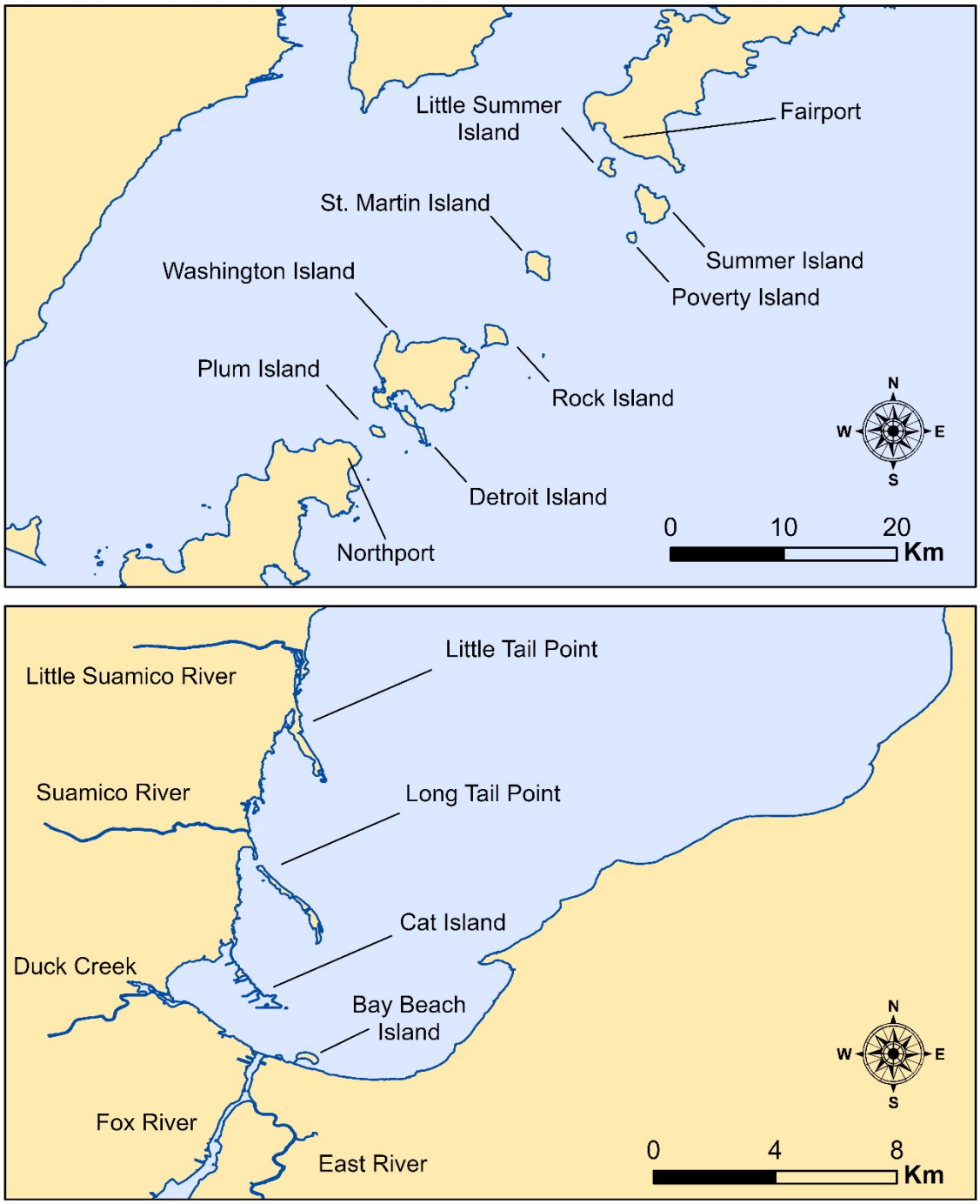

Figure S2. Islands at the area of exchange between Lake Michigan and Green Bay (top) and Lower Green Bay islands (bottom). The latter provide shoreline protection in the western coastal areas where currents and waves are more frequent and stronger in the lower bay.

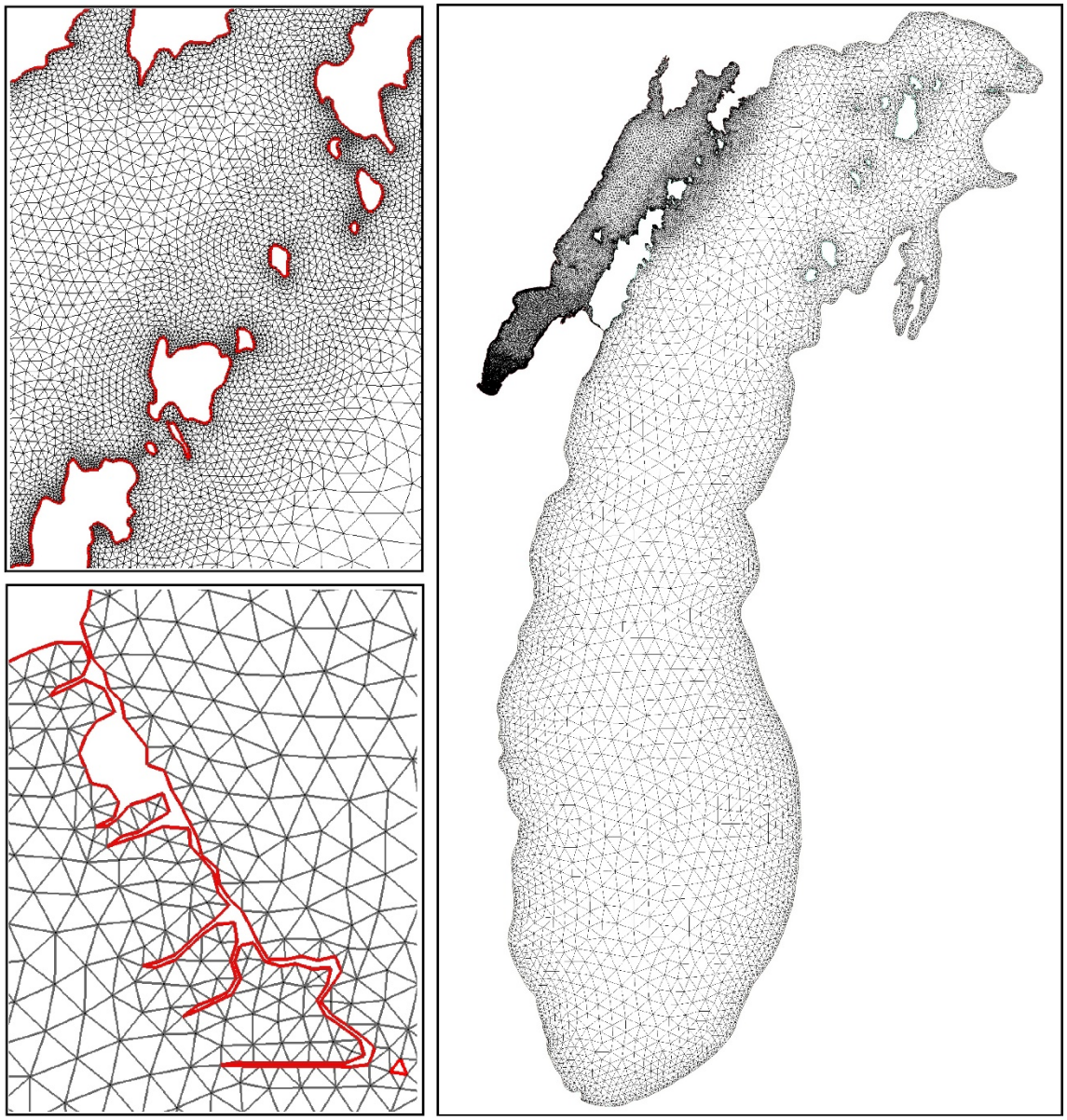

Figure S3. Lake Michigan grid resolution (right), details in Lake Michigan-Green Bay exchange area (top left), and Cat Island (bottom left).

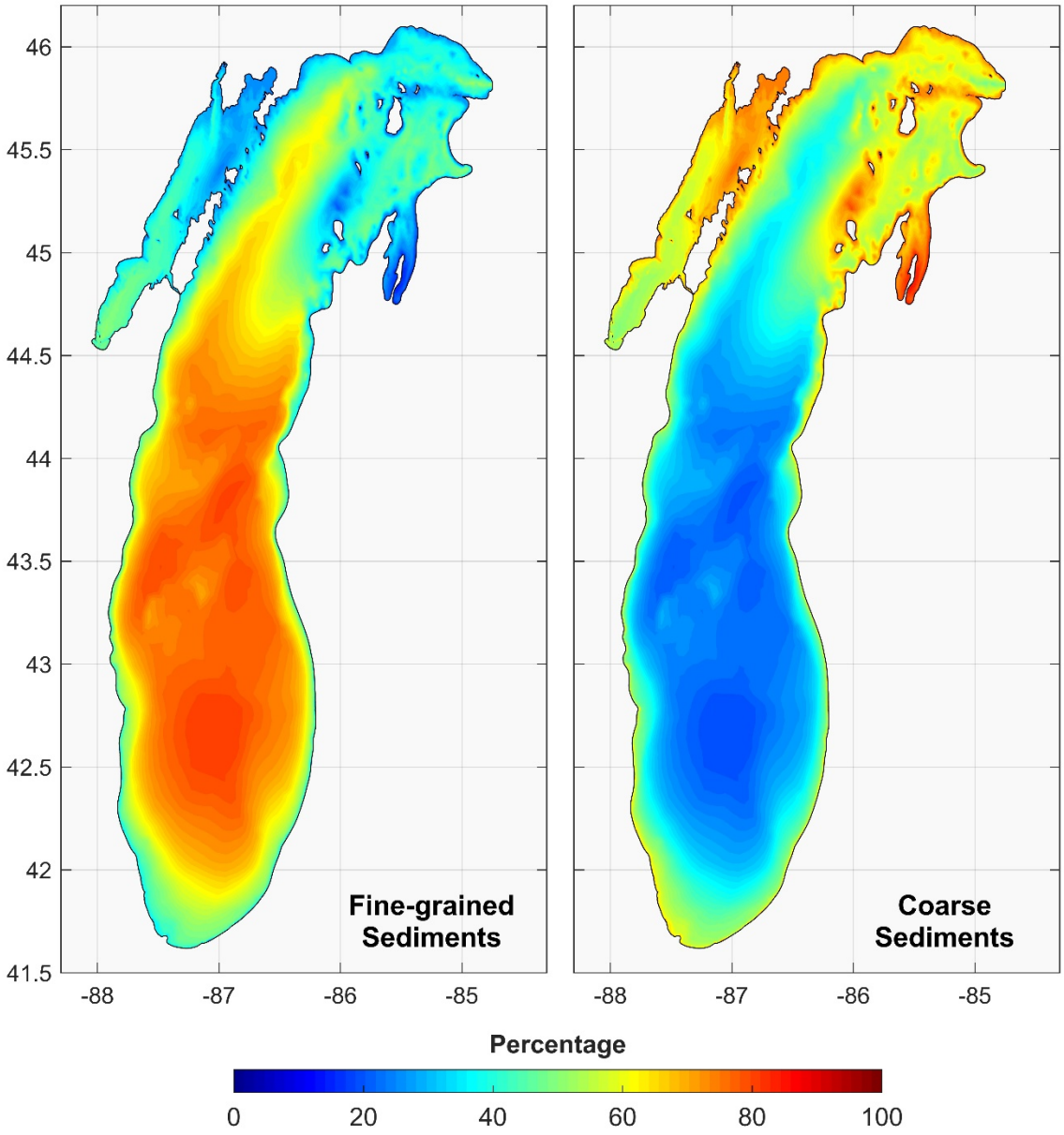

Figure S4. Distribution of fine-grained and coarse sediment classes in Lake Michigan used to initialize the sediment transport model. We defined Clay, Fine Silt, Coarse Silt, and Fine Sand as fine sediments and Coarse Sand, and Gravel as coarse sediments.

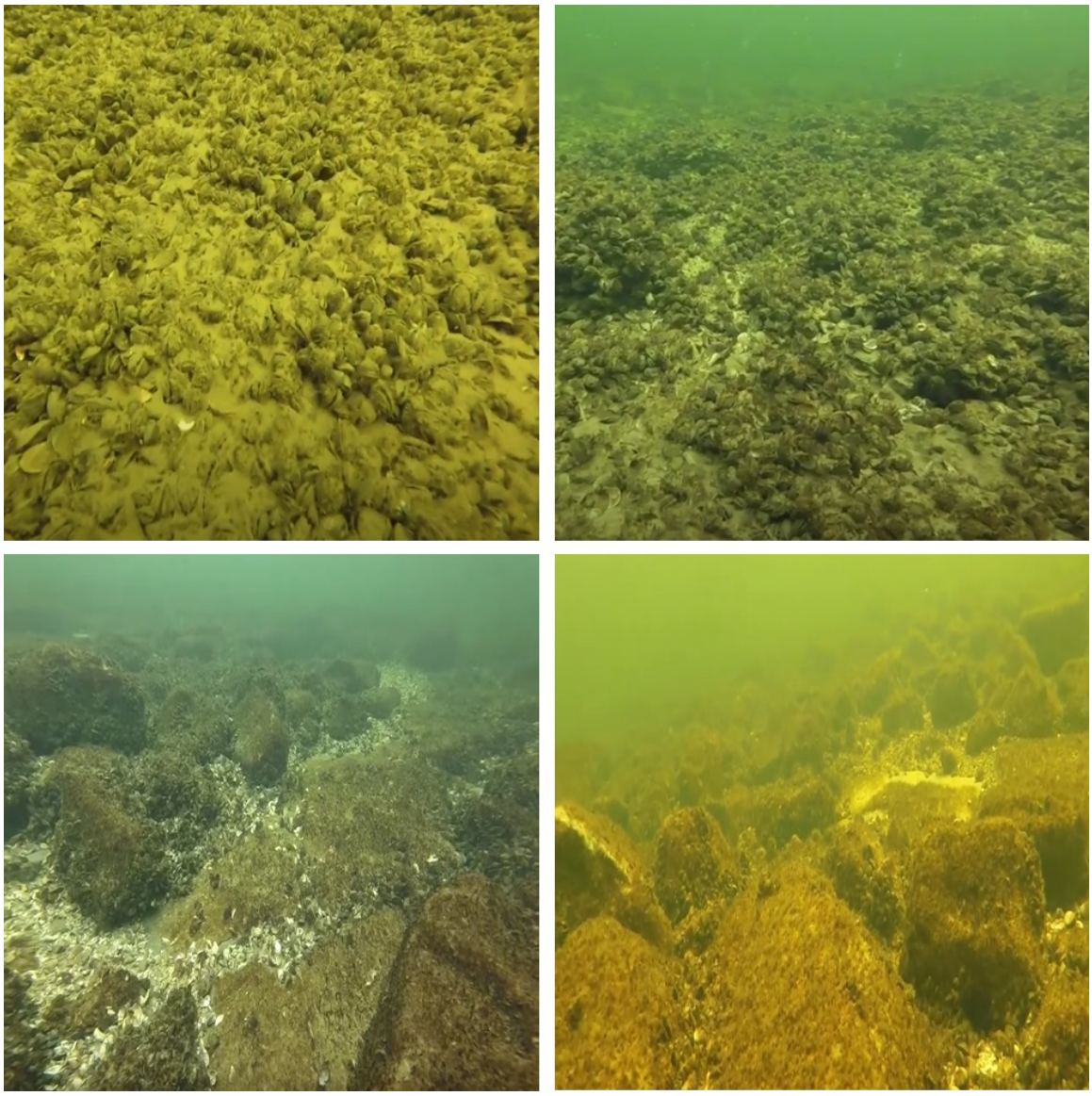

Figure S5. Recent observations of the Green Bay bed conditions in lower Green Bay near the inlet of Sturgeon Bay. These photos are selected as examples to show the population of mussels over the sediment layer, which may affect summertime sediment transport significantly. Photos are the courtesy of Jeff Hugoton (https://www.youtube.com/user/TheRotax1/videos).

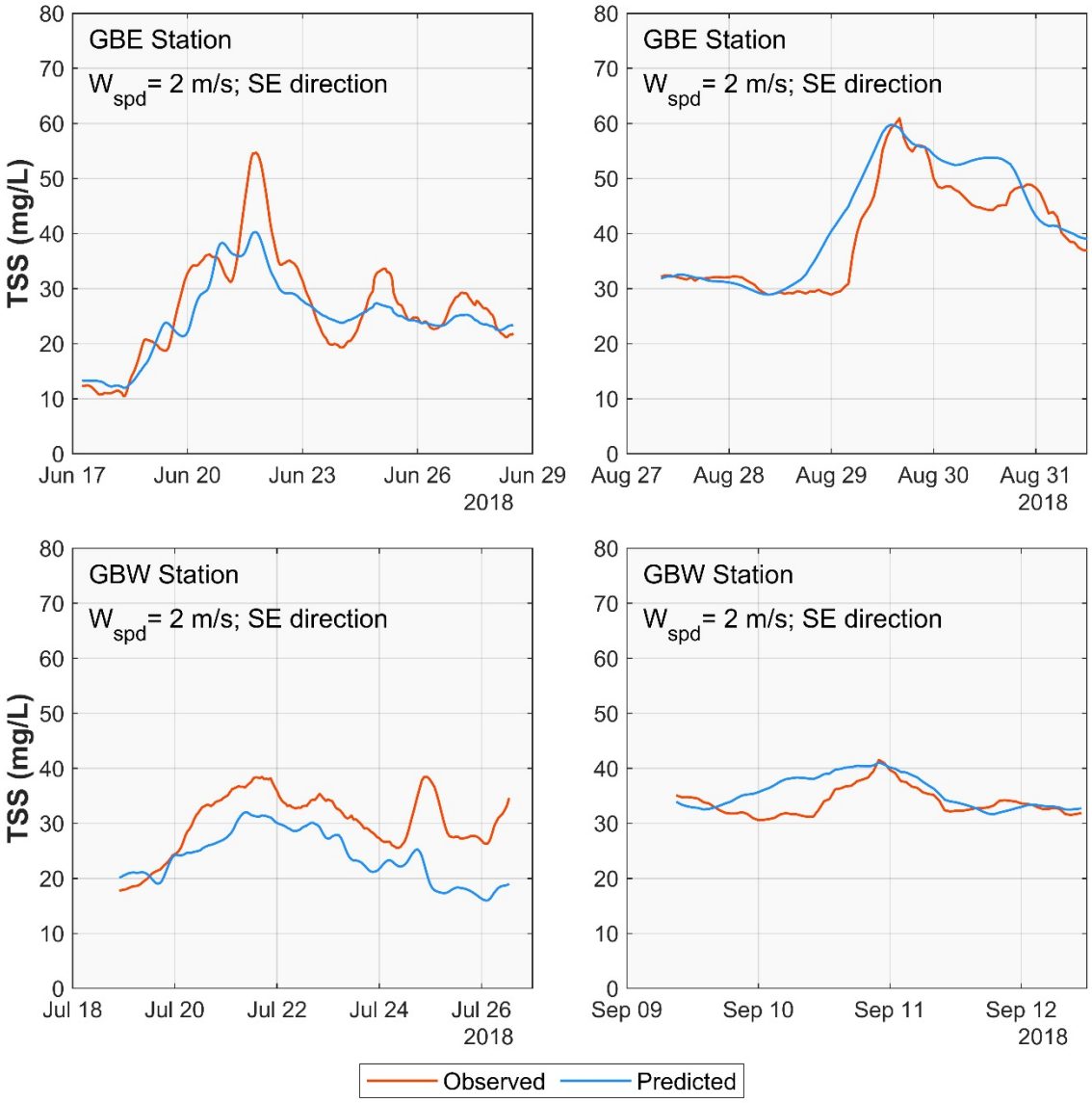

Figure S6. Examples of resuspension episodes in the lower Green Bay and comparison of the observed vs predicted total suspended solids (TSS).

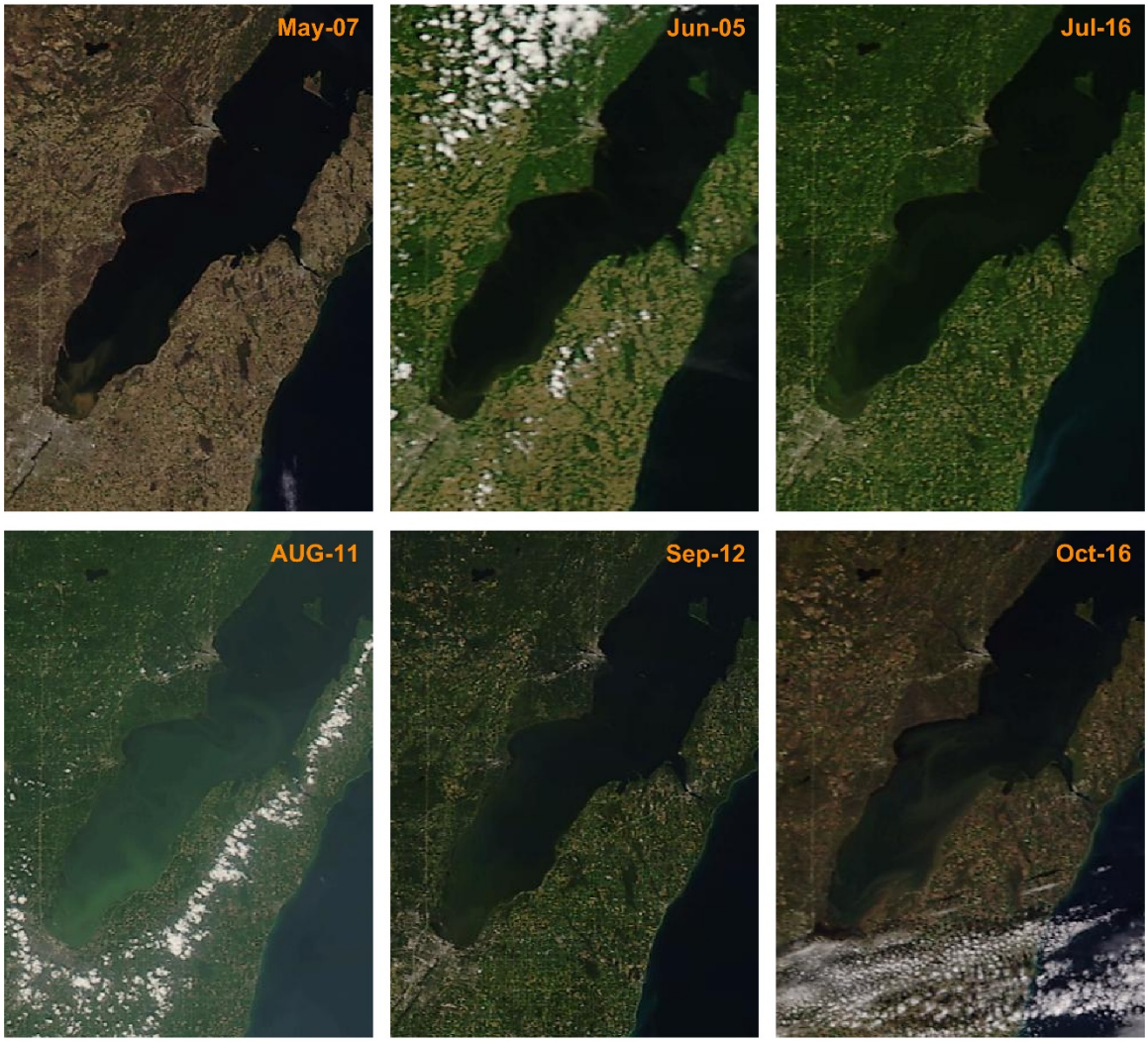

Figure S7. True-color visualization of MODIS imagery data used for mapping surface TSS concentration in the lower Green Bay for six selected days in summer 2018. Data was obtained from MODIS Today (http://ge.ssec.wisc.edu/modis-today/).

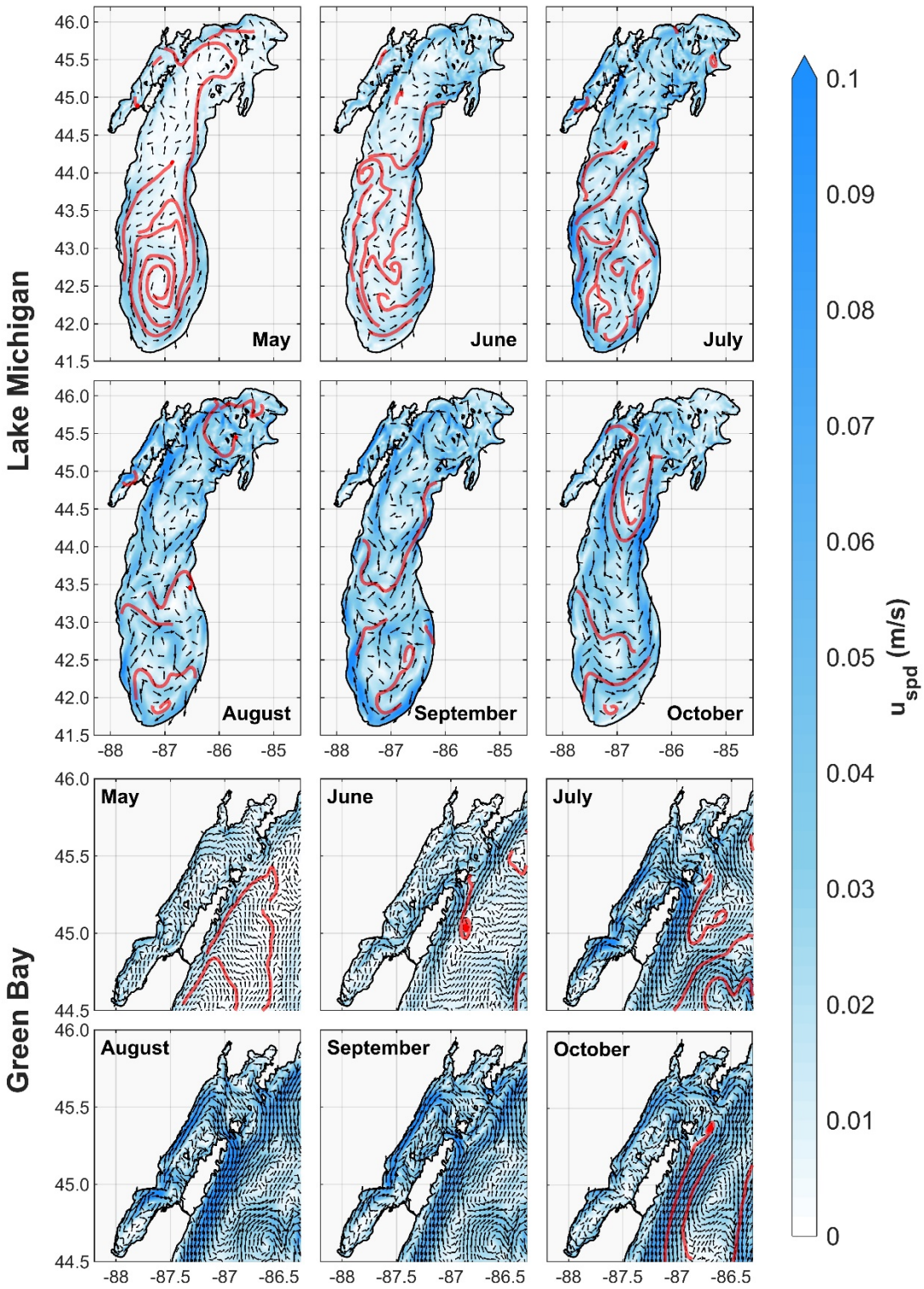

Figure S8. Monthly-averaged surface currents in Lake Michigan and Green Bay during the 2016-2019 period. Bolded red lines indicate dominant circulation patterns. U_{spd} denotes currents magnitude.

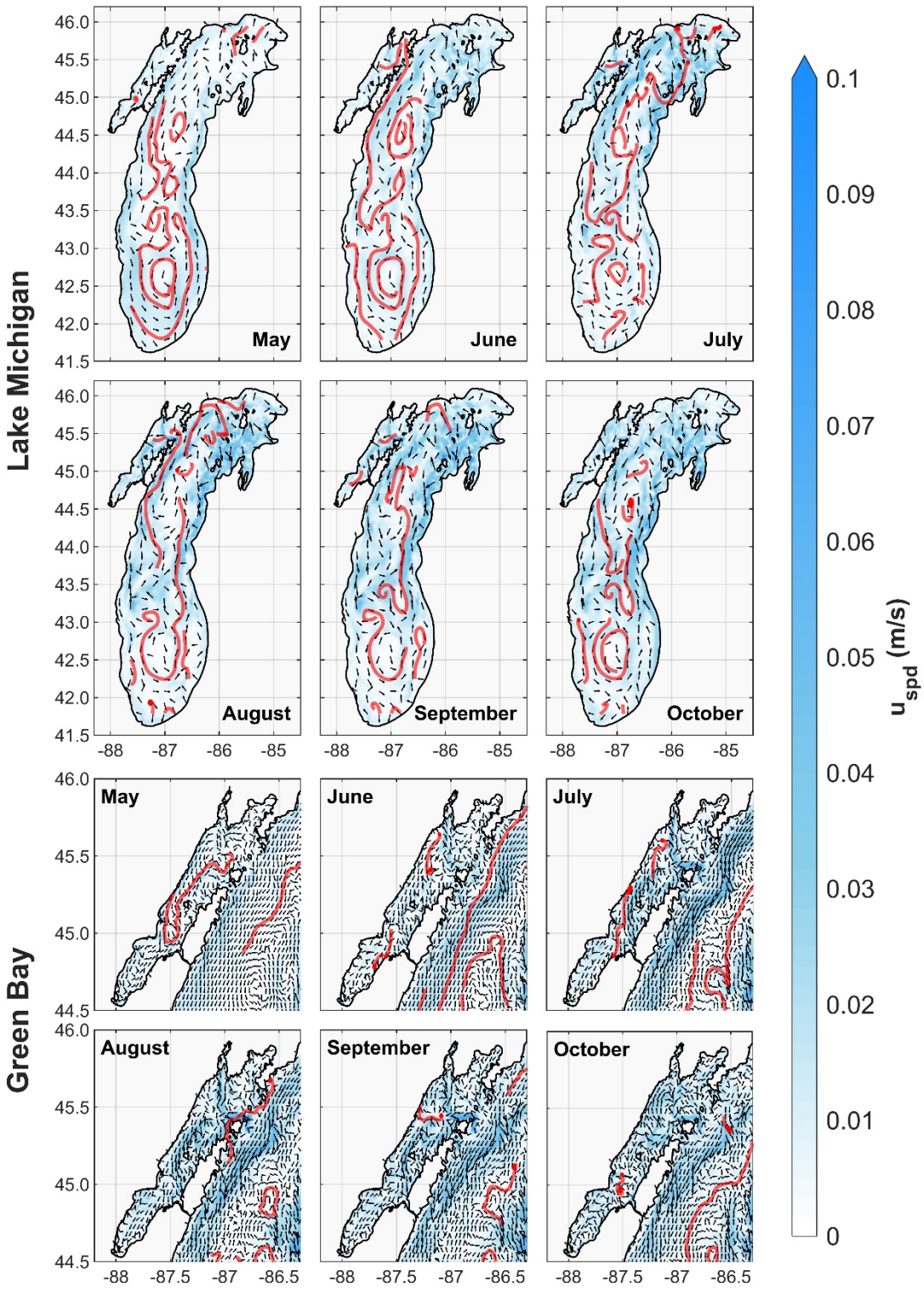

Figure S9. Monthly-averaged bottom currents in Lake Michigan and Green Bay during the 2016-2019 period. Bolded red lines indicate dominant circulation patterns. U_{spd} denotes currents magnitude.

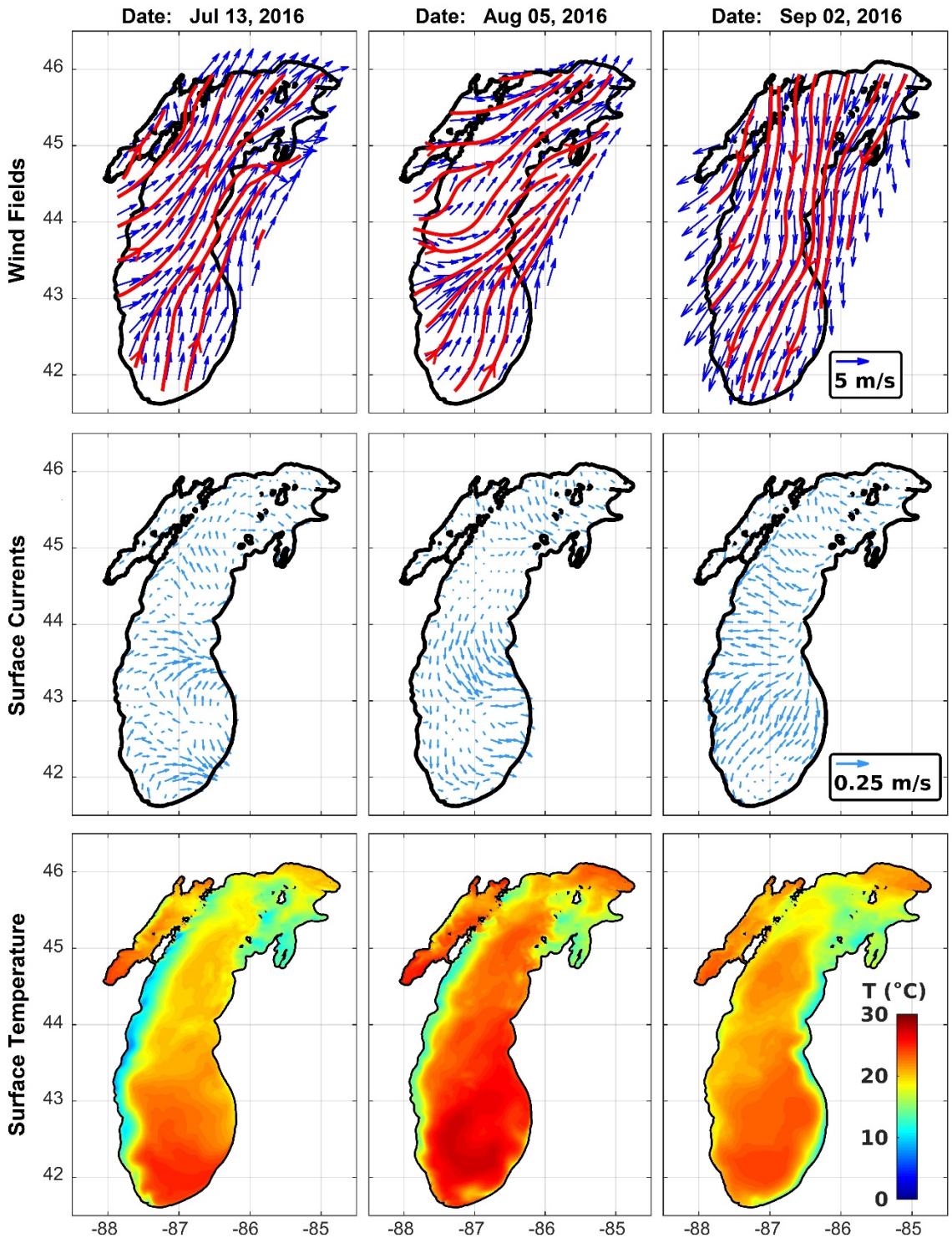

Figure S10. Examples of the upwelling events in Lake Michigan in July, August, and September of 2016 (bottom row) with their corresponding surface currents (middle row) and wind fields (top row). The figure clearly shows that N-S winds drive currents offshore and generate upwellings in Lake Michigan nearshore areas.

Movie S1. Animated daily-averaged snapshots of water temperature (TW) profile along the A-A′ (Green Bay longitudinal axis) cross-section (as shown in Figure 1) during the period of May-October 2018. The vertical axis is exaggerated ~700 times.

Movie S2. Animated daily-averaged snapshots of total suspended solids (TSS) profile along the A-A′ (Green Bay longitudinal axis) cross-section (as shown in Figure 1) during the period of May-October 2018. The vertical axis is exaggerated ~700 times.

Movie S3. Animated daily- and depth-averaged snapshots of total suspended solids (TSS) in Green Bay during the period of May-October 2018. Right-bottom inset provides high-resolution details of TSS transport in the Green Bay AOC and near the mouth of Fox River.