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Supplement of

Diagnosing transit times on the northwestern North Atlantic continental shelf

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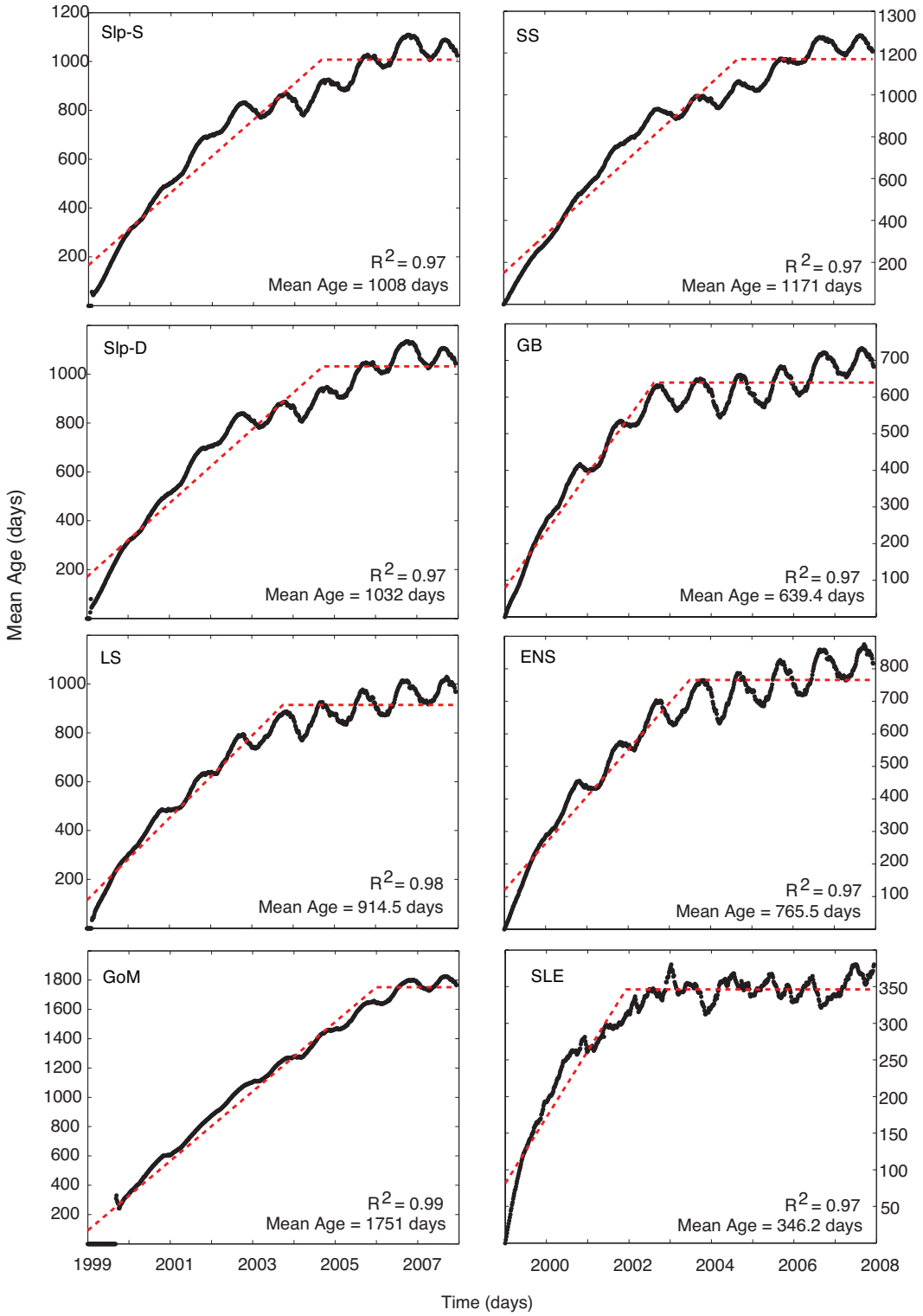

Figure S1: Time series of age averaged within Gulf of St. Lawrence for each dye (black) and bilinear fit (red) used to determine the mean age of each dye in Gulf of St. Lawrence.

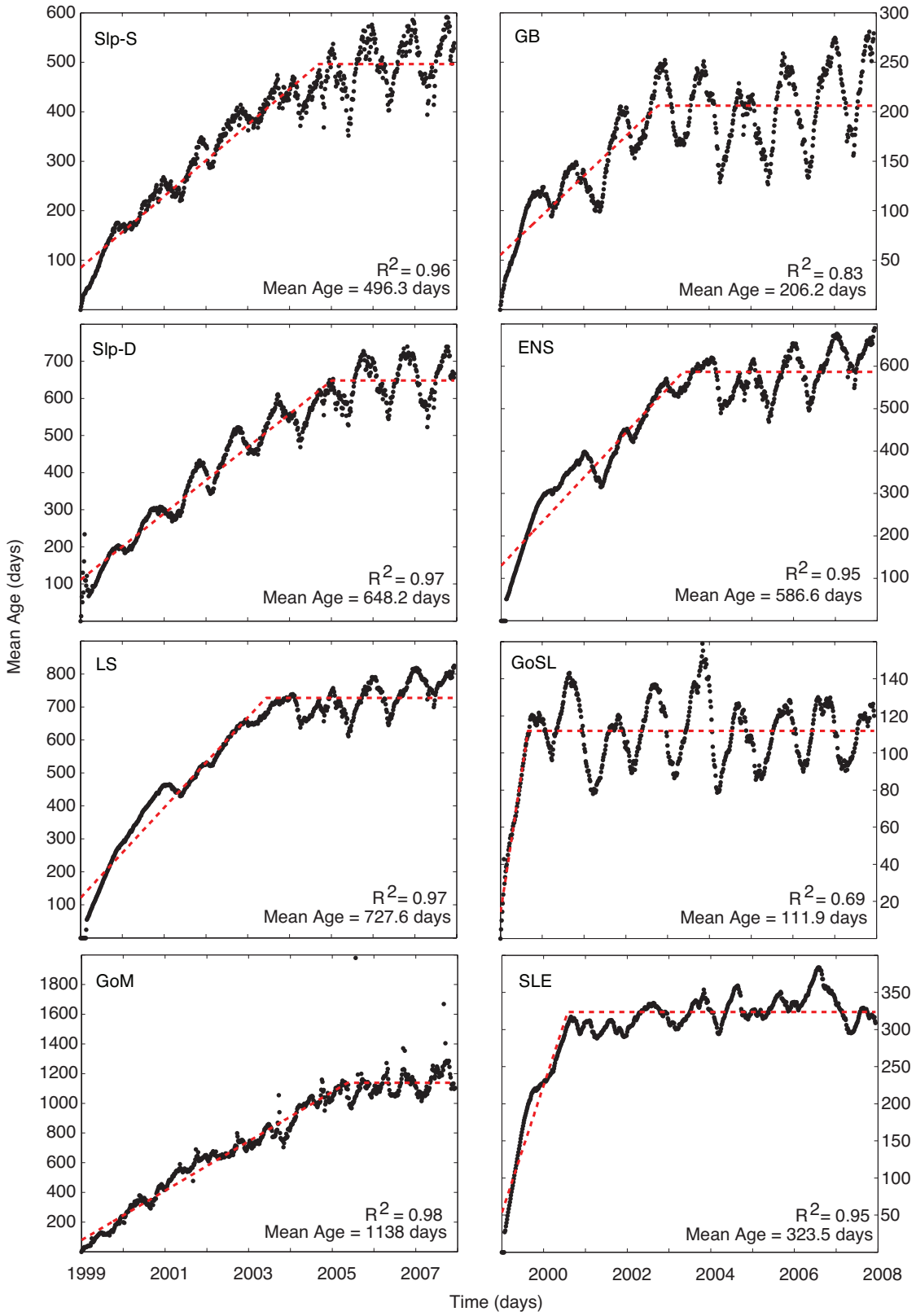

Figure S2: Time series of mean age averaged on Scotian Shelf for each dye (black) and bilinear fit (red) used to determine the steady state or mean age of each dye on the Scotian Shelf.

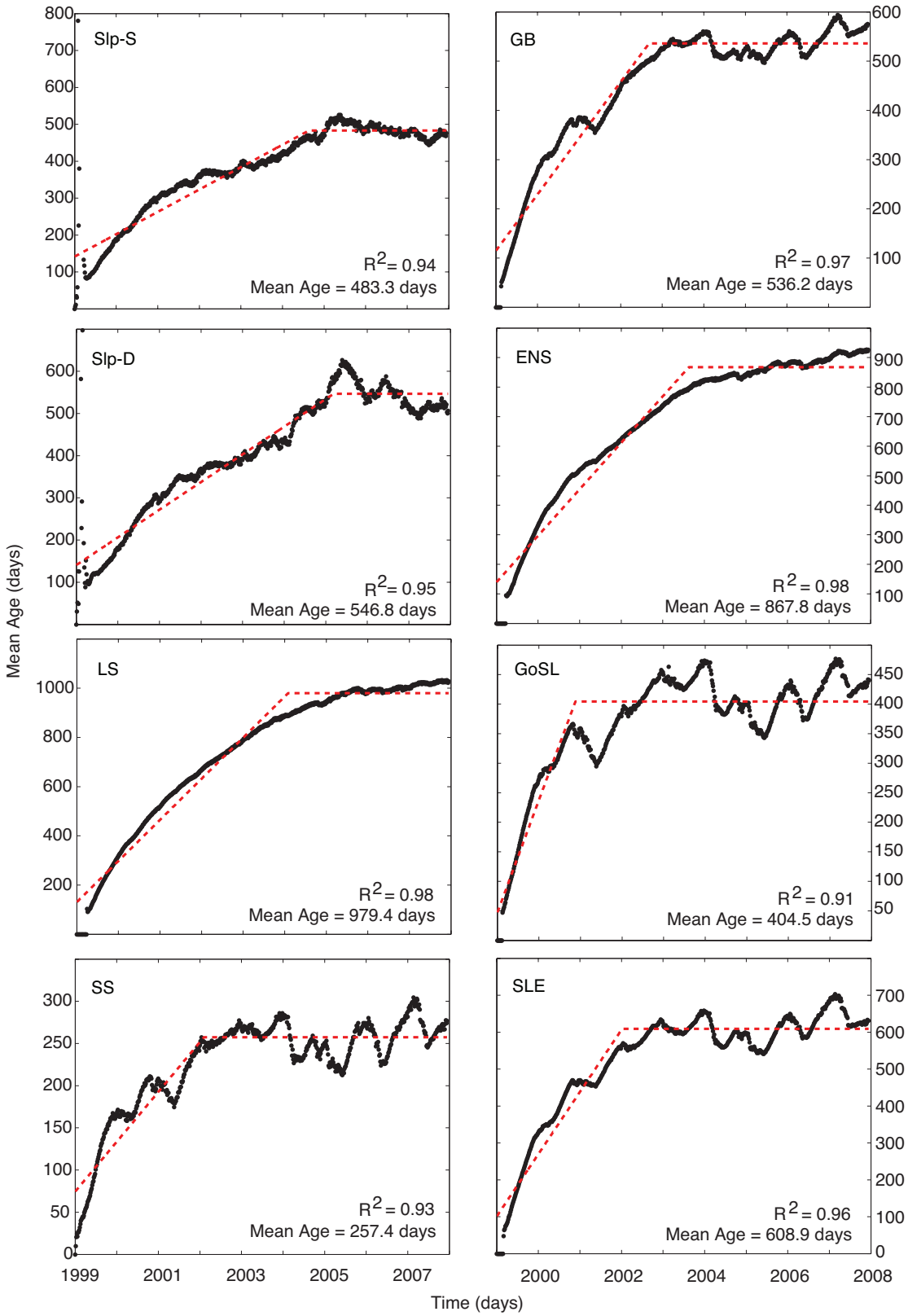

Figure S3: Time series of mean age averaged within the Gulf of Maine for each dye (black) and bilinear fit (red) used to determine the steady state or mean age of each dye in the Gulf of Maine.

S2. Model Validation

The model was extensively validated in Brennan et al. (2016b). Here, we repeat a few key aspects of that validation for our simulation.

Figure S5 and Figure S6 compare model output to Atlantic Zone Monitoring Program (AZMP) observations along two transects on the Scotian Shelf: the Halifax and Louisbourg Lines (locations shown in Figure S4). These transects show that the model is able to capture the vertical structure on the shelf well, specifically in the deeper basins.

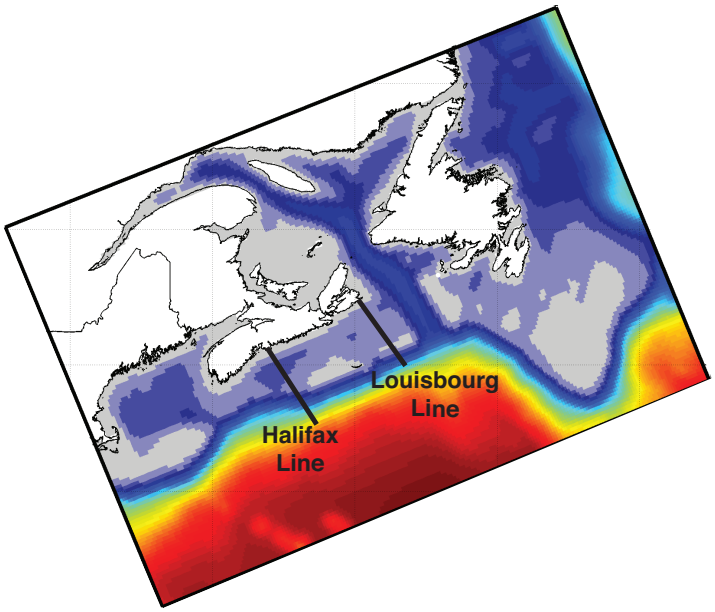

Figure S4: Location of AZMP monitoring transects: Louisbourg and Halifax Lines.

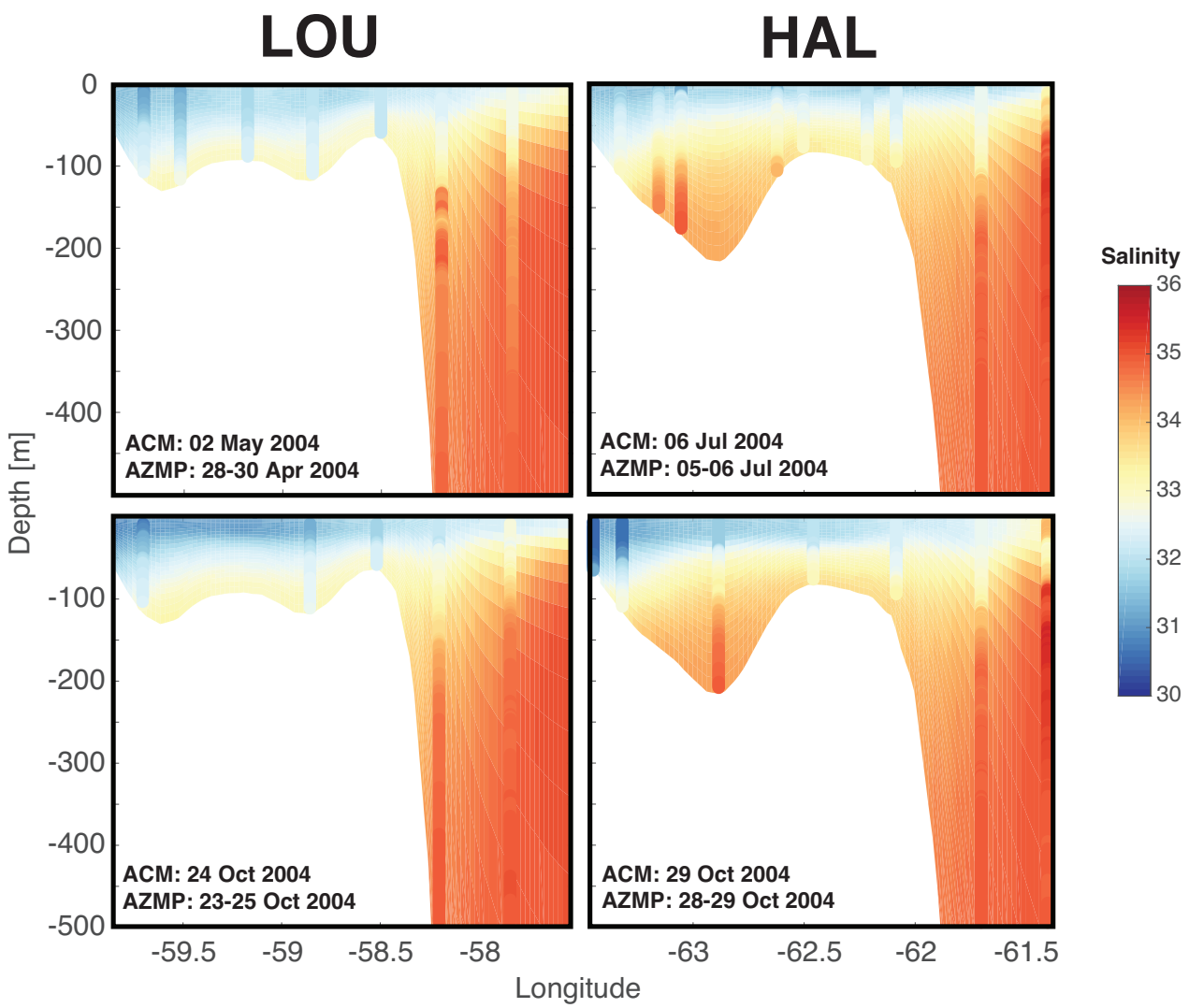

Figure S5: Model salinity along the Louisbourg Line (left panels) and Halifax Line (right panels) transects overlain by AZMP observations.

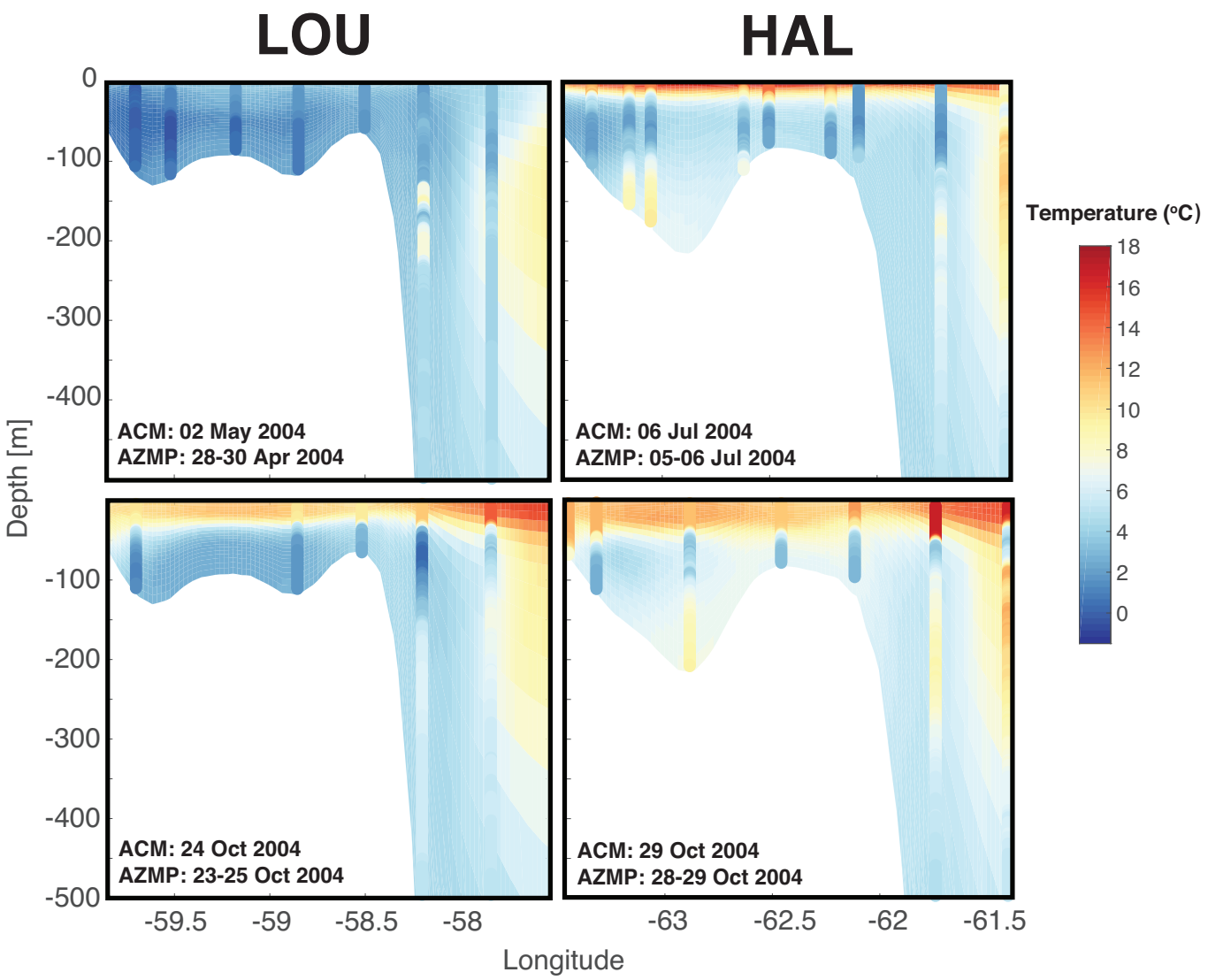

Figure S6: Model temperature along the Louisbourg Line (left panels) and Halifax Line (right panels) transects overlain by AZMP observations.

Further to these transects, Figure S7 compares the model SST and SSS to climatology (Geshelin et al. 1999) and output from a larger regional model (Urrego-Blanco and Sheng 2012) in a time series averaged over the Scotian Shelf. The model captures the seasonal cycle of both surface temperature and salinity well.

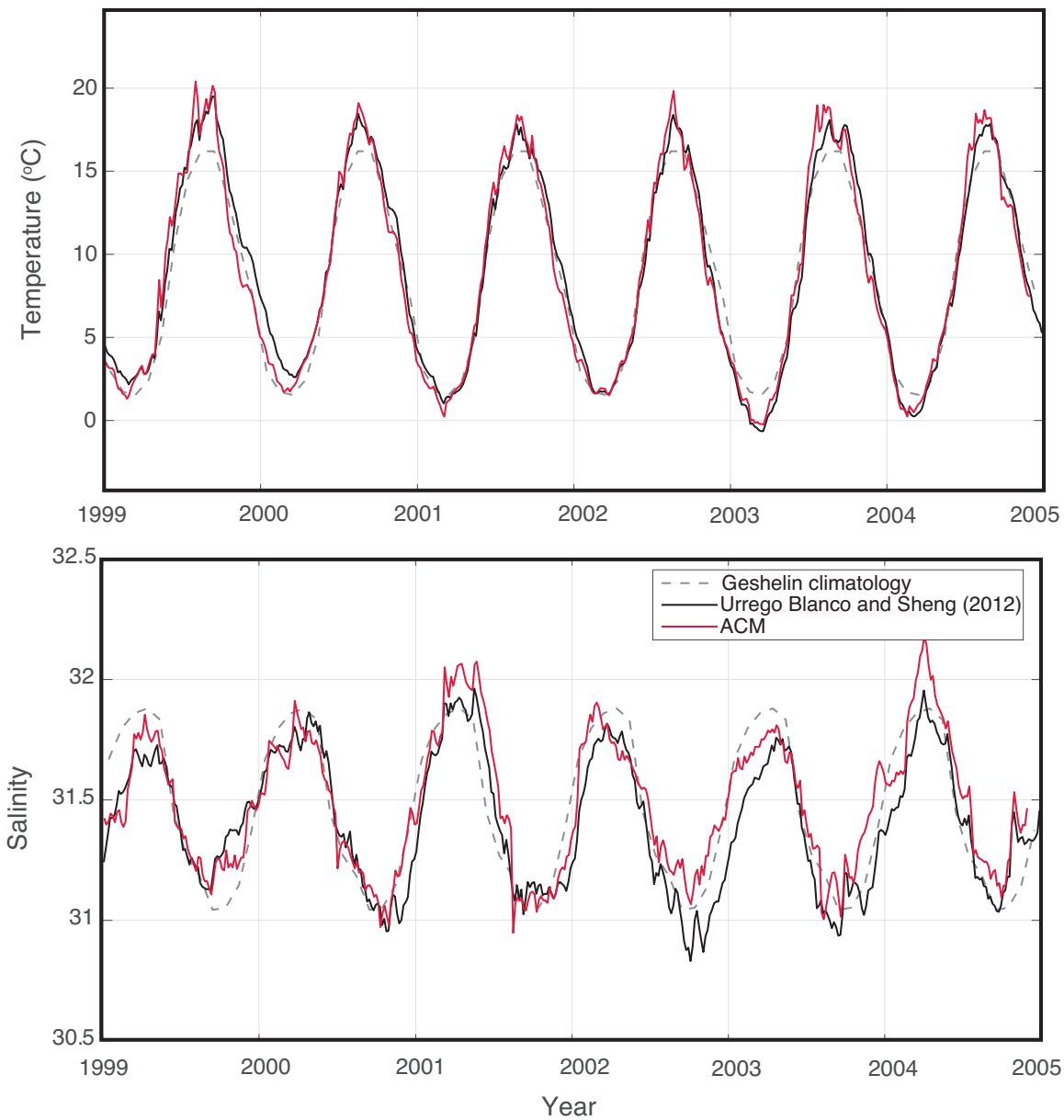

Figure S7: Time series of area-averaged Scotian Shelf temperature (top) and salinity (bottom) at the sea surface.

Figure S8 compares the model mean volume transport to those reported in Loder et al. (1998) along different sections on the continental shelves, illustrating that our model reasonably captures the volume transport throughout the region.

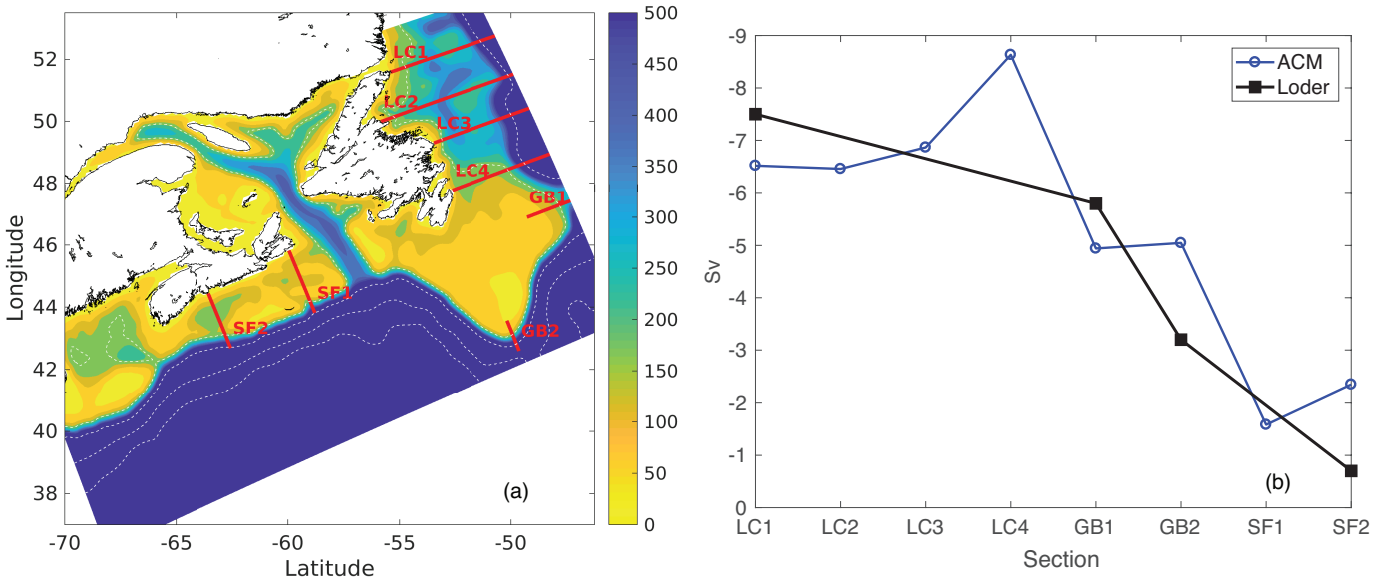

Figure S8: (a) Section locations for model long-term mean volume transport comparison to estimated mean annual transport listed by Loder et al. (1998). LC1, GB1, GB2, and SF2 are the same as their Hamilton Bank, Flemish Pass, Tail of Grand Banks, and Halifax Section, respectively. (b) Long-term mean volume transport (Sv) from model simulation compared to the estimate transport from Loder et al. (1998).

Figure S9 shows SST snapshots from June 29 and August 3, 2004. These plots of surface temperature illustrate the ability of the model to resolve mesoscale features, such as tendrils of cool water off of Newfoundland and finer-scale circulation features throughout the Gulf of St. Lawrence and Scotian Shelf. Additionally, Figure S9 shows a thin band of cool water along the southern coast of Nova Scotia that is consistent with previous reports of coastal upwelling within 10 km of the coast (Petrie et al. 1987; Shan et al. 2016).

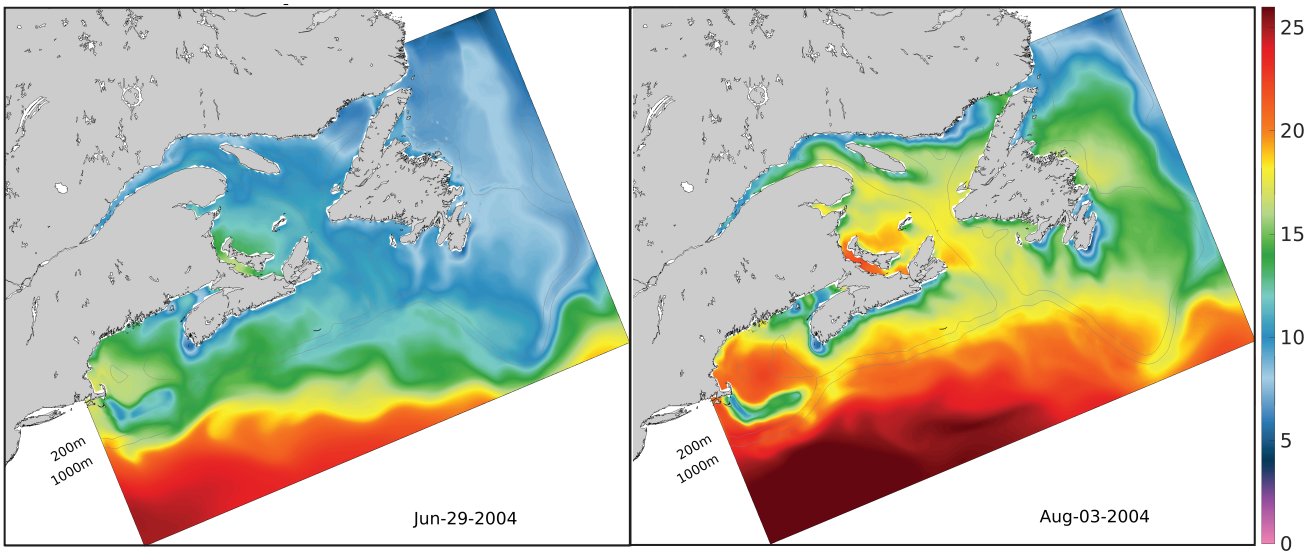

Figure S9: Sea surface temperature snapshots from the model simulation taken on June 29, 2004 (left) and August 3, 2004 (right).

S3. Dye Tracer & Age Distributions

Figure S10 and Figure S11 respectively show maps of vertically averaged dye concentrations and surface ages with the dye initialization areas overlain on top.

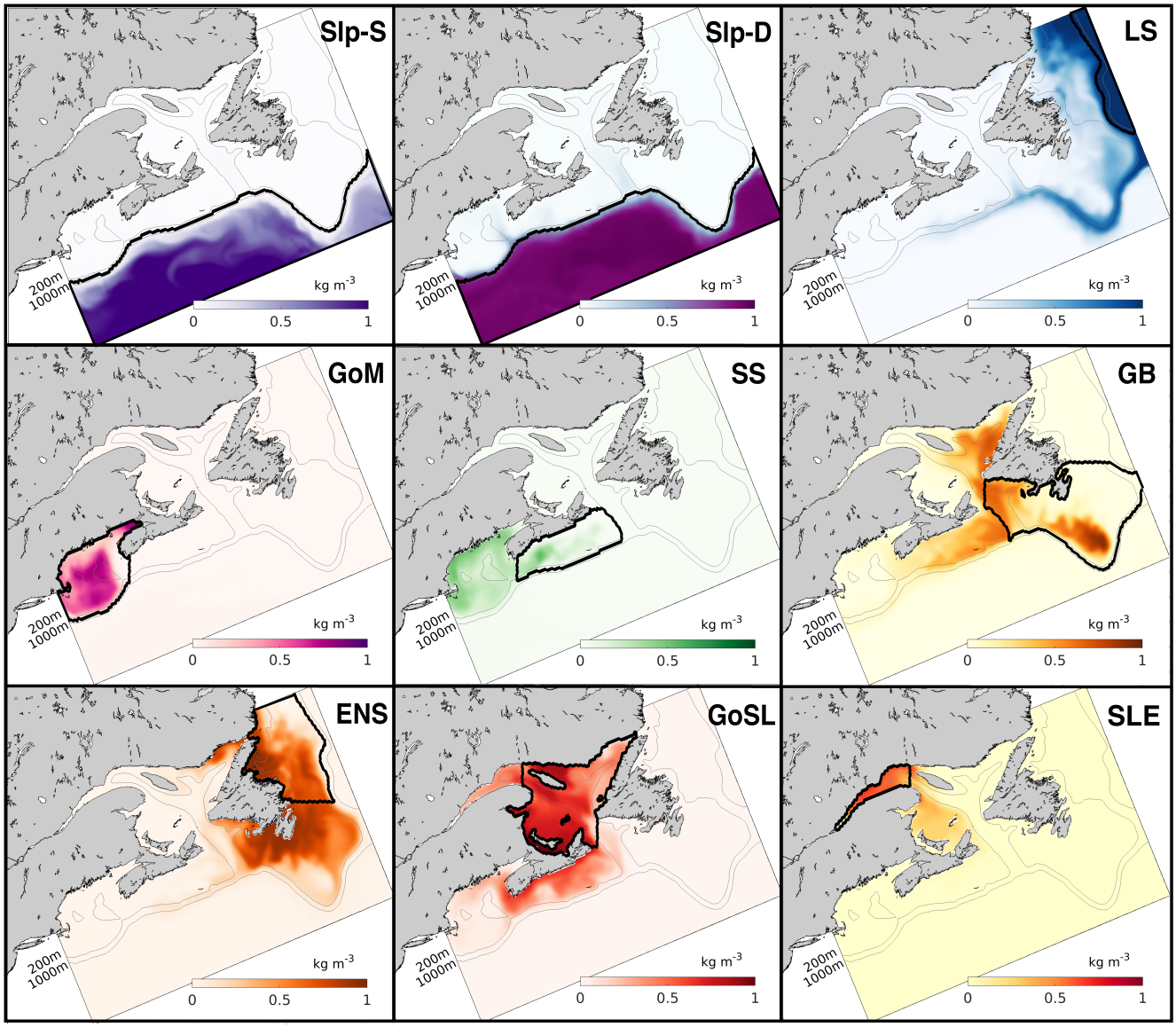

Figure S10: Maps of vertical mean dye concentrations on June 16, 1999 (6 months into the TRANS simulation). Thick black line indicates location of dye initialization.

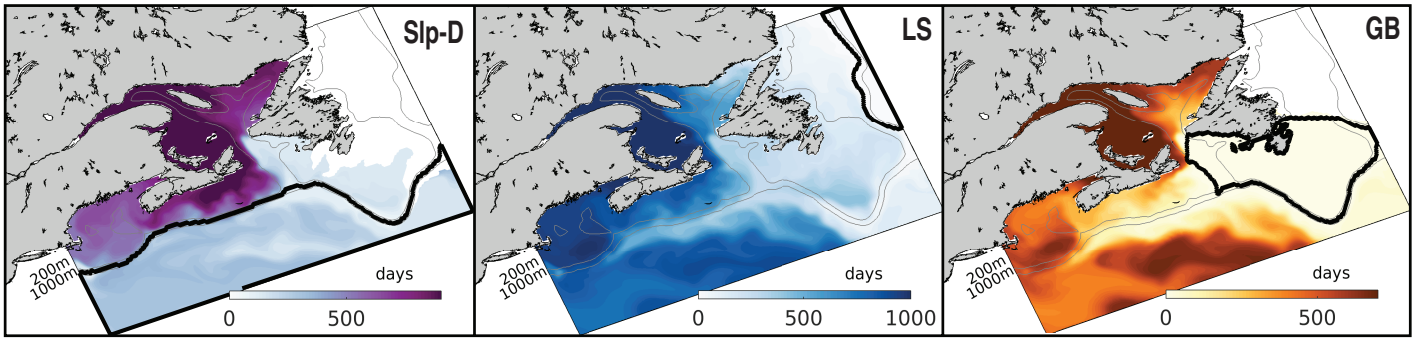

Figure S11: Surface age (days) as determined from the AGE experiment. Snapshot from last year of 6 year simulation (June 10, 2004). White areas are regions where dye concentrations < 0.001kg m^{-3}. Thick black line indicates location of dye initialization.