Figure S1. Ocean Winter (JFM) Temperature for 1993-2019

As in Figure 2 but for 3-month (January-February-March) climatological winter

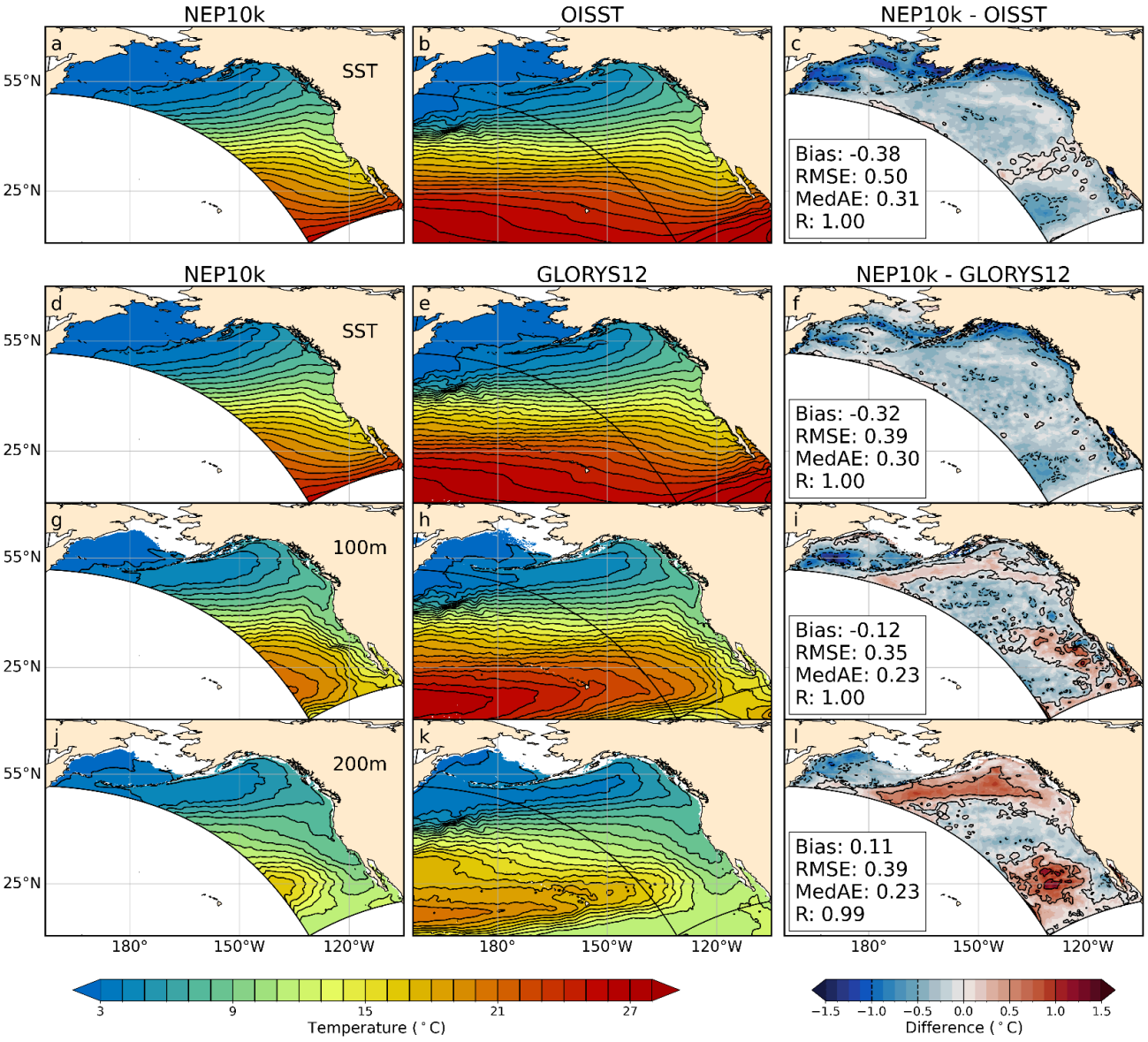

Figure S2. Ocean Summer (JAS) Temperature for 1993-2019

As in Figure 2 but for 3-month (July-August-September) climatological summer

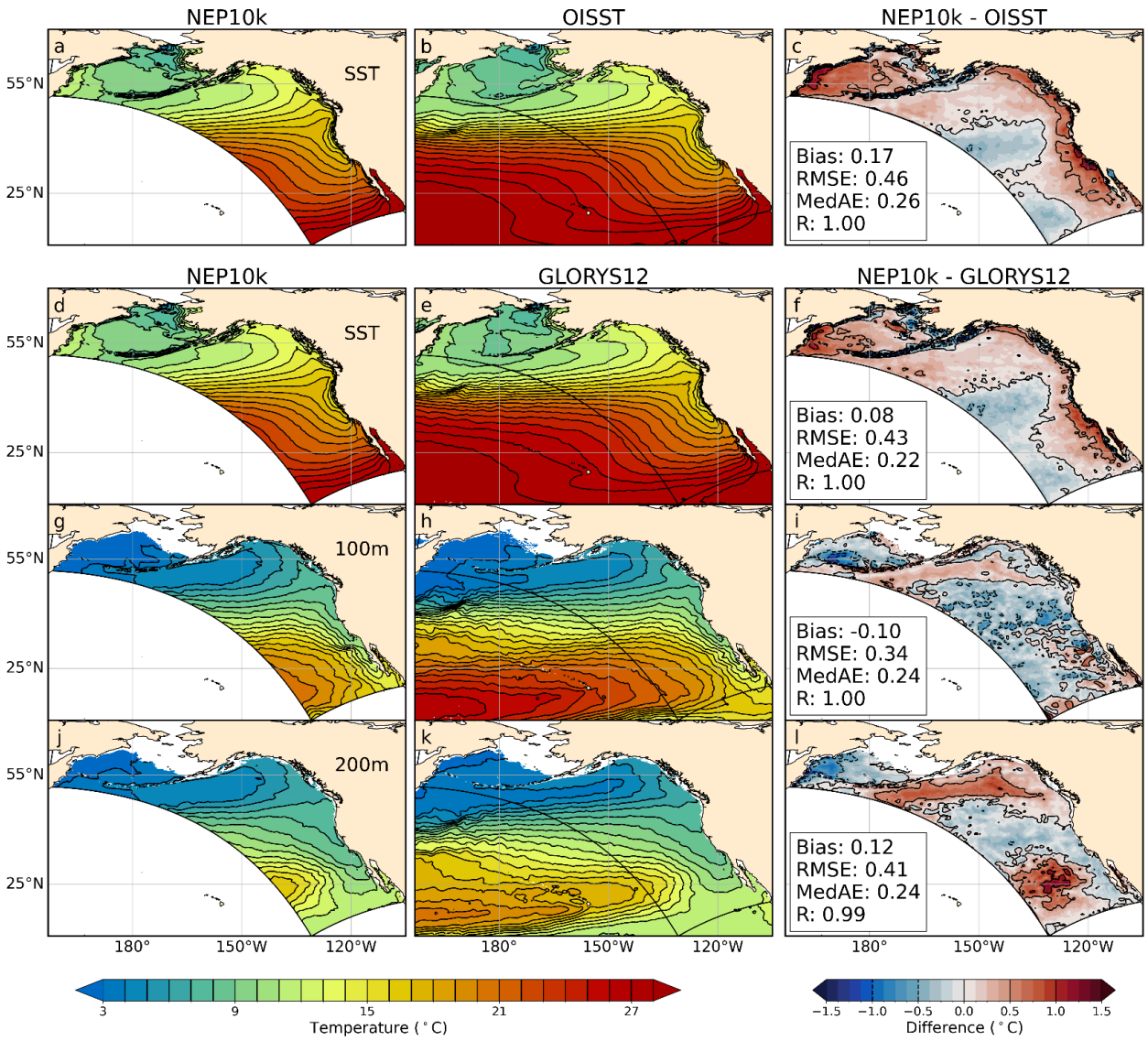

Figure S3. Winter (JFM) Ocean Salinity

As in Figure 3 but for 3-month (January-February-March) climatological winter

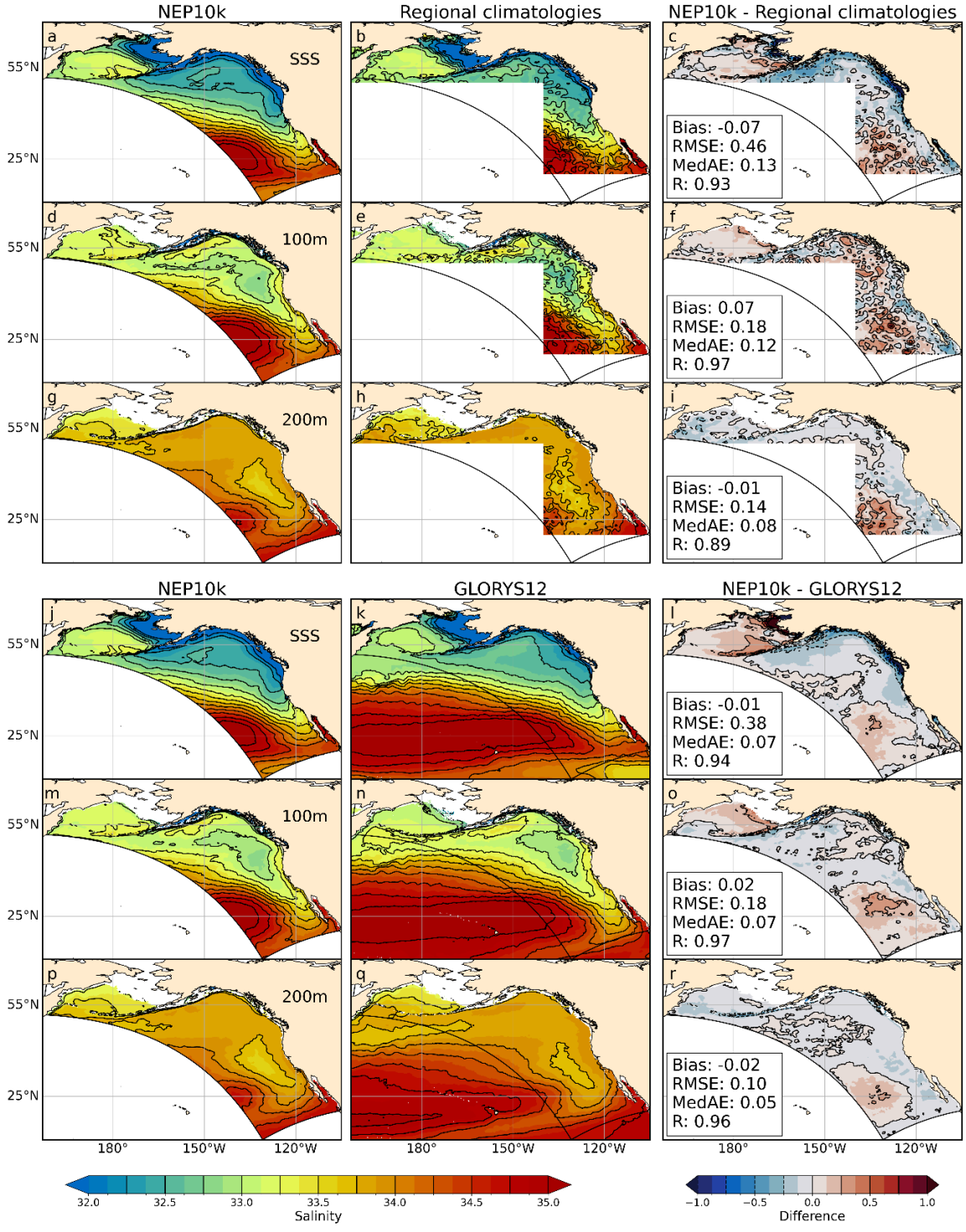

Figure S4. Summer (JAS) Ocean Salinity

As in Figure 3 but for 3-month (July-August-September) climatological summer

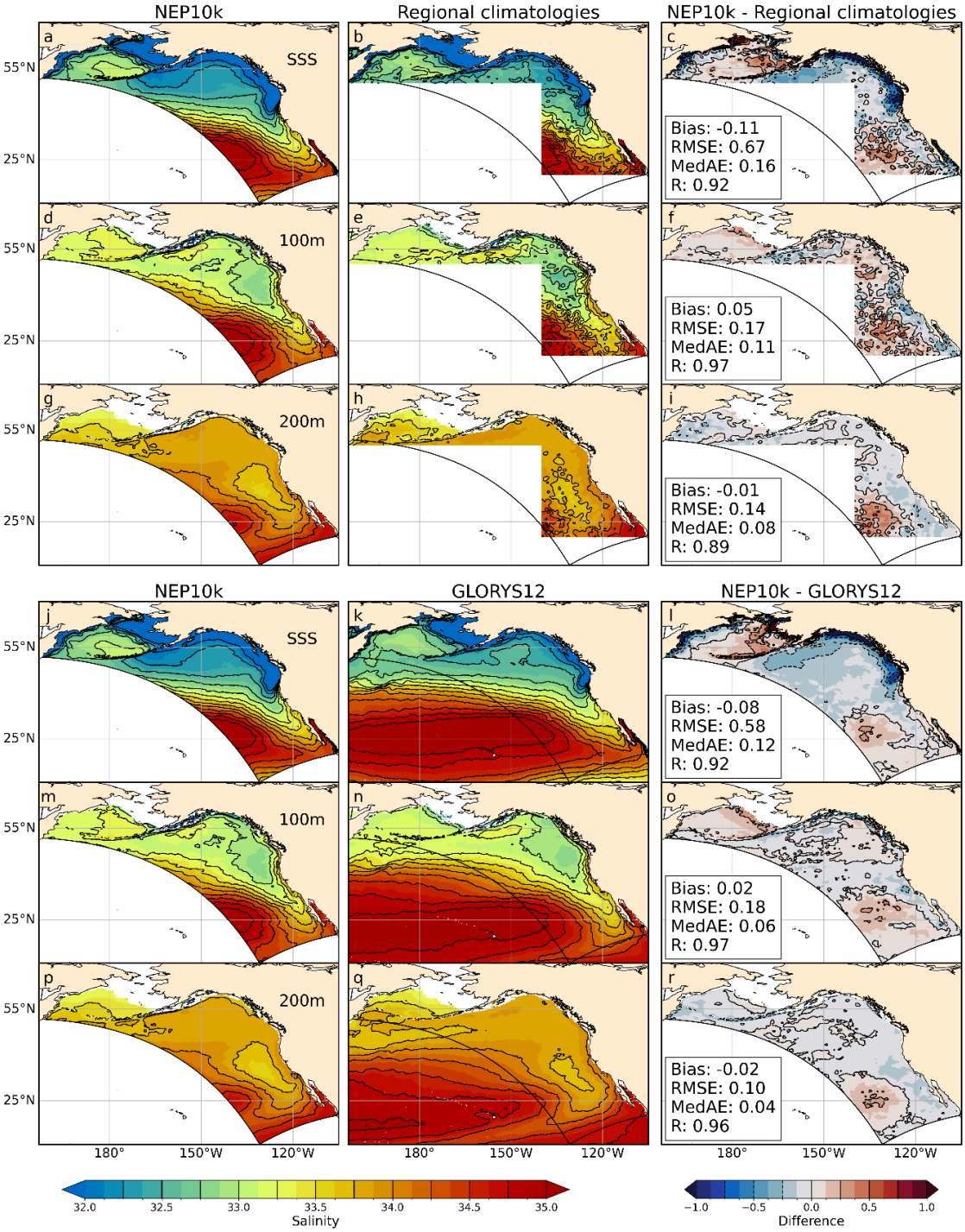

Figure S5. Winter (JFM) Mixed Layer Depth

As in Figure 4 but for 3-month (January-February-March) climatological winter

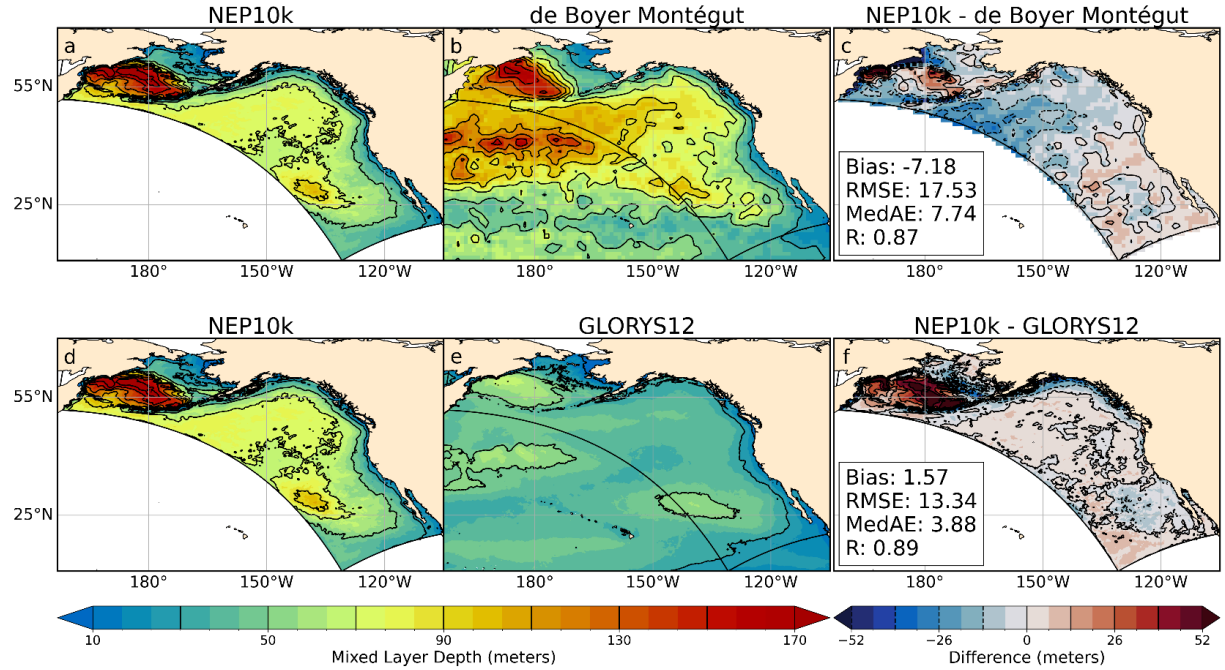

Figure S6. Summer (JAS) Mixed Layer Depth

As in Figure 4 but for 3-month (July-August-September) climatological summer

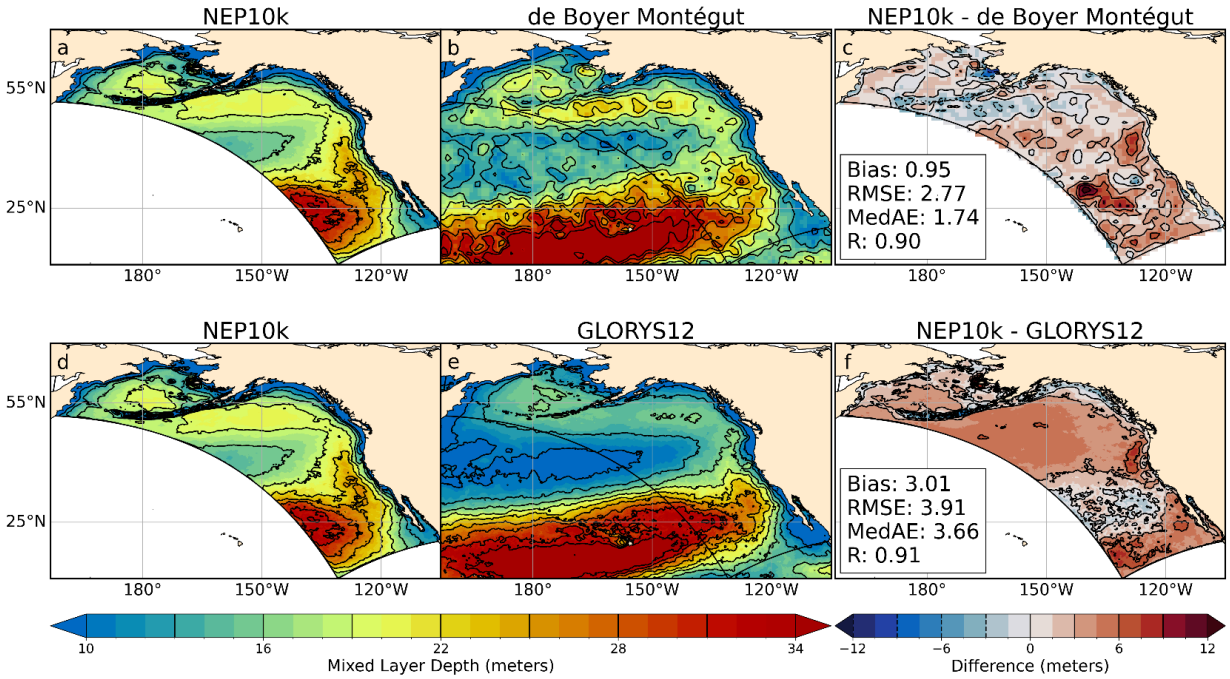

Figure S7. Winter (JFM) sea surface height comparison

As in Figure 5 but for 3-month (January-February-March) climatological winter

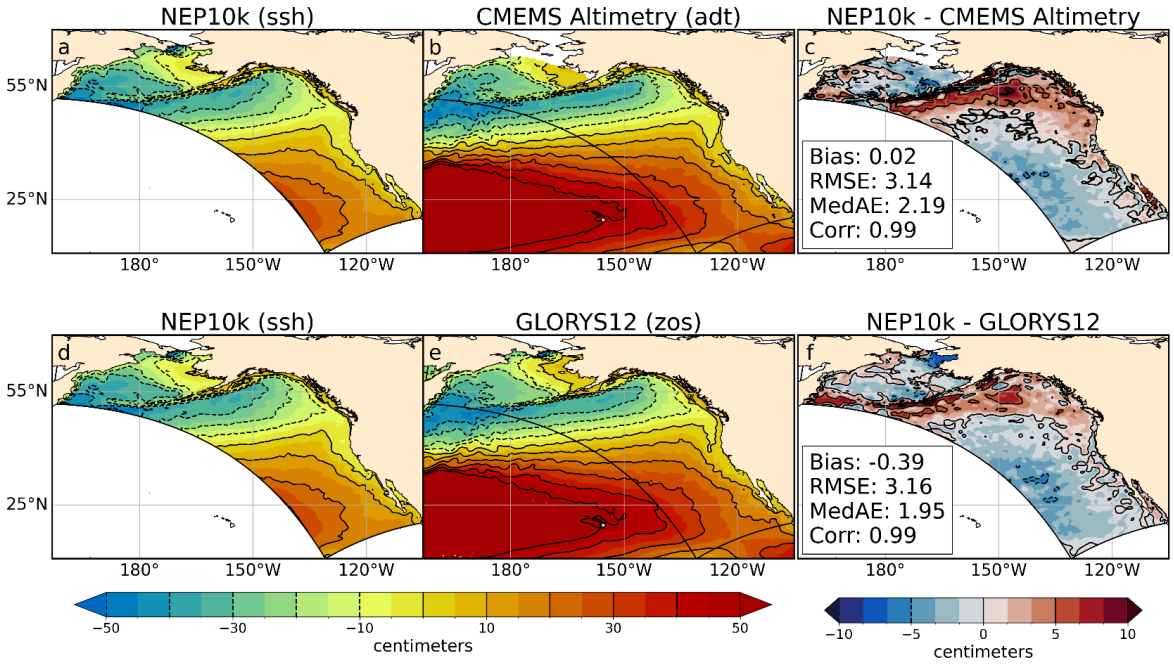

Figure S8. Summer (JAS) sea surface height comparison

As in Figure 5 but for 3-month (July-August-September) climatological summer

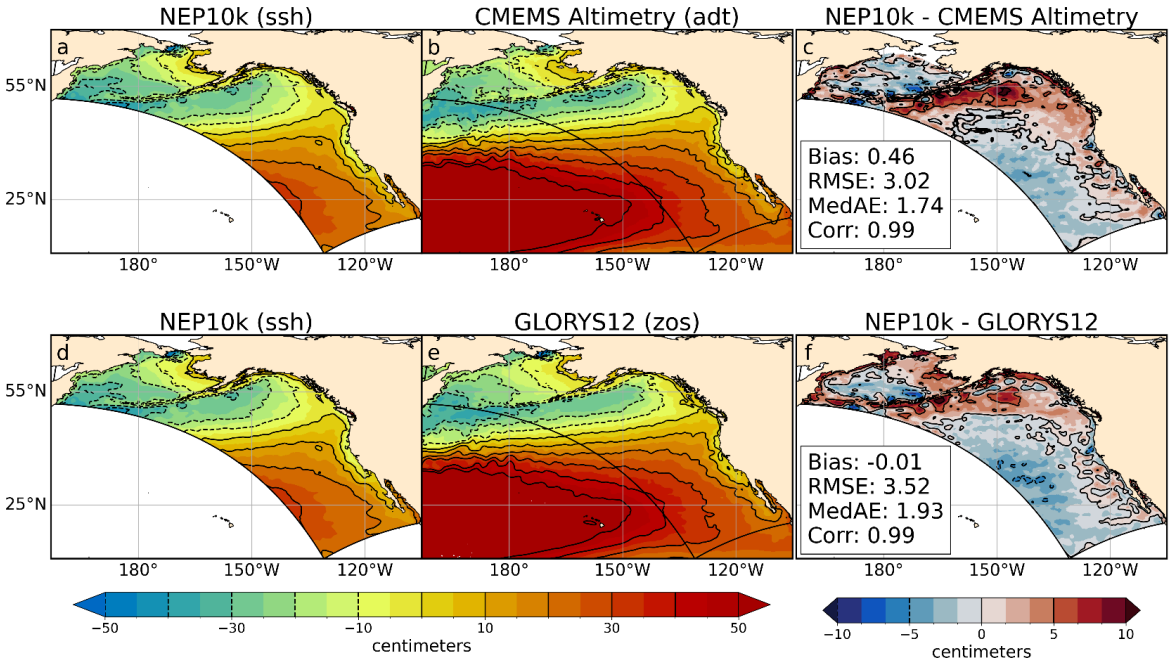

Figure S9. Winter (JFM) Nitrate Concentration

As in Figure 7 but for 3-month (January-February-March) climatological winter

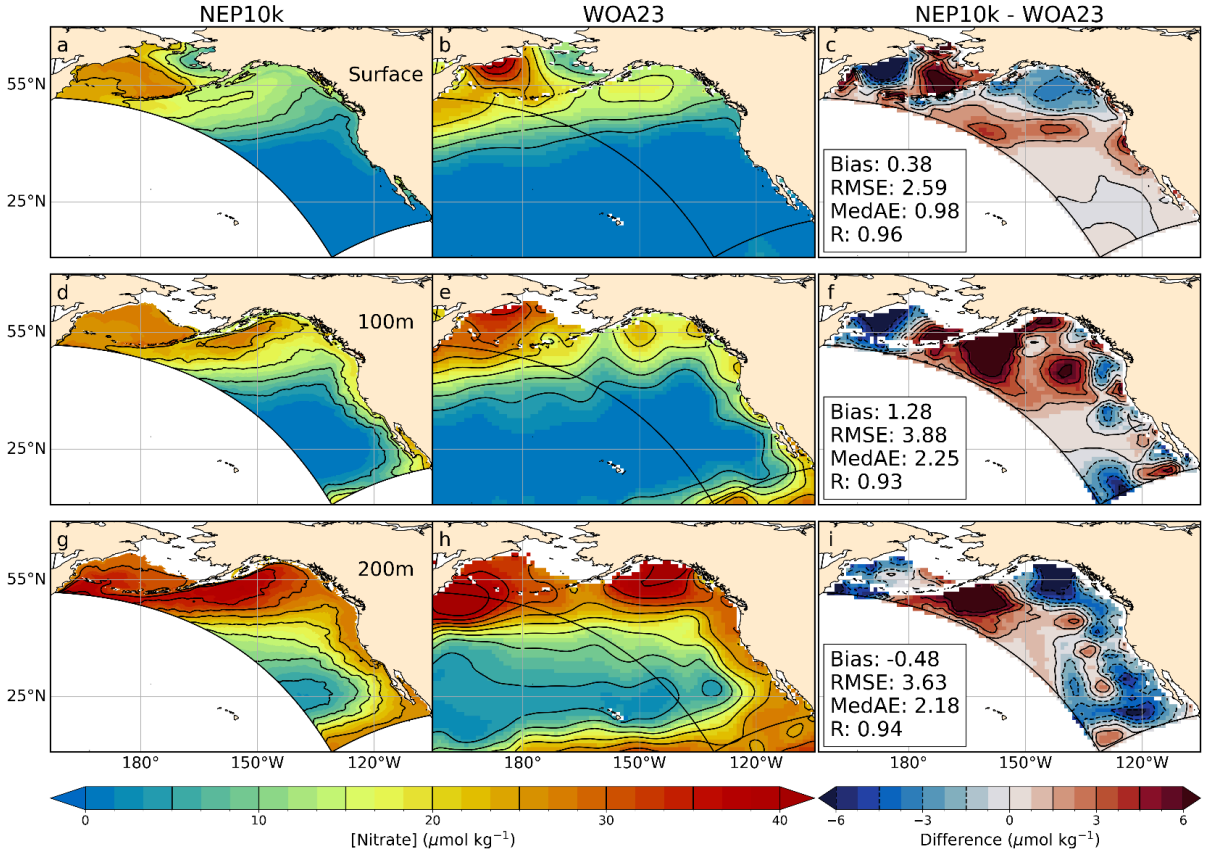

Figure S10. Summer (JAS) Nitrate Concentration

As in Figure 7 but for 3-month (July-August-September) climatological summer

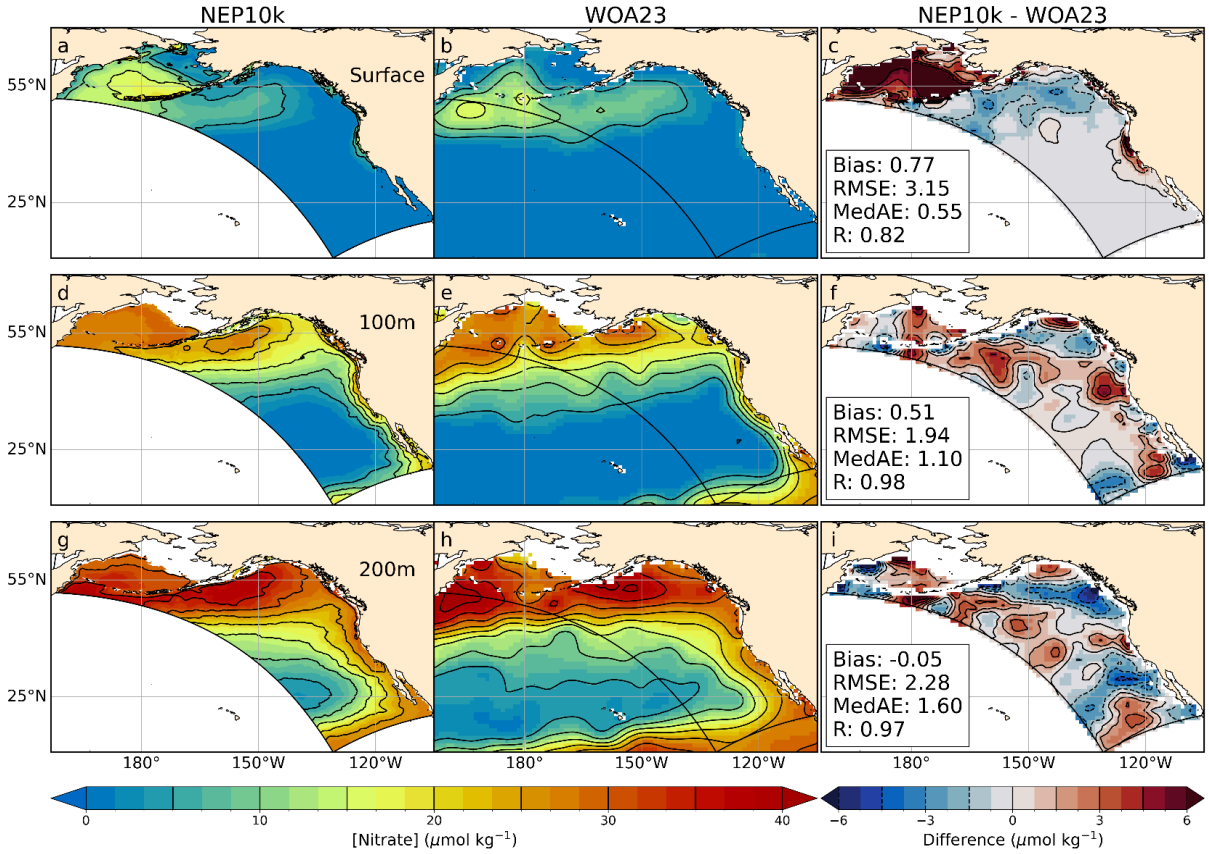

Figure S11. Winter (JFM) Phosphate Concentration

As in Figure 8 but for 3-month (January-February-March) climatological winter

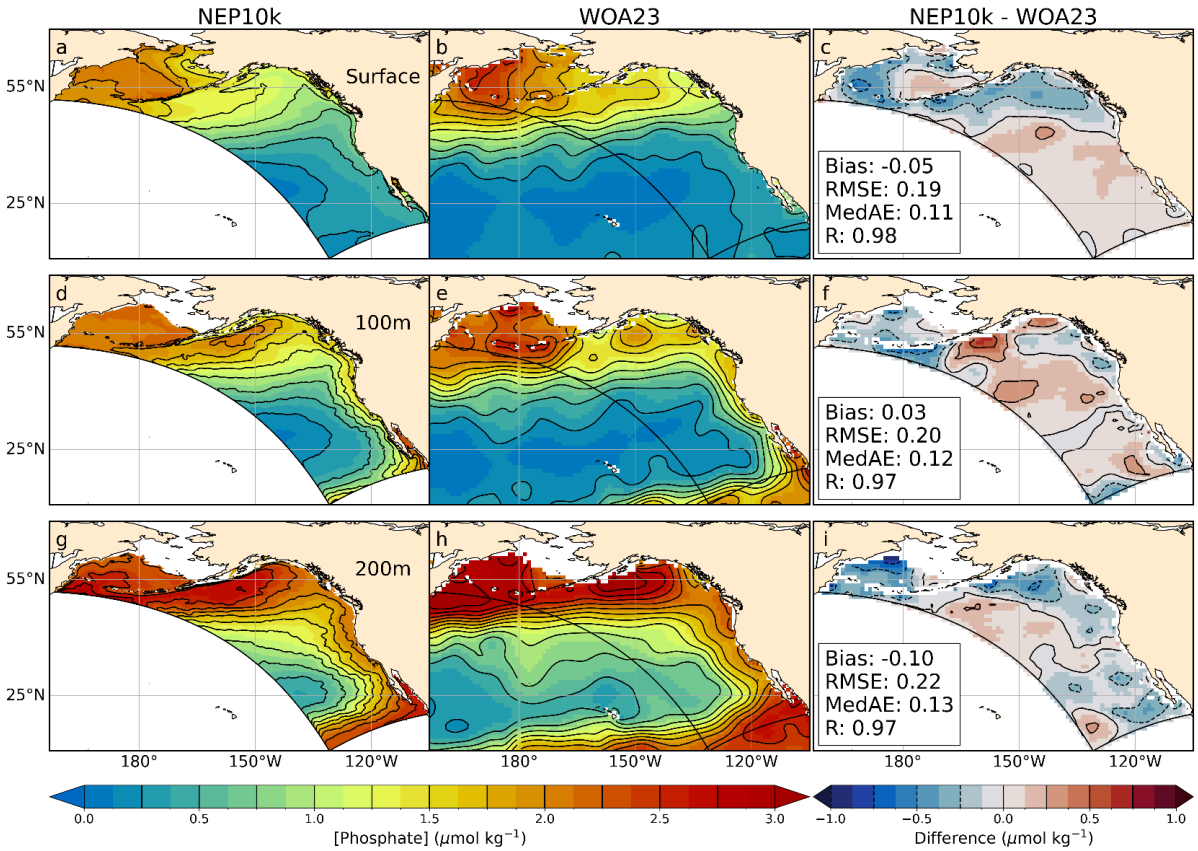

Figure S12. Summer (JAS) Phosphate Concentration

As in Figure 8 but for 3-month (July-August-September) climatological summer

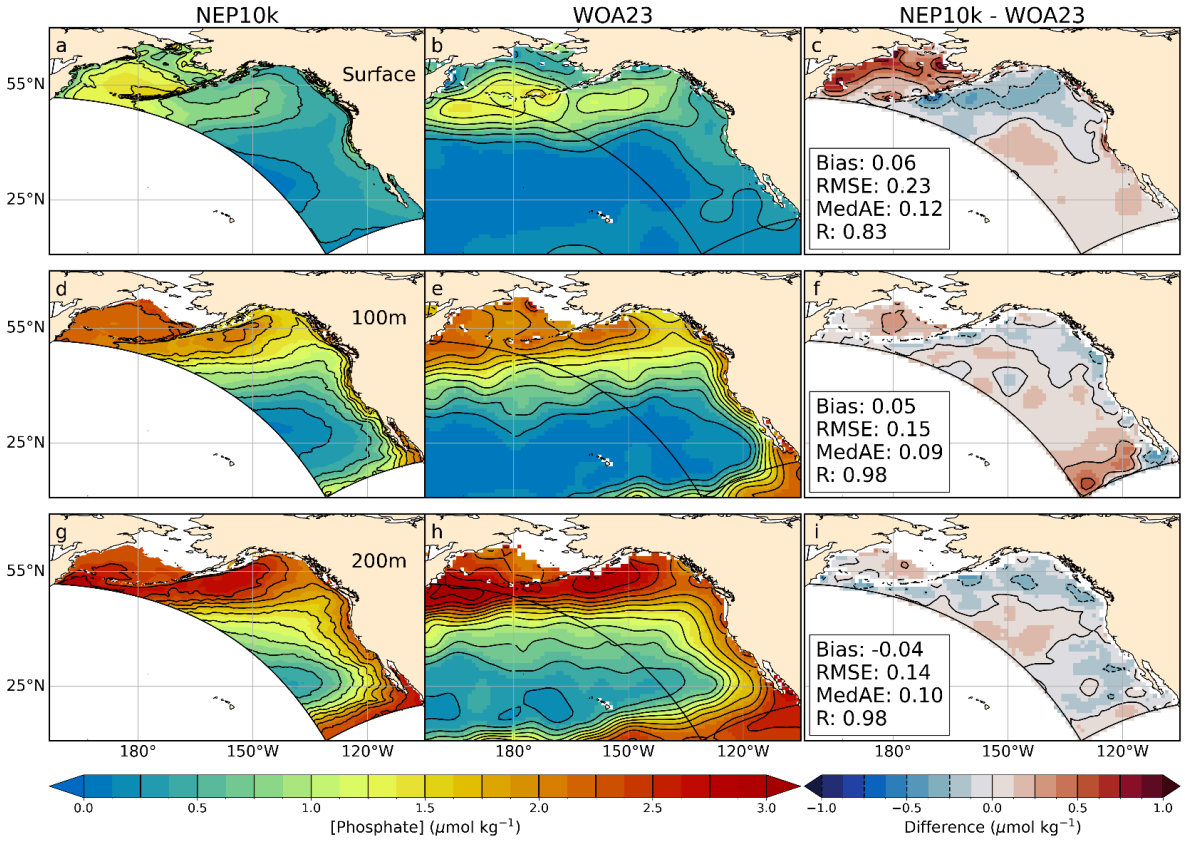

Figure S13. Seasonal Surface Dissolved Iron Concentration and Primary Phytoplankton Nutrient Limitations

As in Figure 9 but for 3-month climatological seasonal means for Winter (Jan-Feb-Mar), Spring (Apr-May-Jun), Summer (July-Aug-Sept), and Winter (Oct-Nov-Dec).

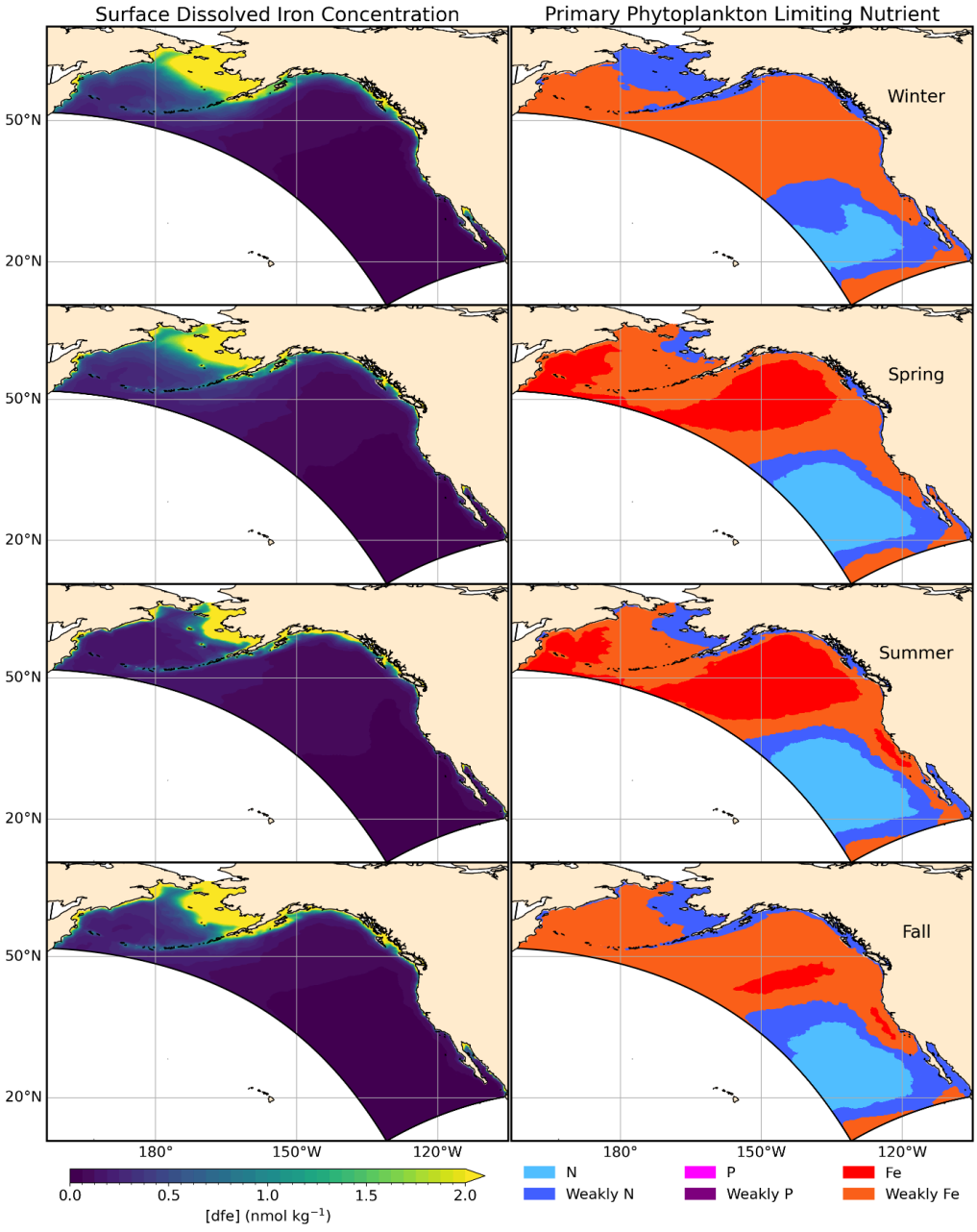

Figure S14. Winter (JFM) Oxygen Concentration

As in Figure 12 but for 3-month (January-February-March) climatological winter

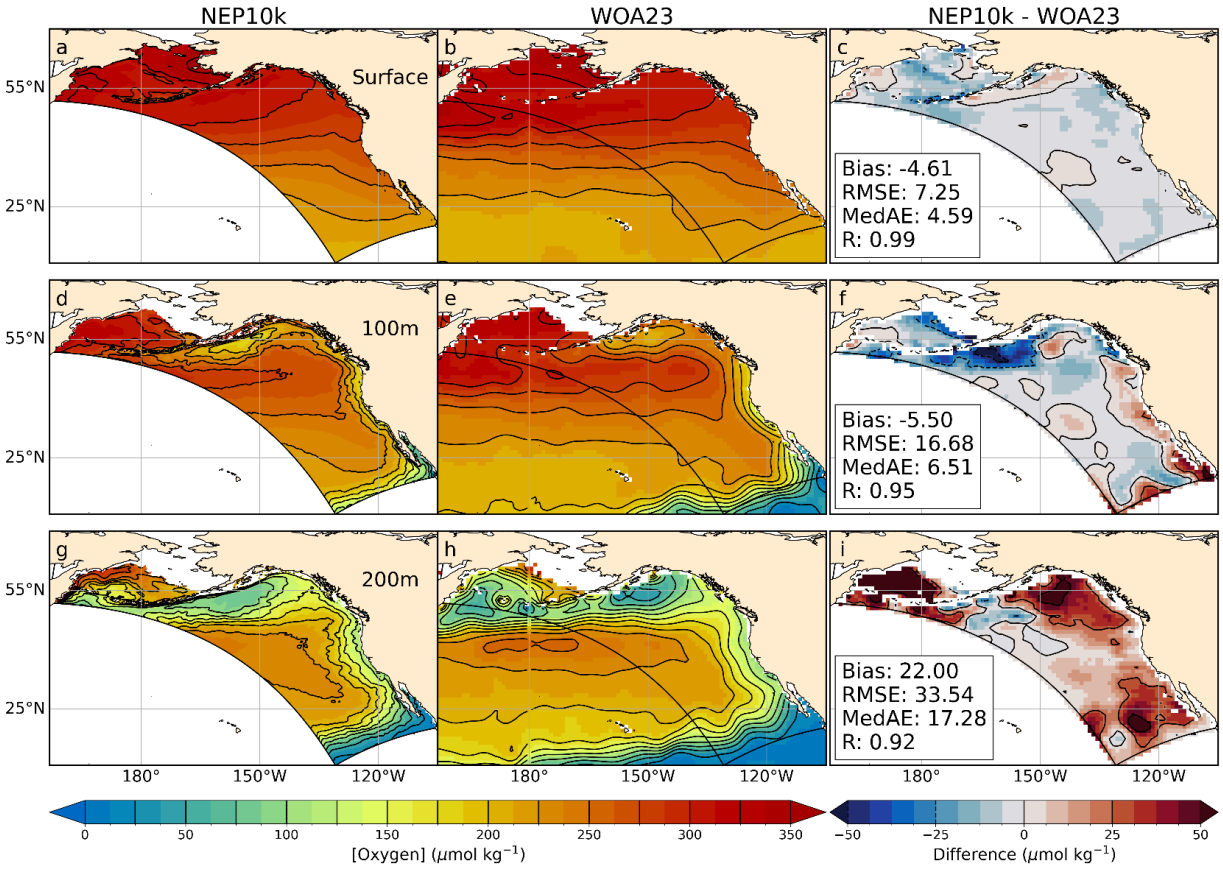

Figure S15. Sumer (JAS) Oxygen Concentration

As in Figure 12 but for 3-month (July-August-September) climatological summer

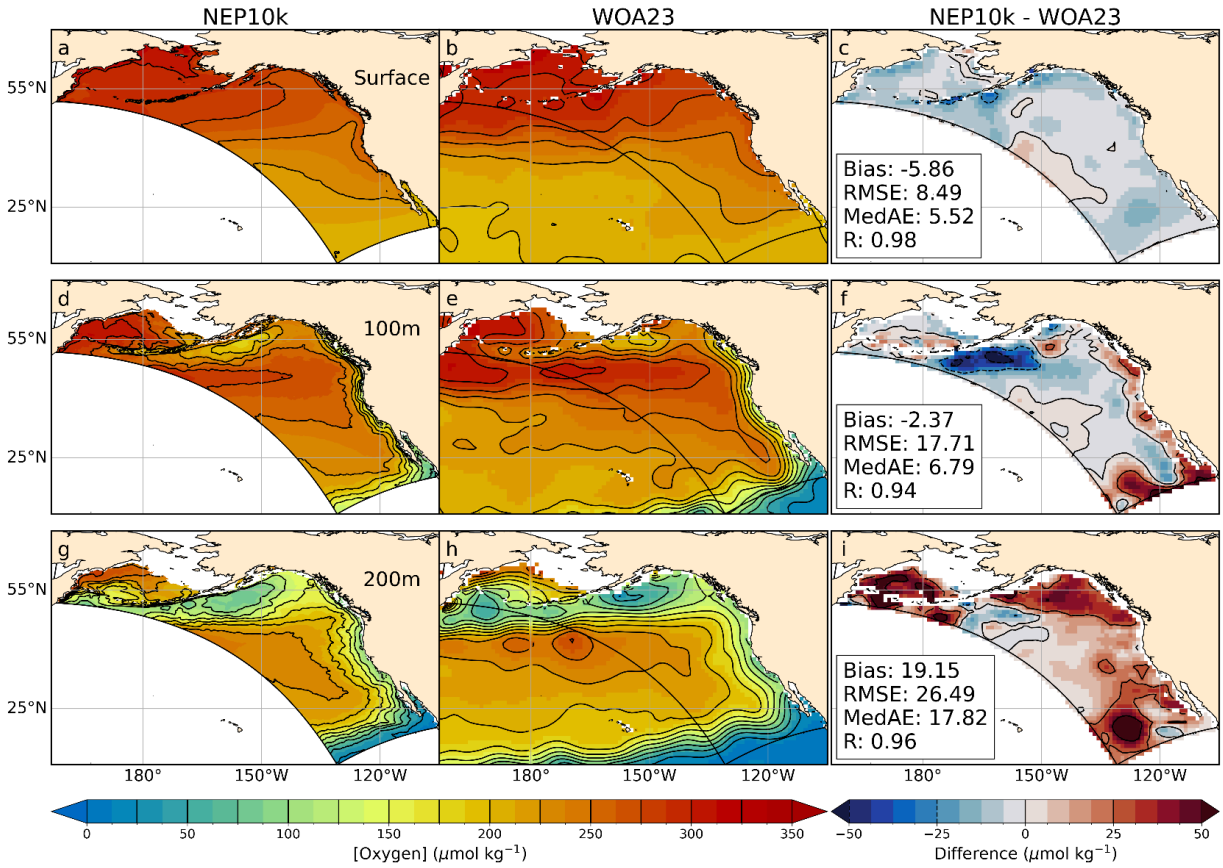

Figure S16. Bering Sea Ice Extent Timeseries

Comparisons of Total area of the South Eastern Bering Sea (Rohan et al., 2022) exhibiting sea ice concentrations of 15% or greater by month as observed by satellites (black) and simulated by NEP10k (red) .

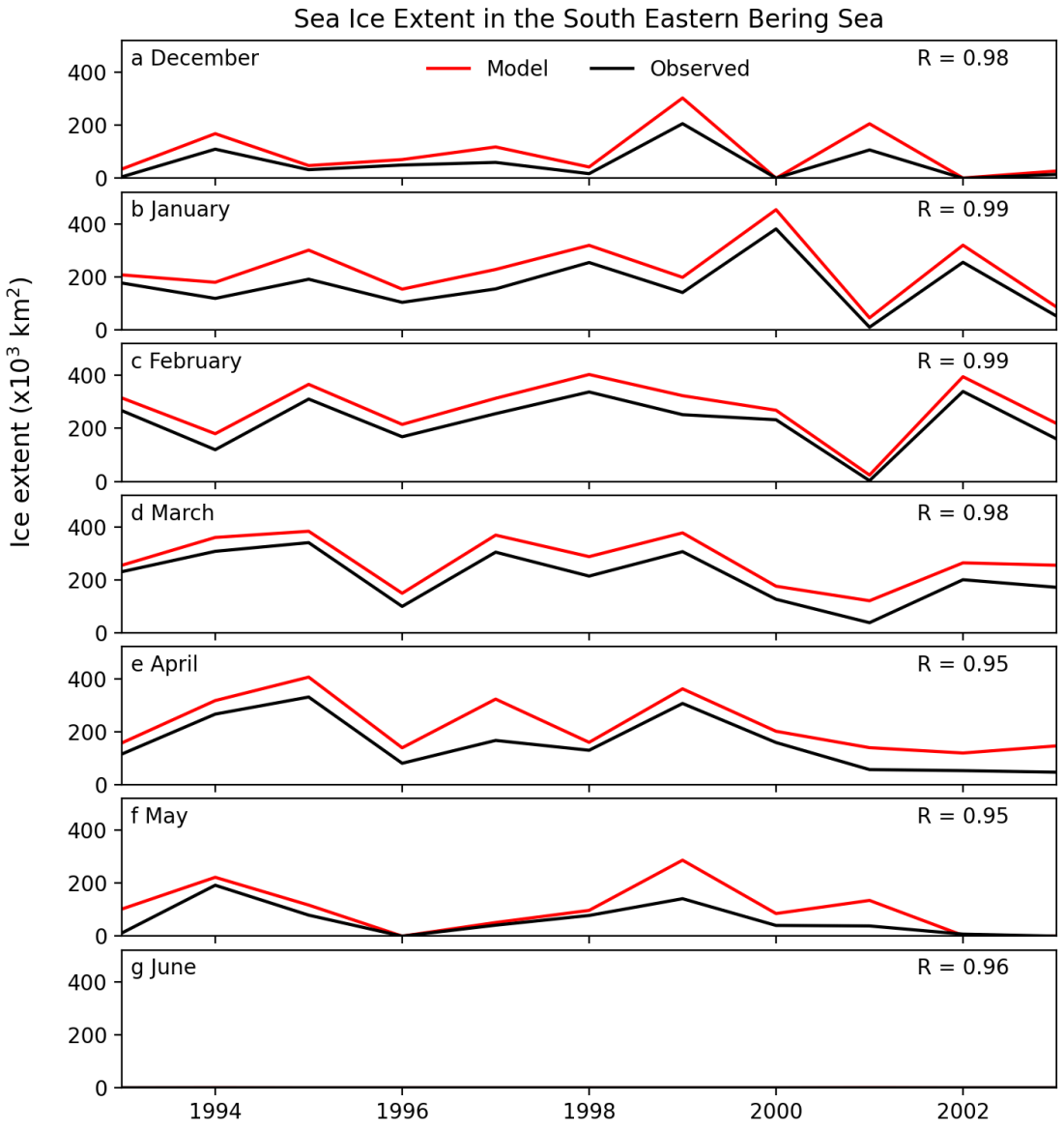

Figure S17. NGAO Composites

Composites of important ecological conditions during the positive (NGAO >1; 54 months out of 324) and the negative (NGAO < -1; 56 months out of 324) phases of the Gulf of Alaska Downwelling Index (NGAO). Grid cells are colored where the composite differs significantly from 0 (i.e., student t-test, p<0.05).

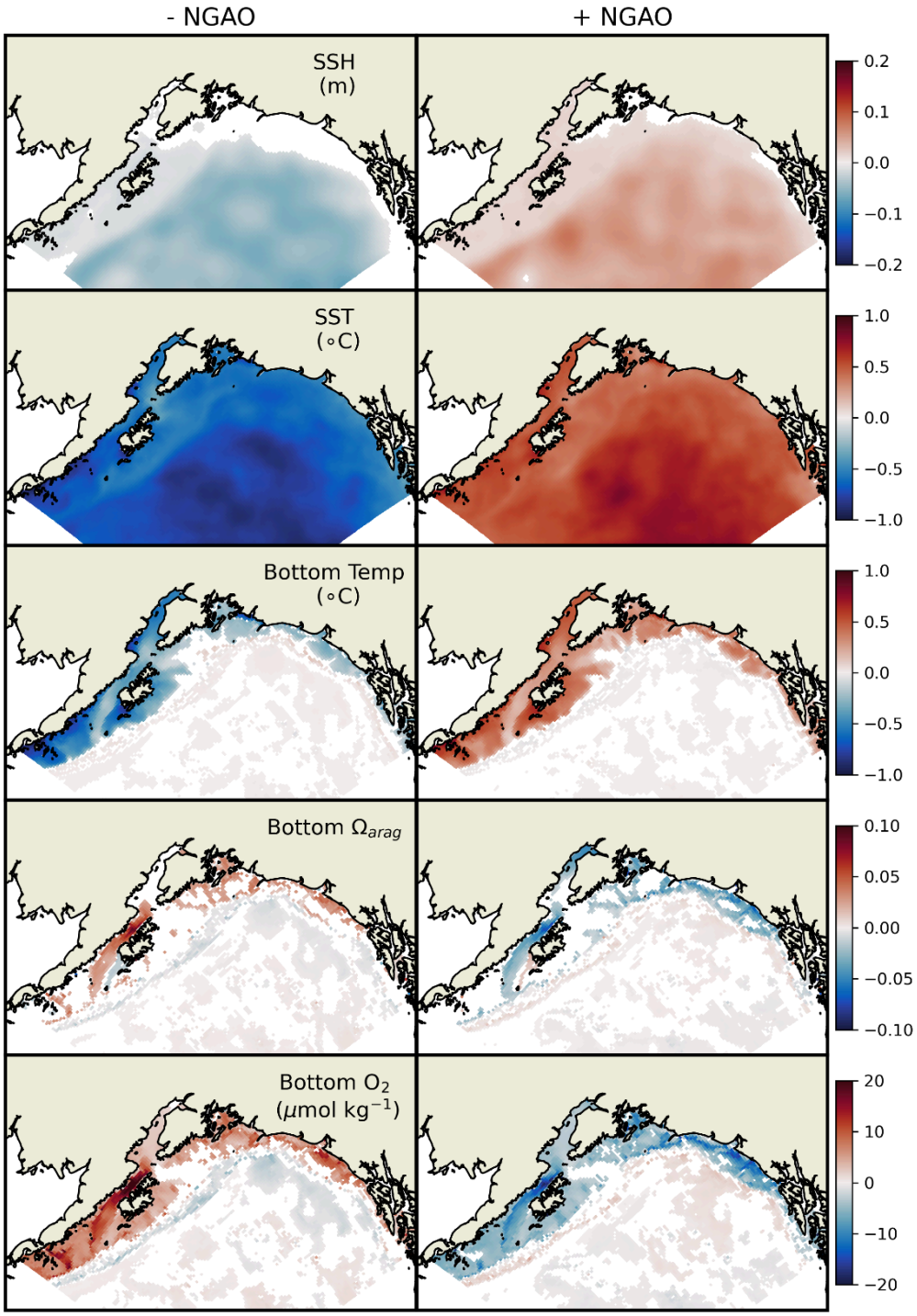

Figure S18. Annual Mixed Layer Depth Comparisons with NEP10k using Fox-Kemper MLD Restratification

Same as Fig. 4 but with NEP10k using the Fox-Kemper restratification methods as in Ross et al., (2023). However, due to the higher latitudes of the NEP10k domain relative to the NWA domain, we set the submesoscale eddy front length 800m for this sensitivity comparison rather than 1500m used in Ross et al., (2023).

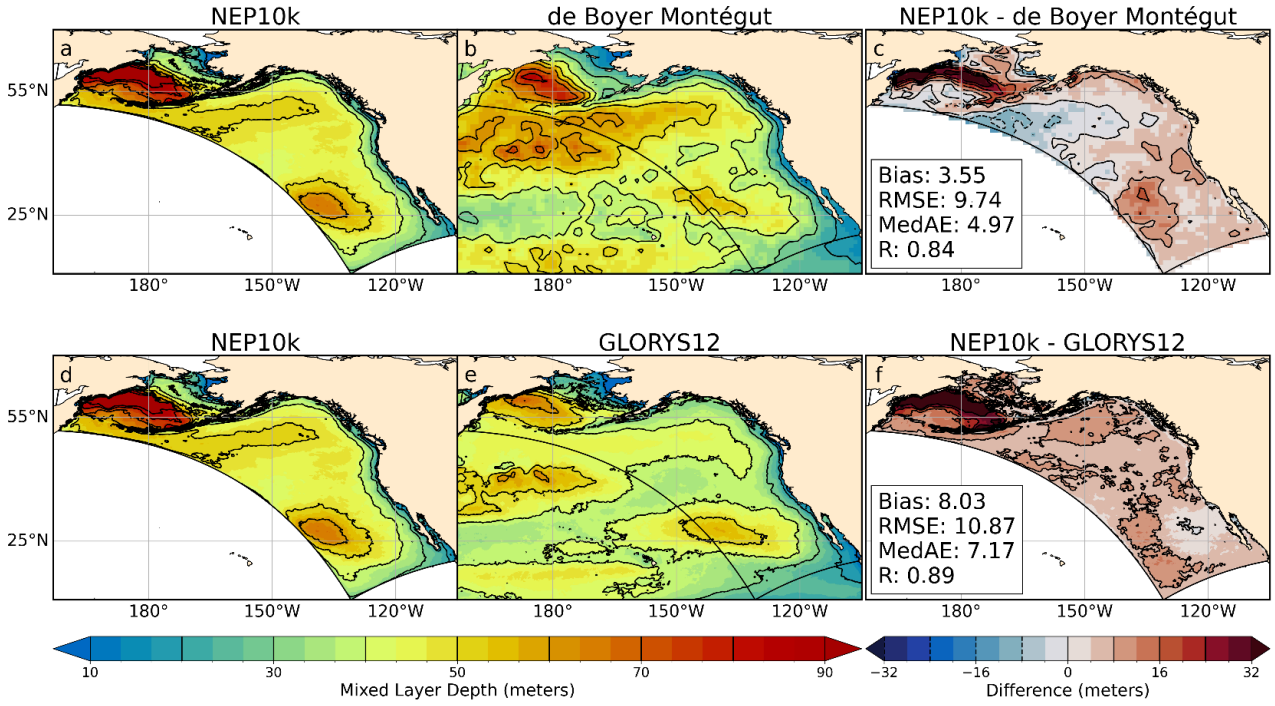

Figure S19. Timeseries, climatologies and correlations of NEP10k EBS cold pool area index.

The top plot shows monthly timeseries of the relative area of the Eastern Bering Sea that is covered in bottom water of a temperature less than or equal to the threshold values depicted in Fig. 20 (i.e., lightest blue indicates water ≤ 2°C, darkest blue indicates water ≤ -1°C). Unlike the NEP10k values in Fig.20, these values are calculated for the monthly mean bottom temperature rather than derived from data points that vary in time and space throughout the summer trawl season. The bottom left plot shows monthly climatological values with standard deviation error bars and the timeframe of the AFSC bottom trawl delimited in red dotted lines. Lastly, the lower right panel depicts the and the Pearson correlation coefficient calculated for each water temperature threshold comparing the timeseries of values for a given month against the trawl-derived value for that year. We would expect most highly correlated values to fall within the time frame of the bottom trawl. However, values with somewhat higher correlation preceding the trawl may be useful for near-term forecasting efforts.

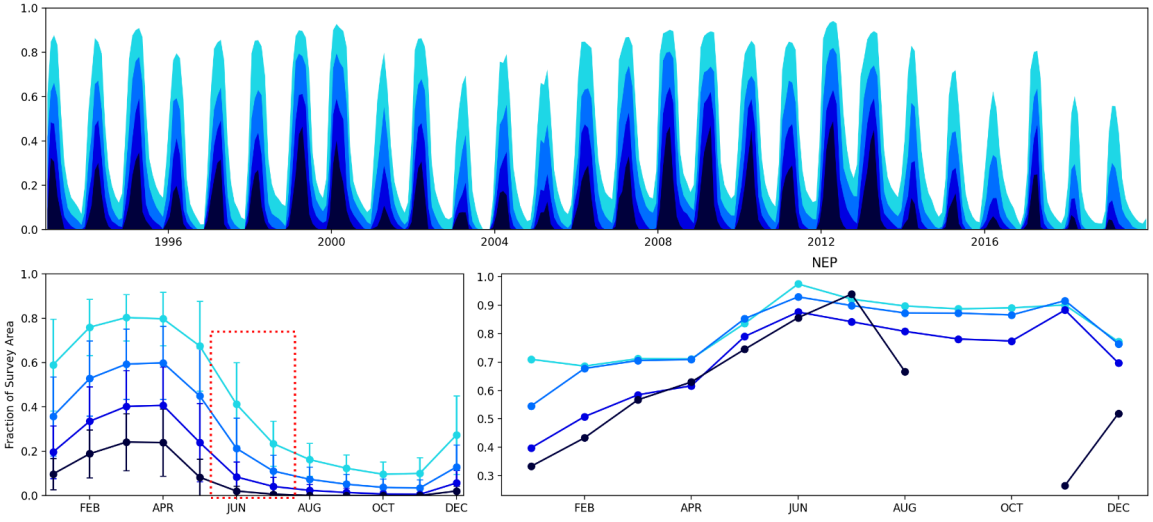

Figure S20. Difference in monthly climatological sea ice concentration in the SEBS

The seasonally progressive change in sea concentration within the south eastern Bering Sea where the majority of the Alaska Fisheries Science Center bottom trawl samples are collected. Only declines in monthly sea ice concentration are shown. The Extent of the SEBS is outlined in black (Rohan et al., 2022).