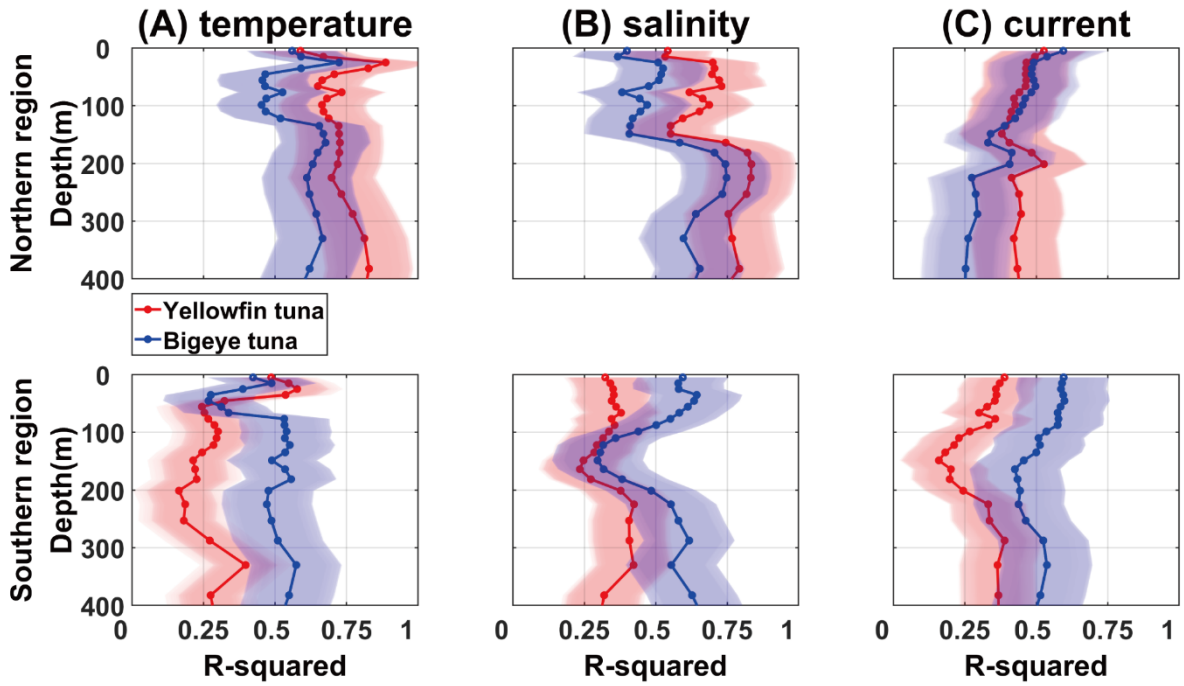
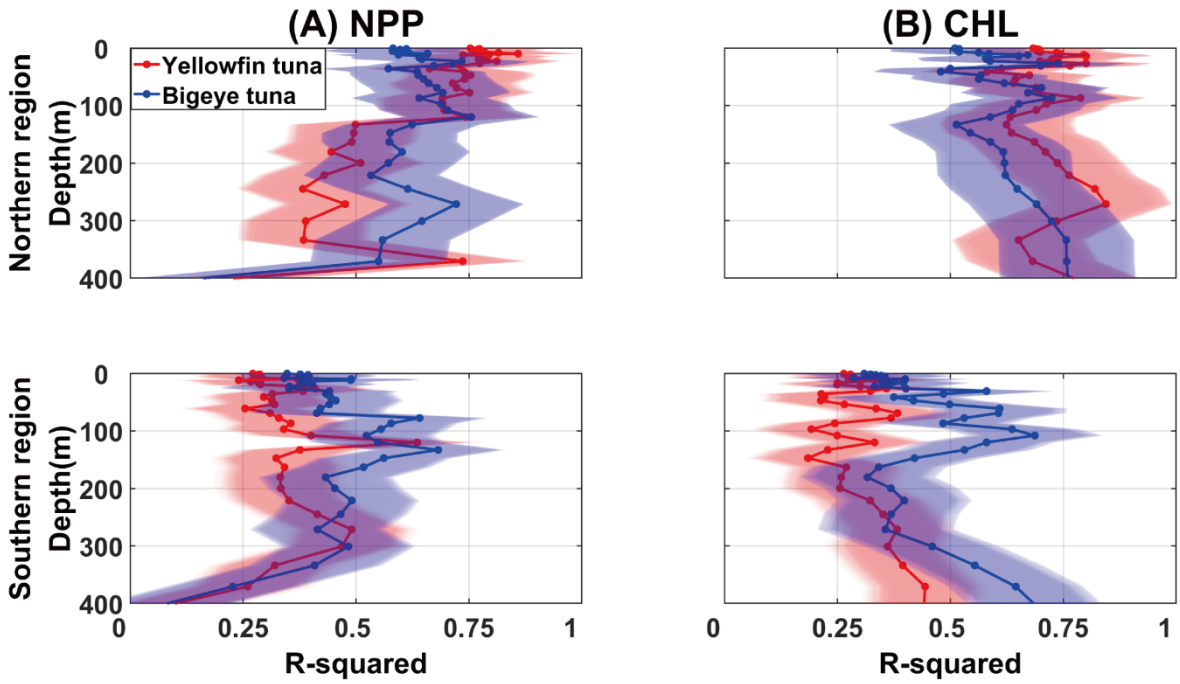
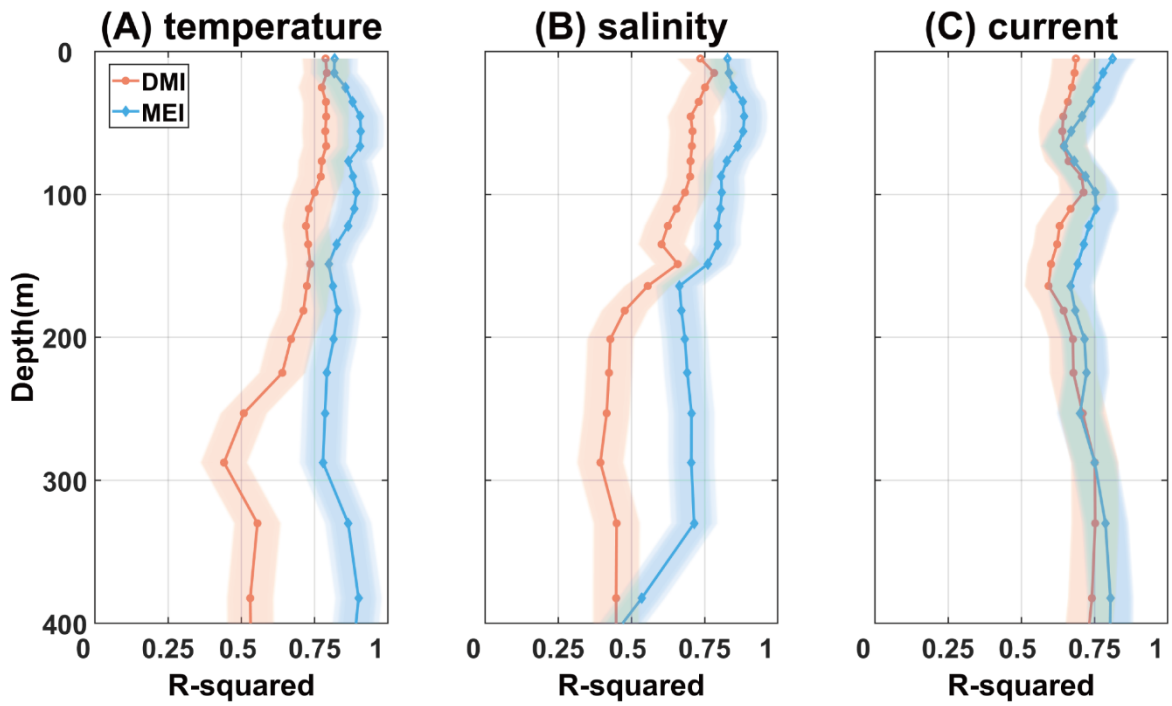


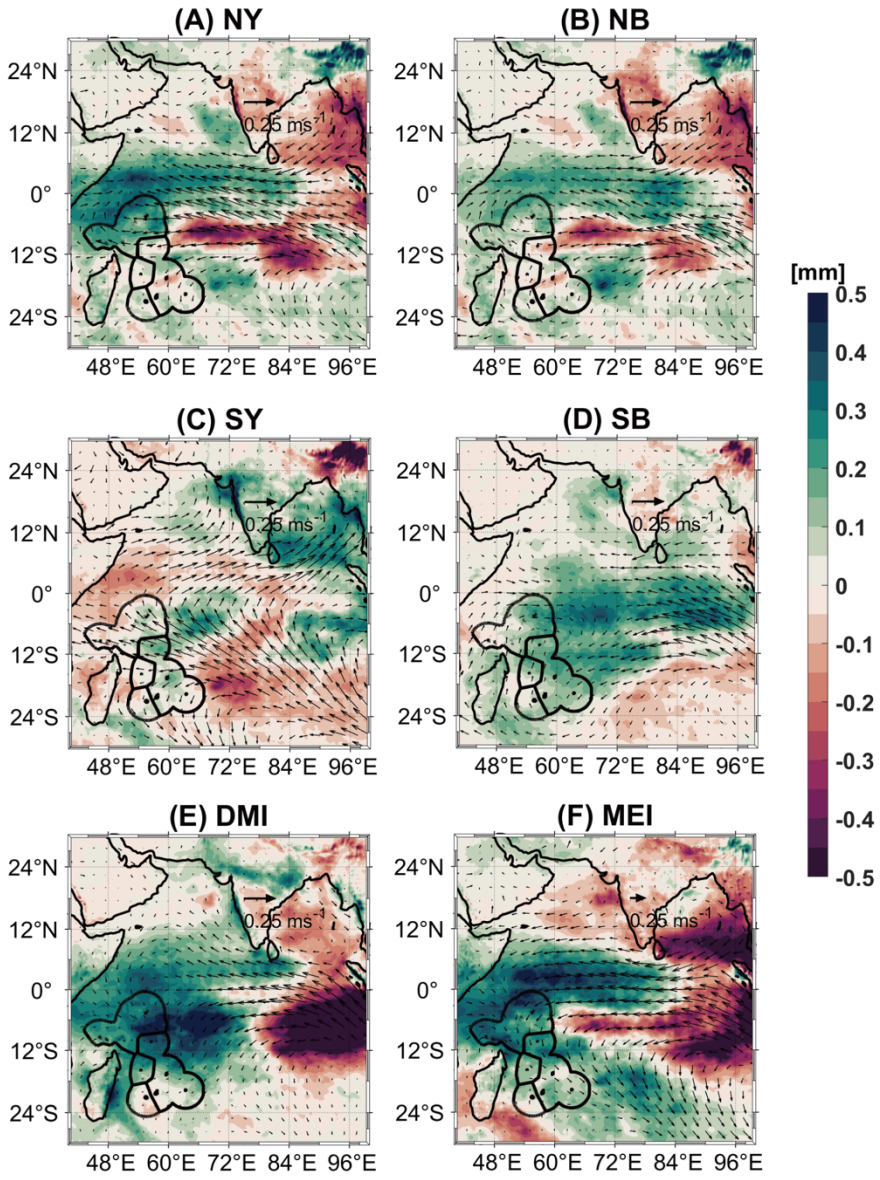
Supplementary Figure 1. The R-squared values of the regression for 1990–2014 from the (**A**) temperature, (**B**) salinity, and (**C**) current velocity at each depth in the tropical Indian Ocean, targeting the YFT (red) and BET (blue) catches in northern (top) and southern (bottom) regions of the SWTIO. The shadings display the 95% confidence intervals of the R-squared values for each depth.



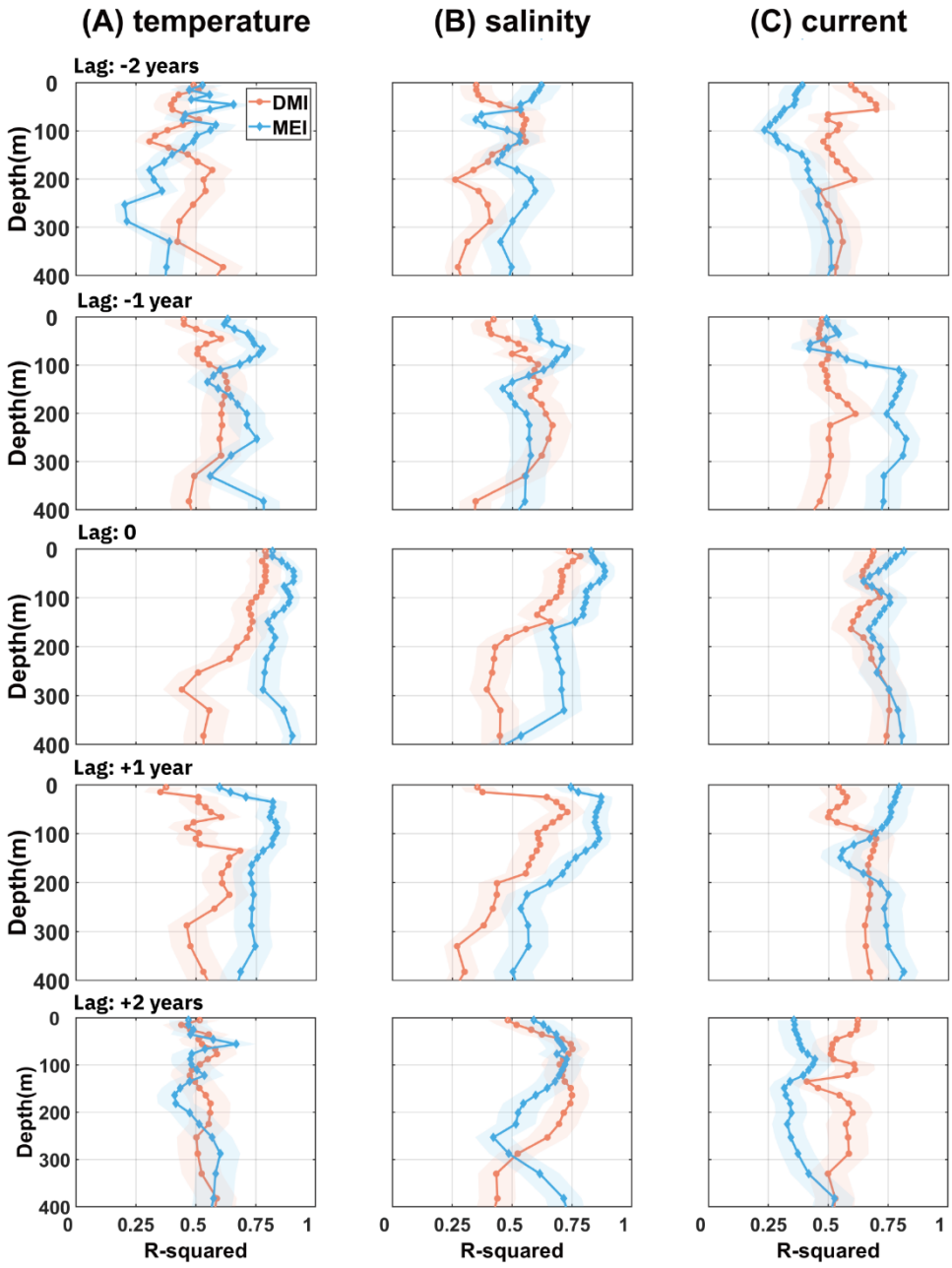
Supplementary Figure 2. The R-squared values of the regression for 1993–2014 from the (**A**) net primary production (NPP) and (**B**) chlorophyll concentration (Chl) at each depth in the tropical Indian Ocean, targeting the YFT (red) and BET (blue) catches in the northern (top) and southern (bottom) regions of the SWTIO. The shadings display the 95% confidence intervals of the R-squared values for each depth.



Supplementary Figure 3. The R-squared values of the regression targeting the normalized indices of the Indian Ocean dipole mode (Dipole Mode Index; DMI) and the multivariate El Niño-Southern Oscillation (MEI) for 1990–2014. The predictor variables are the (**A**) temperature, (**B**) salinity, and (**C**) current velocity at each depth in the tropical Indian Ocean. The positive sign of the lags denotes that climate indices lead the ocean environment. The shadings display the 95% confidence intervals of the R-squared values for each depth.

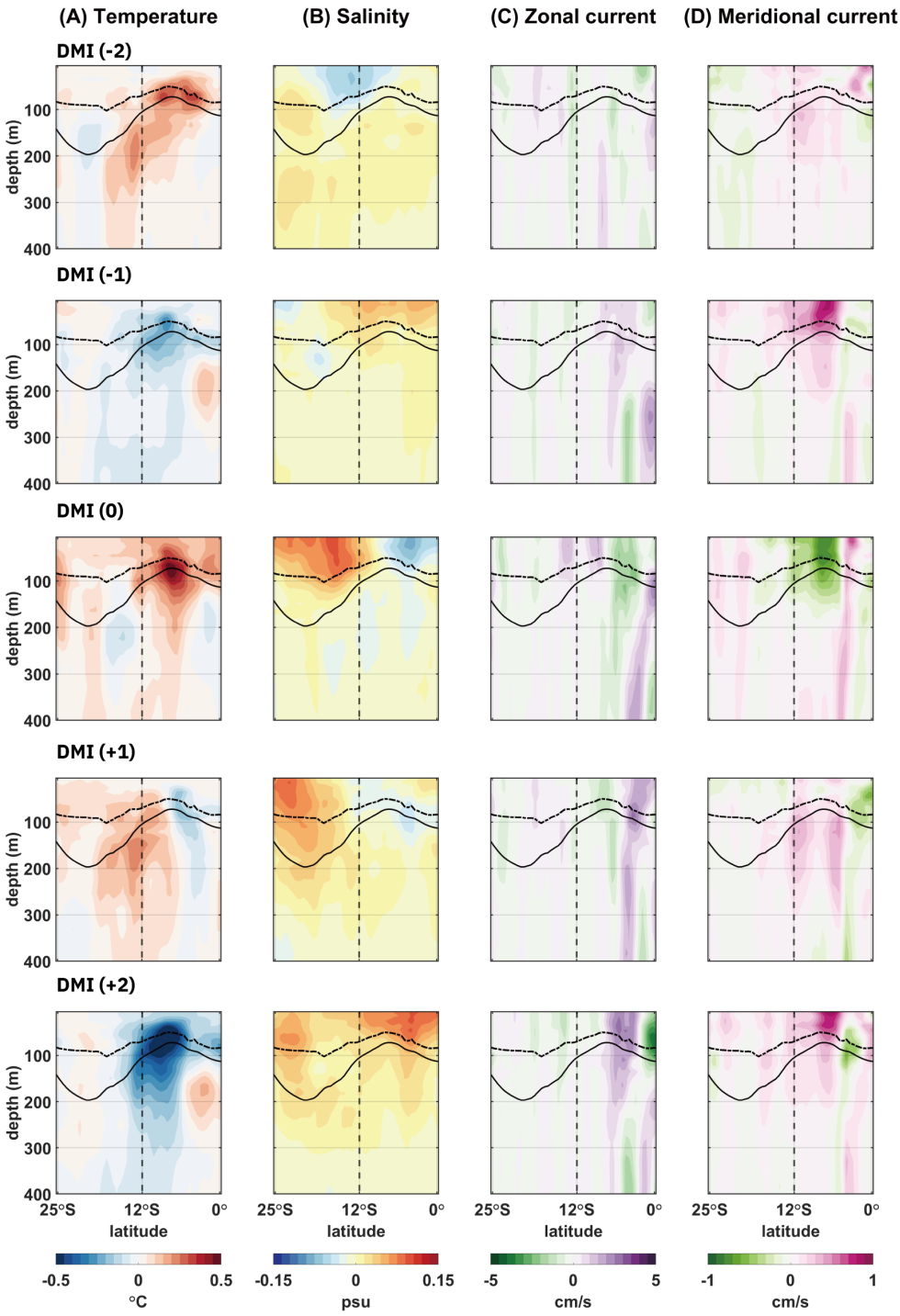


Supplementary Figure 4. The regressed and reconstructed anomalies of the total precipitation (color) and 10-m wind velocity (vector) in the tropical Indian Ocean during 1990–2014 with respect to: (**A**) the catch amounts of yellowfin tuna in the northern region (NY), (**B**) the catch amounts of bigeye tuna in the northern region (NB), (**C**) the catch amounts of yellowfin tuna in the southern region (SY), (**D**) the catch amounts of bigeye tuna in the southern region (SB), (**E**) the normalized Dipole Mode Index (DMI), and (**F**) the normalized multivariate El Niño–Southern Oscillation Index (MEI).



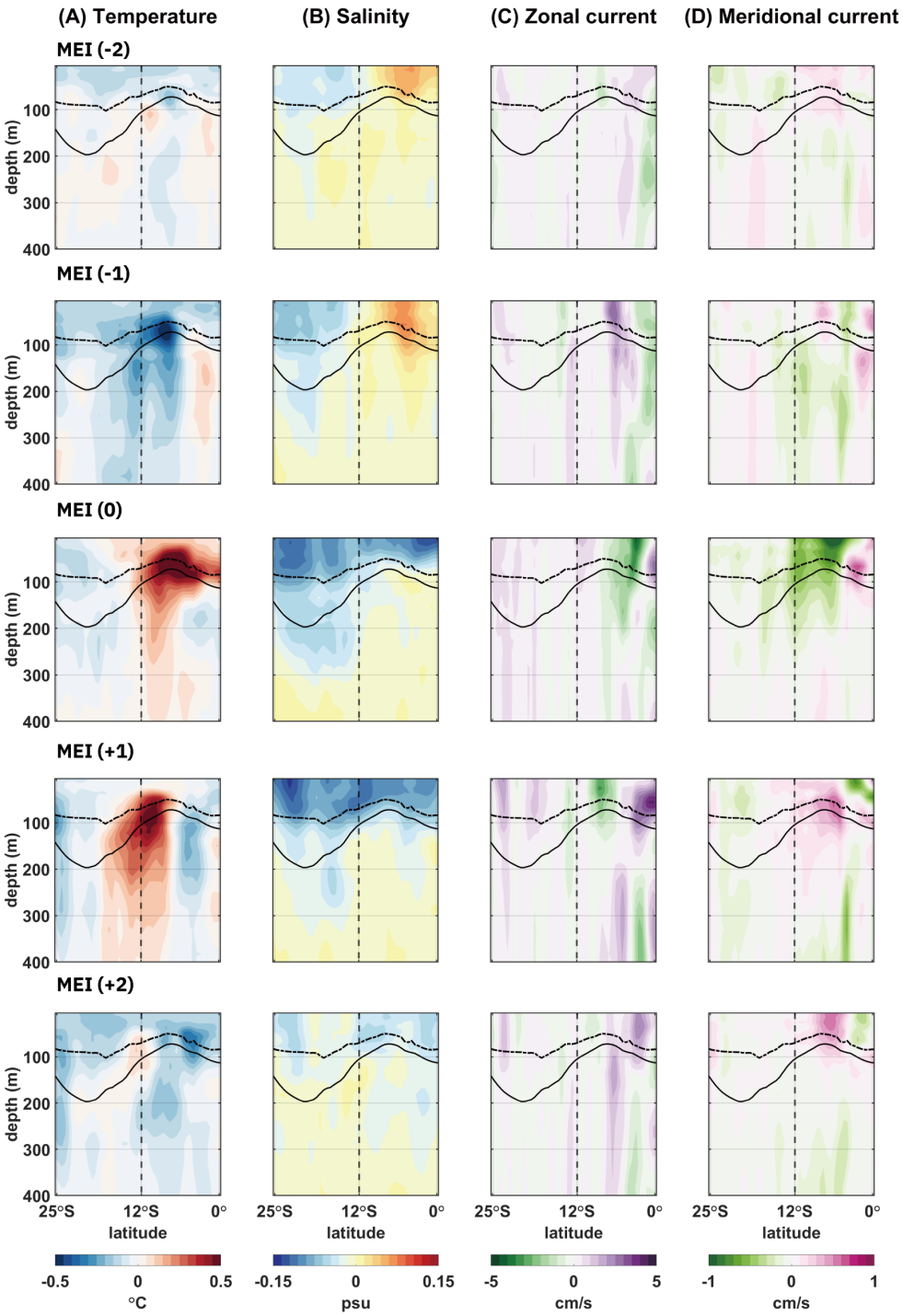
Supplementary Figure 5. The R-squared values of the lagged regression (lags: –2 years, –1 year, 0, +1 year and +2 years, respectively, from top to bottom) targeting the normalized indices of the Indian Ocean dipole mode (Dipole Mode Index; DMI) and the multivariate El Niño-Southern Oscillation (MEI) for 1990–2014. The predictor variables are the (**A**) temperature, (**B**) salinity, and (**C**) current velocity at each depth in the tropical Indian Ocean. The positive

sign of the lags denotes that climate indices lead the ocean environment. The shadings display the 95% confidence intervals of the R-squared values for each depth.



Supplementary Figure 6. Meridional distribution of the regressed and reconstructed anomalies of the ocean environmental variables with respect to the normalized index of Indian Ocean dipole mode (Dipole Mode Index; DMI). The target indices are for 1990–2014, and the ocean environmental variables are for 1988–2016, applying time lags of ±2 years. Numbers in parenthesis indicate the time lags, and positive values denote that the DMI leads

the ocean environmental variables. The anomalies are based on the zonal averages from 54°E to 60°E. Each column represents a different variable: (**A**) temperature, (**B**) salinity, (**C**) zonal current velocity, and (**D**) meridional current velocity. The thick dashed/dotted and solid lines indicate the mean thermocline depth and D20, respectively. The vertical dashed lines denote 12°S, the boundary between the northern and southern regions of the SWTIO.



Supplementary Figure 7. Meridional distribution of the regressed and reconstructed anomalies of the ocean environmental variables with respect to the normalized MEI for 1988–2016 with time lags of ±2 years. Numbers in parenthesis indicate the time lags, and positive numbers denote that the MEI leads the ocean environmental variables. The anomalies are based on the longitudinal average from 54°E to 60°E. Each column represents

a different variable: (**A**) temperature (shading intervals: 0.05°C), (**B**) salinity (shading intervals: 0.015 psu), (**C**) zonal current velocity (shading intervals: 0.5 cm/s), and (**D**) meridional current velocity (shading intervals: 0.1 cm/s). The thick dashed/dotted lines and solid lines indicate the mean thermocline depth and D20, respectively. The vertical dashed lines denote 12°S, the boundary between the northern and southern regions of the SWTIO.