An observational analysis of coupling between the ocean and the atmosphere in the subtropical North Atlantic on interannual time scales

The twenty-year record of satellite sea level along with high quality surface heat fluxes allow an evaluation of processes controlling the interaction between oceanic heat storage and surface heat fluxes on interannual times scales. Using gridded sea level from AVISO as a proxy for upper ocean heat content along with the surface turbulent heat flux from OAFlux, we evaluate the lagged correlations between interannual surface turbulent heat fluxes and sea level variability in the subtropical North Atlantic. Previous work has shown that lagged correlations between SST (sea surface temperature) and surface turbulent heat flux are generally antisymmetric about zero lag with negative correlations when SST leads and positive correlations when SST lags. This relationship indicates that surface heat flux force the SST variability, and at later times the SST is damped by the surface fluxes. In contrast, the lagged correlation between sea level anomalies and the turbulent flux of heat show a distinctly asymmetric relationship about zero-lag. Throughout much of the region the correlations are negative when SSH leads and are not significant when SSH lags. The Gulf Stream region sea level anomalies show the strongest predictive skill for surface heat flux anomalies indicating a strong local feedback to the atmosphere. The lack of significant correlation when SSH lags indicates that in this region heat content anomalies are generated by oceanic heat transport convergence. Linkages between heat content changes to observational estimates of the Atlantic Meridional Overturning Circulation and Meridional Heat Transport are also discussed.