Abstract View

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Simulation of North Atlantic Decadal/Multidecadal Winter SST Anomalies Driven by Basin-Scale Atmospheric Circulation Anomalies

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ABSTRACT

The North Atlantic winter sea surface temperature anomaly (T_{sa}) response to anomalous surface atmospheric circulation anomalies that vary over decadal and short-term inter-decadal periods is simulated for 1950 through 1992. Anomalous ocean variability is driven by adding monthly COADS-derived anomalous fields of vector wind stress and wind speed to the climatological annual cycle forcing. A simple model is derived relating winter T_{sa} to the integrated atmospheric forcing present earlier in time that is responsible for its existence. The basin-scale structure of forced winter T_{sa} patterns depends on the structure of the atmospheric forcing along with regional differences in the dominant mixed layer processes that generate T_{sa}. For example, when the atmospheric subtropical high and subpolar low pressure systems are simultaneously strong, enhanced flow around, and baroclinic adjustments within, the subtropical gyre results in anomalously warm water in the Gulf Stream region off the U.S. East Coast. At the same time, however, the open ocean generally cools because the westerlies and trades are anomalously strong. By analyzing T_{sa} variability not driven by the atmosphere, an anomalously cold decade is identified characterized by rapid onset and termination that both occur within one year. The onset during 1968 coincides with the appearance of the great salinity anomaly, while the termination during 1977 coincides with an abrupt Northern Hemisphere climate shift that is particularly evident in the Pacific.