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Multidecadal Variability in the North Atlantic

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Multidecadal variability (MDV) has been identified as an oscillation ranging from 30-90 yrs in numerous observations and numerical modeling studies concerning north Atlantic climate change. The low frequency variability is associated with variations of the Atlantic meridional overturning.

Composite analysis of the results of ECHAM5/MPIOM shows that the salinity signal in the north Atlantic in Multidecadal scale is coherent with the temperature signal. The anomaly moves around the subpolar gyre, getting enhanced in the Irminger Sea and Labrador Sea. The multidecadal signal is coherent from the surface till the depth around 2500m, with anomalies with one sign near Newfoundland Island, and with the opposite sign in the rest of the northern North Atlantic.

Three possible mechanisms are proposed to explain its mechanism: 1). as a damped oceanic response to atmospheric forcing; 2). as an ocean-only process; 3). as an atmosphere-ocean coupled mode. A series of integrations using the ocean component of the coupled model are performed for this purpose. It shows that MDV emerges as an oceanic response to atmospheric forcing, which is consistent with the result of the GFDL model. Surface heat flux is comparably more important in generating MDV in the ocean. Sensitivity studies have been carried out using climatological forcing in certain areas of the ocean. Without the random variability of the surface heat flux north of 40˚N, MDV is strongly damped, which indicates the important role of this region in integrating atmospheric change into the ocean to excite the MDV.