3rd International Conference on Earth System Modelling
Vol. , 3ICESM-280, 2012
3rd International Conference on Earth System Modelling

North Atlantic Multidecadal Variability simulated in Coupled General Circulation Models (CGCMs)

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Some climate models (CMIP3) indicate that the Atlantic Meridional Overturning Circulation (MOC) varies on multidecadal time scale, independent of external forcing. In these models the MOC is key to Atlantic Multidecadal Variability (AMV), because of its poleward heat transport. However, there is large spread in simulated AMV, with major uncertainty in the roles played by the North Atlantic Oscillation (NAO) and ocean-atmosphere interaction. In the Kiel Climate Model (KCM), the MOC fluctuates with a 60-years period, driving changes in Atlantic Sea Surface Temperature (SST). The mechanisms for this variability are studied using statistical analysis, including three-dimensional Temperature and Salinity Joint Empirical Orthogonal Functions (EOFs). The NAO plays little role in driving these fluctuations. Wintertime convection in the Greenland-Iceland-Norwegian (GIN), Irminger, and south Greenland Seas play different roles in MOC variability. Irminger Sea convection primarily drives MOC changes, leading them by about 15 year. In this region salinity contribution to density dominates. The Subpolar Gyre (SPG) also plays an important role with leading MOC changes by about 15 years, which indicates that a strong SPG leads to an intensified AMOC 15 years later, by increasing warm and salty water transport from low-latitudes to the Irminger Sea and thereby affecting density anomalies in this sinking region. Additionally the 1000 years salinity restoring run is applied to investigate salinity's contribution to multidecadal variability of MOC in KCM.