Multi-model comparison for Atlantic Multi-decadal Variability

Abstract

A multi-model comparison for Atlantic Multi-decadal Variability (AMV) is analyzed here to investigate the similarities to observation and how robust is the mechanism proposed by Delworth et al. 1993 (D93) in Coupled General Circulation Models (CGCMs). The analysis of similarity to observation is performed with preindustrial control simulations from 14 CGCMs, while the robustness of D93 mechanism is assessed with only 6 models, due to data deficiencies.

In most of models AMV indices show power on multi-decadal time scale but with different periodicity. AMV is mainly related with Sea Surface Temperature (SST) variations in the mid-latitude region, which is consistent with them being largely driven by Atlantic Meridional Overturning Circulation (AMOC) associated heat transport changes. The relationship between AMOC and North Atlantic Oscillation (NAO) is not clear in these models, except in one model where NAO variations tend to lead AMOC changes by about 10 years.

In D93 the salinity-induced density anomalies in the sinking region that drive AMOC variations are transported by the Subpolar Gyre (SPG). The wintertime oceanic deep convection sites and their relation to AMOC variability differ among models. Salinity induces density anomalies in the sinking region that tend to lead AMOC in four models. The Kiel Climate Model (KCM) provides the strongest evidence that wintertime Irminger Sea convection drives AMOC

fluctuations. Furthermore, KCM is the only model with a similar mechanism to D93. There is one model in which AMOC variability is not related with SPG. In all other models variations in convection in the sinking region tend to strengthen the SPG and then drive AMOC.