Internal Mechanism of Atlantic Multidecadal Variability in HadGEM3-GC3.1

Mr Michael Lai

University of Reading

Michael Lai, Dr. Jon Robson, Dr. Laura Wilcox

We characterised the internal AMV mechanism in, HadGEM3-GC3.1 at 2 resolutions, N96ORCA1 and N216ORCA025, using the 500-year pre-industrial control simulations. AMV-like variability exists at both resolution with a timescale of 50-100 years, with spatial pattern and magnitude of variability broadly comparable to observations. In both models, the subpolar and polar sea surface temperature (SST) variability is linked to ocean heat transport (OHT) anomalies associated with changes in ocean circulations, especially the Atlantic Meridional Overturning Circulations (AMOC). While the subtropical SST variability is linked to surface fluxes associated, in part, with changes in cloud concentration. Furthermore, in both models, we identified two regions where ocean density anomalies drive deep water formation and hence the AMOC and AMV. First, is a pool of dense Arctic water moving South into the subpolar deep convection regions preceding the AMV. Second, is the surface-flux forced density anomalies in the Labrador Sea subsurface driven by a NAO-like sea level pressure (SLP) pattern. Although both models exhibit largely similar mechanisms, there are key differences. For example, surface-flux forced density anomalies and Gulf Stream ocean heat transport are more important in N216, whereas the Arctic plays a larger role in N96. The model differences are likely due to differences in the model mean states, particularly stronger Labrador Sea stratification in N96 and a better representation of the Gulf Stream in N216.