Geophysical Research Abstracts, Vol. 9, 09816, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09816

Applications of 3d EOFs to multi-decadal variability and predictability of the Atlantic thermohaline circulation

E. Hawkins, R. Sutton

Walker Institute, Department of Meteorology, University of Reading

We describe the use of bivariate 3d empirical orthogonal functions (EOFs) in characterising low frequency variability of the Atlantic thermohaline circulation (THC) in the Hadley Centre global climate model, HadCM3. We find that the leading two modes are well correlated with an index of the meridional overturning circulation (MOC) on decadal timescales, with the leading mode alone accounting for 54% of the decadal variance. This approach retains only a few degrees of freedom but provides a better representation of the complex three-dimensional thermohaline circulation dynamics than a 2d streamfunction. Episodes of coherent oscillations in the sub-space of the leading EOFs are identified; these episodes are of great interest for the predictability of the THC, and could indicate the existence of different regimes of natural variability. The mechanism identified for the multi-decadal variability is an internal ocean mode, dominated by changes in convection in the Nordic Seas, which lead the changes in the MOC by a few years. Variations in salinity transports from the Arctic and from the North Atlantic are the main feedbacks which control the oscillation. This mode has a weak feedback onto the atmosphere and hence a surface climatic influence. Interestingly, some of these climate impacts lead the changes in the overturning. There are also similarities to observed multi-decadal climate variability.

We are continuing to explore the analysis of THC predictability using our EOF basis with the aim of estimating empirical singular vectors for the THC and will report our latest findings.