Geophysical Research Abstracts, Vol. 8, 08018, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08018
© European Geosciences Union 2006

Stability of the thermohaline circulation in different complexities and resolutions of earth system model

R. Marsh (1), R. J. Myerscough (1), T. M. Lenton (2), A. R. Price (3), S. J. Cox (3), N. R. Edwards (4), D. J. Lunt (5)

(1) National Oceanography Centre, Southampton, UK, (2) School of Environmental Sciences, University of East Anglia, Norwich, UK, (3) Southampton e-Science Centre, University of Southampton, UK, (4) Earth Sciences, Open University, Milton Keynes, UK, (5) Department of Geography, University of Bristol, UK (rma@noc.soton.ac.uk / Phone: +44 23 80 596214 / Fax: +44 23 80 596400)

We use the GENIE Earth system modelling framework to examine how the stability / hysteresis diagram of the thermohaline circulation (THC) depends on the use of complex (GCM) or simple (energy-moisture balance) atmosphere models and how it varies with ocean resolution.

The model versions all use the GOLDSTEIN frictional geostrophic ocean, but with 3 different horizontal resolutions (and 8 depth layers in each case): (i) 36x36 longitude-sine(latitude), (ii) 72x72 longitude-sine(latitude), (iii) 64x32 longitude-latitude. To these we have coupled the Reading Intermediate General Circulation Model (IGCM) at T21 resolution with 7 vertical levels. We contrast this with earlier work using an energy-moisture balance model (EMBM) and ocean resolution (i).

For each model version, we construct an ensemble of runs in which we vary atmospheric freshwater transport from the Atlantic to Pacific. In some cases we also vary a parameter controlling equator to pole freshwater transport. The resulting ensembles are run toward equilibrium and then restarts are used to search parameter space for regions of THC bi-stability.

The resulting hundreds of thousands of years of 3D ocean-atmosphere model integration were achieved by using UK Grid computing resources, including 6 nodes of the National Grid Service, and additional clusters in Norwich, Southampton and Bristol. A specially developed database system was used to execute and manage the runs.

The results are expected to shed light on whether a dynamical atmosphere alters or removes the bi-stability of the THC, and whether THC stability is sensitive to ocean resolution.