Geophysical Research Abstracts, Vol. 9, 05521, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05521

Timely detection of changes in the meridional overturning circulation at 26N in the Atlantic

J. Baehr (1), H. Haak (1), S. Alderson (2), S. A. Cunningham (2), J. H. Jungclaus (1), J. Marotzke (1)

(1) Max Planck Institute for Meteorology, Hamburg, (2) National Oceanography Centre, Southampton; baehr@mit.edu

We investigate how changes in the North Atlantic meridional overturning circulation (MOC) might be reliably detected within a few decades using the observations provided by the RAPID-MOC 26N array. Previously, the investigation of detectability of MOC changes had been based on a single integrated transport timeseries, exhibiting strong internal variability which would prohibit the detection of MOC changes within a few decades. Here, the observed variability of water mass properties along the transatlantic section at 26N is first compared to a control climate simulation of the coupled ECHAM5/MPI-OM global model. The results suggest that the observed changes in temperature and salinity between 1957 and 2004, can be associated with variations of the MOC of several Sverdrups, which are within the range of the model's natural variability. For the detection analysis, three realizations of the IPCC (Intergovernmental Panel on Climate Change) scenario A1B are analyzed, in which the MOC weakens by approximately 25 percent in the 21st century. In these simulations, the zonal mean temperature at 26N is dominated by the global warming signal, and salinity at 26N increases. Short-term changes in the MOC are, in contrast, associated with changes in the zonal density gradient. A fixed spatial pattern of natural variability is derived from the observations and used to investigate at which time the zonal density gradient in the climate change scenario departs from the given range of natural variability. For a random observation error of 0.01 kg m-3, and only using zonal density gradients between 1700 m and 3100 m depth, statistically significant detection occurs with 95 percent reliability after about 30 years. Compared to using a single MOC timeseries as detection variable, continuous observations of zonal density gradients reduce the detection time by 50 percent.