Geophysical Research Abstracts, Vol. 8, 02693, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02693

Unforced centennial variability of the MOC and its imprints on climate

M. Vellinga, P. Wu and J. Knight

Hadley Centre, Met Office, FitzRoy Road, Exeter EX1 3PB, United Kingdom
(michael.vellinga@metoffice.gov.uk)

Variability of the Atlantic meridional overturning circulation (MOC) has been analysed in a long control simulation of the Hadley Centre's coupled climate model HadCM3. It is shown that internal MOC variability in this coupled model is concentrated at interannual and centennial timescales, with the centennial mode being dominant. A mechanism for this centennial variability in the model is proposed, based on large-scale changes in air-sea interaction in the tropical Atlantic. Salinity anomalies are formed, and propagate northward from the tropics to the sub-polar North Atlantic at time scales of 5-6 decades. Northward propagation at these multi decadal time scales is also seen in an idealised tracer experiment, where a tracer is released in the tropical North Atlantic.

The centennial fluctuations of the MOC impact on surface climate via an interhemispheric SST contrast, of 0.1 deg C in the tropics and more than 0.5 deg C in mid and high latitudes. This SST anomaly pattern in the model bears a strong resemblance to that of multi-decadal SST fluctuations in the instrumental record. It suggests we can link these observed multi-decadal SST anomalies to low-frequency fluctuations in the MOC. We use that model-based relation between SST and MOC to reconstruct low-frequency changes of the MOC in the 20th century, with confidence intervals. Over the last 25 years an increase in MOC strength is inferred at the 85% level.