Geophysical Research Abstracts
Vol. 13, EGU2011-13059, 2011
EGU General Assembly 2011

Potential predictability of the North Atlantic heat transport based on an oceanic state estimate

Bente Tiedje, Armin Köhl, and Johanna Baehr

Institute of Oceanography, KlimaCampus, University of Hamburg, Grindelberg 5, 20144 Hamburg, Germany (bente.tiedje@zmaw.de)

We examine the potential predictability timescales of the North Atlantic meridional heat transport (MHT) using a hindcast ensemble based on an oceanic data assimilation product. We focus on the relation of the potential predictability timescales of the MHT to the potential predictability timescales of the meridional overturning circulation (MOC).

For our investigations, we use the GECCO synthesis which combines most of the data available during the estimation period of 50-years (1952-2001) with the ECCO-Massachusetts Institute of Technology (MIT) ocean circulation model using its adjoint (Köhl and Stammer, 2008). GECCO's optimized forcing is used to generate a reference run, which provides the initial conditions for an ensemble of free forward integrations with a length of 10 to 12 years. The ensemble is generated by using different periods of optimized forcing of GECCO during the past decades (1959-1982). Presently, we have 10 ensembles, which start every year from 1983 to 1992 and consist of 15 to 24 members.

We analyse the potential predictability of the MHT by calculating the prognostic potential predictability (PPP) following Pohlmann et al. (2004). PPP patterns are quantified through the ratio of the ensemble spread as a function of time to the variance of the reference run of the prediction period at every latitude (30°S-60°N). We assume that MHT variations are potentially predictable as long as the ensemble spread is smaller than the range of variance of the reference run. However, this method sets only a theoretical limit for the timescales of potential predictability.

The results show that the MHT is potentially predictable for 6 - 7 years between 25°N-35°N and around 10 years between 45°N-55°N. The decomposition of the MHT shows that the PPP pattern can be reconstructed from the individual consideration of the PPP pattern of the overturning and gyre component. The PPP pattern of the gyre component shows similarities to the PPP pattern of the heat content of the upper 700m, whereas the PPP pattern of the overturning component shows similarities to the PPP pattern of the MOC. Therefore, the PPP patterns of the MOC and the MHT are not similar. The PPP timescales of the MHT are longer than those of the MOC at higher latitudes and shorter at lower latitudes which is mirrored in the PPP pattern of the gyre component.

Within the employed model set-up, we find that the PPP timescales of the Atlantic MOC cannot be directly transferred to the PPP timescales of the total MHT.