Geophysical Research Abstracts
Vol. 18, EGU2016-9151, 2016
EGU General Assembly 2016

Reconstructing Links between AMOC and Surface Temperature Variability in the North Atlantic

Leonard Borchert (1,2), Matthias Fischer (2), Wolfgang Müller (3), and Johanna Baehr (2)

(1) International Max Planck Research School on Earth System Modeling, Max Planck Institute for Meteorology, Hamburg, Germany (leonard.borchert@mpimet.mpg.de), (2) Institute for Oceanography, Center for Earth System Research and Sustainability (CEN), Universität Hamburg, Hamburg, Germany, (3) Max Planck Institute for Meteorology, Hamburg, Germany

Recent studies found an impact of the Atlantic Meridional Overturning Circulation (AMOC) through sea surface temperatures (SSTs) and ocean-atmosphere surface heat fluxes (SHFs) on North Atlantic (NA) climate on inter-annual time scales. Since fluctuations in SSTs and SHFs as well as AMOC and oceanic heat transport (OHT) are highly model dependent and cannot be assumed to be independent of the mean state of the model in use. By using the Max Planck Institute Ocean Model (MPIOM) forced with the *Twentieth Century Reanalysis* (20CR, Compo et al (2011)), we confirm earlier studies and reconstruct for the governing period 1871-2010, that cold SSTs emerge in the Gulf Stream region and warm SSTs emerge in the NA Subpolar Gyre after strong AMOC anomalies at 50˚N. The MPIOM in use has an average 1.5˚ horizontal resolution and 40 vertical non-equidistant depth levels. The model is forced by fluxes of heat, momentum, and freshwater at the air sea boundary through bulk formulas as described in Müller et al (2014).

A positive density anomaly in the NA (= higher salinity / lower temperatures) is followed by an intensification of the AMOC and subsequently OHT. The proposed mechanism is examined in more detail studying correlations between AMOC, OHT, SSTs, and SHFs, as well as composite means of SSTs and SHFs in the Atlantic focusing on particularly strong and weak AMOC and OHT states at 50˚N. High SSTs are shown to mostly appear simultaneously with upward SHFs and vice versa. The characteristic AMOC anomaly pattern appears in both correlation analysis and composite mean analysis over strong AMOC states after 2-6 years, and seems to occur favorably in winter (DJF). We further demonstrate that a similar, stronger pattern arises from OHT anomalies on similar time scales.

Literature:

Compo, GP, JS Whitaker, PD Sardeshmukh, N Matsui, RJ Allan, X Yin, BE Gleason, RS Vose, G Rutledge, P Bessemoulin, S Brönnimann, M Brunet, RJ Crouthamel, AN Grant, PY Groisman, PD Jones, MC Kruk, AC Kruger, GJ Marshall, M Mauger, HY Mok, Ø Nordli, TF Ross, RM Trigo, XL Wang, SD Woodruff, SJ Worley (2011): *The Twentieth Century Reanalysis Project*. Q J R Meteorol Soc, 137: 1-28

Müller, W, D Matei, M Bersch, JH Jungclaus, H Haak, K Lohmann, GP Compo, PD Sardeshmukh, J Marotzke (2014): *A twentieth-century reanalysis forced ocean model to reconstruct the North Atlantic climate variation during the 1920s*. Clim Dyn, 44: 1935-1955