

U.S. Atlantic Meridional Overturning Circulation (AMOC) Update July 2011

Under the guidance and support of relevant federal agencies (NASA [lead], NOAA, and NSF), the US AMOC Program is coordinating research focused on the 4th near-term priority of the Ocean Research Priorities Plan, the Atlantic Meridional Overturning Circulation (AMOC). The AMOC Science Team continues development of the AMOC Program with annual meetings and strong collaboration with European, South American and South African colleagues.

A successful joint meeting between the US AMOC group and the UK RAPID program was held in Bristol, UK, from 12-15 July. The program and abstracts are available online: <http://www.noc.soton.ac.uk/rapid/ic2011/>

Recent US AMOC Activities

- Young-Oh Kwon attended the ICES Workshop on Basin-wide Impact of Atlantic Multidecadal Oscillation at WHOI, June 6-10. The agenda is attached. Approximately 30 people were in attendance with a mix of fisheries scientists and some climate scientists/physical oceanographers including a few US AMOC Science Team members. The co-chairs of the workshop are Ken Drinkwater (ken.drinkwater@imr.no), Janet Nye (nye.janet@epa.gov), and Juergen Alheit (juergen.alheit@io-warnemuende.de).

There was strong desire among fisheries/ecosystem scientists to collaborate with physical climate scientists to understand the AMO related spatial patterns (in basin as well as regional scale) and the physical mechanism of AMO, so that they can better understand the AMO related variability observed in their ecosystem data. One purpose of the meeting was to foster communication between the disciplines.

Kwon briefed the group about the US AMOC Science Team, and task teams. The group was interested in communication US AMOC, but no firm decision was made during the meeting. Ken Drinkwater, personally expressed interest in communication between the two groups. He also mentioned the Ecosystem Studies of Sub-Arctic Seas (ESSAS; <http://www.imr.no/essas>), a program he is involved, and the possibility of collaboration with AMOC Science Team in association with that program. This is one possible way to strengthen the climate/ecosystem impact component.

- The task teams are developing plans for workshops to advance progress on

key near-term research priorities described in the 2010 annual report. Among these is a workshop focused on assessing proxy data, model results, and the modern oceanographic record to further develop an "AMOC fingerprint" for tracking variations in the AMOC. Another workshop will focus on mechanisms of AMOC variability, the robustness of mechanisms in different models, and the requirements necessary for verifying these mechanisms in observations. These workshops will be open to all interested participants. USAMOC PI's who are interested in these questions should keep an eye out for updates and announcements.

- The 2012 USAMOC Annual Meeting will be held in Boulder, CO in the May-June time frame. The dates and details on the venue will be announced in the near future
- PIs: Xiao-Hai Yan and Young-Heon Jo 1 examined sea level trends in the North Atlantic based on different temporal scales based on Ensemble Empirical Mode Decomposition (EEMD) to identify dominant forcing, resulting in that the trends are not geographically uniform over the ocean. While the areas of the relatively high sea level rise trends are associated with decadal time scales, the decreasing sea level rise trend in the Northern Recirculation Gyre (NRG) was associated with interannual variability. The results related AMOC strength based on Complex Empirical Orthogonal Function (CEOF) shows that the AMOC strength was decreasing after 1999 (Jo, Yan, et al., 2011). In addition, geostrophic velocities derived from altimeter data shows that the trends of cyclonic circulation of the subpolar gyre (SPG) increased in the 2000s, resulting in weakening SPG. GRACE and ICESat measurements showed that this may be attributed to observed accelerated ice mass loss in the Canadian Arctic Archipelago (CAA) and the Greenland since 2005. Advancing of the sea ice edge towards the Labrador Sea (LS) interior regulates the Deep Ocean Convection (DOC) development, which are influenced by North Atlantic Oscillation (NAO) phase (Li, Yan and Jo, 2011).

| **New Science Results**

- Bower, A.S., M.S. Lozier and S.F. Gary, 2011. The export of Labrador Sea Water from the subpolar North Atlantic: a Lagrangian perspective. *Deep Sea Research*, **58**, 1798-1818.
- Gary, S.F., M.S. Lozier, C. Böning and A. Biastoch, 2011. Deciphering the pathways for the deep limb of the Meridional Overturning Circulation. *Deep Sea Research*, **58**, 1781-1797.
- Jo, Y-H, X.-H. Yan, R. Zhang, and T. Liu, A new insight on sea level

trends in different time scales in the North Atlantic, *Submitted to Deep Sea Research*

- Johns, W.E., M. O. Baringer, L. M. Beal, S. A. Cunningham, T. Kanzow, H. L. Bryden, J. J. M. Hirschi, J. Marotzke, C. S. Meinen, B. Shaw, and R. Curry, 2011: Continuous, array-based estimates of Atlantic Ocean heat transport at 26.5°N. *J. Climate*, **24**, 2429-2449, doi: 10.1175/2010JCLI3997.1
- Li, Feili, Yan, X-H. and Jo, Y-H, Strengthened subpolar gyre circulation and its relationship to the deep convection in late 2000s', to be submitted to *Journal of Geophysical Research*.
- Rypina, I.I., L.J. Pratt and M.S. Lozier, 2011. Near-surface transport pathways in the North Atlantic ocean: looking for throughput from the subtropical to the subpolar gyre, *Journal of Physical Oceanography*, **41** (5), 911-925.
- Wan, X., Chang, P. C. S. Jackson, L. Ji and M. Li., 2011: Effect of Climate Model Bias on Abrupt Climate Change Simulations in Atlantic Sector, *Deep Sea Res. II*, 58, 1904-1913,doi:10.1016/j.dsr2.2010.10.068.
- Wen, C., Chang, P. Saravanan, R. 2011: Effect of Atlantic Meridional Overturning Circulation on Tropical Atlantic Variability: A Regional Coupled Model Study, *J. Climate*, doi:10.1175/2011JCLI3845.1.