Geophysical Research Abstracts
Vol. 17, EGU2015-12938, 2015
EGU General Assembly 2015

Competition between the Atlantic and Antarctic overturning cells

Kevin Oliver

University of Southampton, National Oceanography Centre, Southampton, Ocean and Earth Science, Southampton, United Kingdom (k.oliver@noc.soton.ac.uk)

Recent decades have seen a decrease in density in bottom waters in all ocean basins. The implications of these changes within the Antarctic overturning cell for the North Atlantic has only recently begun to receive attention, but evidence from a general circulation model (GCM) suggests that the direct effect would be a strengthening of the Atlantic meridional overturning circulation (AMOC).

Here, a framework for predicting the response of the AMOC to remote density changes is developed. This brings together ocean energetics and "rotated geostrophy" to predict that the AMOC is controlled by meridional gradients in gravitational potential energy (GPE). The result is that the AMOC and the Antarctic overturning cell compete for a global resource of available GPE. The relative densities of the deep/bottom waters determines the fraction of this resource available to the AMOC.

The framework is validated with a GCM and used to predict the response of the AMOC to ongoing density changes in the AMOC. On centennial and longer timescales, the strengthening associated with this mechanism is of the same order as the weakening associated with changes in surface buoyancy forcing within the North Atlantic.