

# THE ROLE OF EDDIES IN THE SOUTHERN OCEAN TEMPERATURE RESPONSE TO THE SOUTHERN ANNULAR MODE

James A. Screen\*

Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, UK

## ABSTRACT

The role of eddies in modulating the Southern Ocean response to the Southern Annular Mode (SAM) is examined, using an ocean model run at multiple resolutions from coarse to eddy resolving. The high-resolution versions of the model show an increase in eddy kinetic energy that peaks 2-3 yr after a positive anomaly in the SAM index. Previous work has shown that the instantaneous temperature response to the SAM is characterised by predominant cooling south of 45°S and warming to the north. At all resolutions the model captures this temperature response. This response is also evident in the coarse-resolution implementation of the model with no eddy mixing parameterisation, showing that eddies do not play an important role in the instantaneous response. On the longer timescales, an intensification of the mesoscale eddy field occurs, which causes enhanced

poleward heat flux and drives warming south of the oceanic Polar Front. This warming is of greater magnitude and occurs for a longer period than the initial cooling response. The results demonstrate that this warming is surface intensified and strongest in the mixed layer. Non-eddy-resolving models are unable to capture the delayed eddy-driven temperature response to the SAM. The authors therefore question the ability of coarse-resolution models, such as those commonly used in climate simulations, to accurately represent the full impacts of the SAM on the Southern Ocean.

## ADDITIONAL MATERIAL

The full version of this manuscript is in press with the Journal of Climate and is available at: <http://ams.allenpress.com/perlserv/?request=get-abstract&doi=10.1175%2F2008JCLI2416.1>, or by emailing the author.

\* *Corresponding author address:* James A. Screen, Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, Norfolk, NR4 7TJ, United Kingdom; e-mail: [j.screen@uea.ac.uk](mailto:j.screen@uea.ac.uk).