28*th* IUGG Conference on Mathematical Geophysics, June 7-11, 2010, Pisa, Italy
Session 3: Geophysical fluid dynamics III - Atmosphere and ocean

The dynamics of the Antarctic Circumpolar Current

Joseph H. LaCasce[1], Pal E. Isachsen[2]

[1] *University of Oslo, Oslo, Norway*
[2] *Norwegian Meteorological Institute, Oslo, Norway*

Keywords: *modelling, ocean, fluid dynamics*

The Antarctic Circumpolar Current (ACC) is the largest current in the world, and the only truly circumpolar one. As such, our thinking about the ACC has been strongly influenced by theories of the Jet Stream in the atmosphere, which also is circumpolar. These theories are fundamentally nonlinear, as the Jet Stream structure is determined by eddy fluxes of heat and momentum. There are linear theories of the ACC as well, similar to those proposed for the Gulf Stream. But these have received much less attention. However, the linear solutions are very revealing with regards to the dynamics. The solutions depend strongly on the "geostrophic contours" in the Southern Ocean. These are latitude lines, if the bottom is flat, and more complex structures with stratification and topography. If the contours are unblocked by lateral barriers (continents), the ACC follows the geostrophic contours and is typically very strong. But if the contours are blocked, the dynamics are more like that in the Gulf Stream models, with western boundary currents. The solutions in the latter case bear a strikingly resemblance to the actual ACC. And the transport predicted by the model is within errors of the observed value. This is not to say that eddies are unimportant in the Southern Ocean, as the linear models do not predict the vertical structure of the flow. But the success in reproducing the current path suggests the linear solutions can be used to understand how the ACC responds to changes in wind stress and topography.