Improved representation of Southern Ocean fronts in a finite element ocean model

T. Janjic (1,2), R. Timmerman (2), and J. Schroeter (2)

(1) Massachusetts Institute of Technology, Cambridge, USA, (2) Alfred Wegener Intitute for Polar and Marine Research, Bremerhaven, Germany

Orsi et al. 1995 determined the positions of fronts in Southern Ocean based on the water mass criteria from hydrographic sections data. Following Orsi et al. 1995 three main Southern Ocean fronts are distinguished, the subantarctic front (SAF), the polar front (PF) and the southern Antarctic Circumpolar current (sACC) front. All three fronts are continuous features of the ACC, and extend from the sea surface to the deep ocean. Several studies used satellite observations (gradients of sea surface height and sea surface temperature) to locate ACC fronts. In recent work by Sokolov and Rintoul 2009, the authors introduced south, north and middle branches of each of the three major fronts. The position of the branches are determined based on the contour lines of absolute SSH, where the absolute SSH values were calculated by adding the SSH anomalies to the mean surface dynamic height (relative to 2500 dbar) derived from the World Ocean Circulation Experiment climatology.

In this work, we estimate the locations of the Southern Ocean fronts using the finite element ocean model and the same criteria as specified in Orsi et al. 1995. The ocean model representation of the locations of fronts is improved by assimilating dynamical ocean topography (DOT) data. In our study, the DOT is generated using the satellite altimetry and our knowledge of the geoid as given by the $GOCO_2S$ model which combines GRACE and GOCE gravity data. In addition, front locations determined in such a way are compared to the streamline approach of Sokolov and Rintoul 2009.