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Heat budget in the SAMW formation area

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Subantarctic Mode Water (SAMW) is formed by deep winter convection on the Northern side of the Subantarctic front in the southern Indian Ocean. Strong convection creates a link between the atmosphere and the mode water layer, setting the water mass proprieties of temperature, salinity, carbon,and oxygen which will be maintained a long time after subduction. This formation area is a key region for understanding the mode water circulation, modification, and heat transport around the Indian Ocean. Our study focuses on the formation area on the equatorward side of the Antarctic Circumpolar Current and east of the Kerguelen Plateau, where the mixed layer depth is maximum (Thompson and Edwards [1981], Sallee [2004]).

The first part of our study involves computing the terms of the heat budget equation for the formation region. Although the historical subsurface data is relatively sparse in this region, we now have available approximately 100 Lagrangian ARGO floats, which allows us to compute the heat content variation over the two year period : 2003 and 2004. NCEP and altimetric data are used to calculate the air-sea fluxes and the advection terms. We find that the Ekman advection is only a small component of the winter heat budget, in the formation area, which is dominated by the geostropic advection and the air-sea heat flux.

If ARGO data are a very helpful in-situ database, they are obviously not perfect. The spatio-temporal cover is restricted, generating, for instance, errors on spatial means. For the second part of our study we combine all available oceonographical data (historical data, satellite data, profiling floats, altimetric surface currents, etc.) to provide a more complete gridded dataset. We analyse the temporal evolution of this 3D-gridded physical dataset by adapting the Kalman data assimilation technique developed by

F.Gaillard et al. [2004]. After validation of this synthesyzed dataset we can then analyse the temporal evolution of the mode water properties.

The combination of these two different approaches minimizes the uncertainties attached to the calculations and produces more precise and detailed results.