

SOUTHERN OCEAN EDDY MIXING AND THE FORMATION OF MODE WATERS

J.B. Sallée, R. Morrow

As part of the programme **FLOSTRAL** (FLOtteurs de l'océan auSTRAL), 30 Argo floats were deployed in the Southern Indian Ocean, in order to study the mechanisms acting on the formation of deep winter mixed layers in the Southern Ocean, where Subantarctic Mode Waters form. Our analyses showed that the deep winter mixed layers (Fig. a), were formed due to deep convection from surface cooling, dominated by air-sea fluxes (Fig. b) and Ekman transport (Fig. c) (Sallée et al., 2006, 2008a). However, although these surface cooling terms are circumpolar in nature, the resulting mixed layer depths show strong regional variations. We calculated a new lateral eddy diffusion coefficient from lagrangian statistics based on 15 years of surface drifters and altimetric surface currents (Sallée et al., 2008b). When the lateral eddy heat flux is calculated based on this new eddy diffusion coefficient, we see that the mesoscale eddies introduce strong heating in winter in certain key areas (Figs. d, e), which overrides the cooling from the surface forcing, and blocks the formation of deep winter mixed layers.

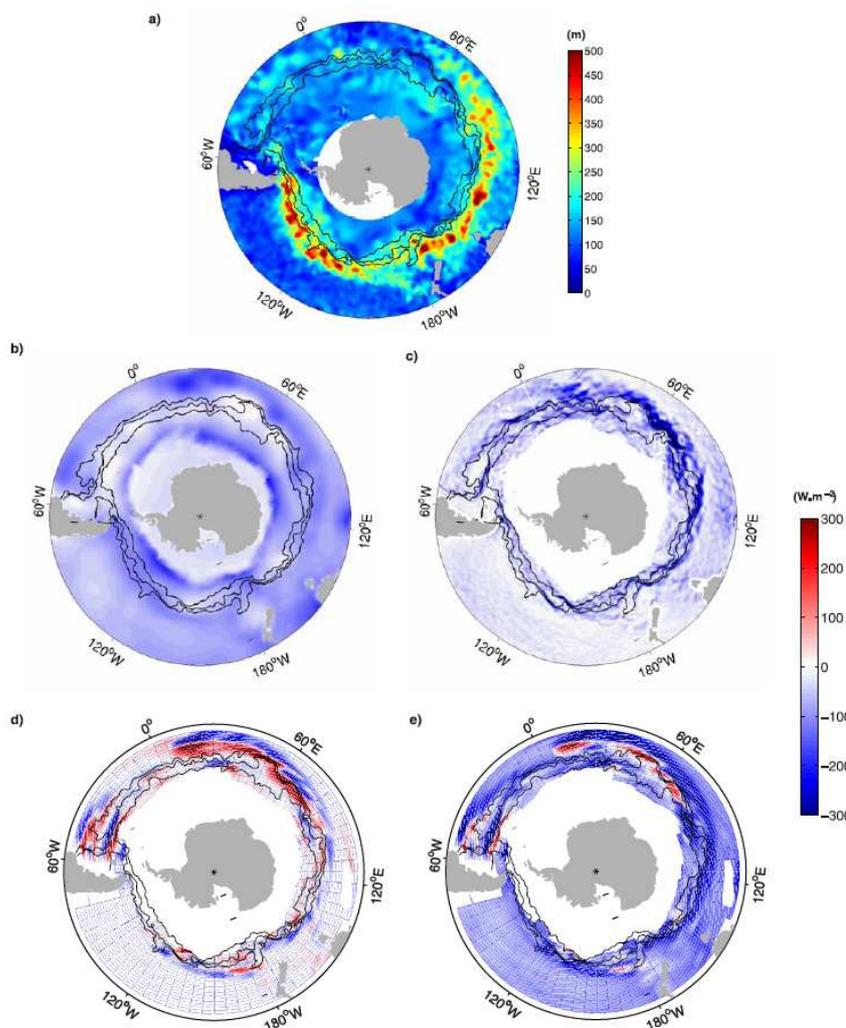


Figure (a) Winter mixed layer depth in the Southern Ocean from Argo and ship data,

(b) climatological winter air-sea heat flux (blue is cooling),

(c) Ekman heat advection,

(d) eddy heat diffusion in the mixed layer (eddies warm the ocean north of the fronts, and cool south of the fronts)

(e) total heat budget, based on these three components.

Black contours represent the mean ACC fronts (PF, SAF and SAF-N).

Sallée, J.B. N. Wienders, K. Speer and R.A. Morrow, 2006. Formation of subantarctic mode water in the southeastern Indian Ocean, *Ocean Dynamics*, 56, 5-6, pp. 525-542.

Sallée, J.B.; Morrow, R. ; Speer, K., 2008. Eddy heat diffusion and Subantarctic Mode Water formation, *Geophys. Res. Lett*, 35, L05607, doi:10.1029/2007GL032827

Sallée, J.B. Morrow, R.; Speer, K. and Lumpkin, R. An estimate of Lagrangian eddy statistics and diffusion in the mixed layer of the Southern Ocean, submitted to *J. Mar. Res.*, 2008