

HOW DOES HEAT CROSS THE ANTARCTIC CIRCUMPOLAR CURRENT SYSTEM? A FIRST APPROACH.

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It has been estimated that $\sim 30 \times 10^{13}$ W of oceanic meridional heat fluxes through the Antarctic Circumpolar Current System (ACC) are necessary to compensate the heat loss to the atmosphere around the Antarctic continent. However, in a strongly zonal current system, forced by western winds and without meridional land barriers, the Sverdrup dynamics in their usual form cannot be applied in order to supply a mean meridional flux through the ACC.

Several processes may be important to account for such a heat transport to the south of the ACC. The balance can be expressed as the sum of a mean transport (geostrophic), the contribution by winds (Ekman Transports) and an eddy component.

In this work we utilize the Polar Front to define the position of the ACC, and: (1) calculate the Ekman transport, with wind stress data from atmospheric reanalysis; (2) integrate the thermal wind equations to obtain geostrophic velocities and, consequently, transports; and (3) from the theory of baroclinic instability, following the pioneer work by Green (1970) and Stone (1972) developed for the atmosphere and applied to the ocean by Visbeck et al. (1997), estimate the contribution of baroclinic eddies to the heat balance through the ACC.

We then compare the circumpolar integral of those quantities to the total heat lost to the atmosphere.

To achieve objectives (2) and (3), we use the uniformly spaced gridded property fields from the Southern Ocean Atlas ($1^\circ \times 1^\circ$), constructed using all stations from WOCE and a carefully screened selection of historical stations.

In this way, we conclude that eddy fluxes play a central role in both the dynamical and thermodynamical balances of the Southern Ocean.