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Characterization of the ocean mesoscale eddies in the Antarctic Circumpolar Current from in situ, model and remotely sensed data

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Mesoscale variability and associated eddy fluxes play crucial roles in the ocean dynamics, transport of water mass properties and ecology of the upper ocean. In the Southern Hemisphere, where the nearly zonal flow of the Antarctic Circumpolar Current (ACC) acts as a barrier to the direct poleward transport toward the Antarctica, the eddy flux across the ACC is the main mechanism that guarantees the heat budget and distributes physical and biogeochemical properties between subtropical and polar regions. We focused on a high dynamical region located between the South-West Indian Ridge and the South Pacific Ridge. In this area, the interaction between the ACC and the major bathymetric features produces relatively large values of eddy kinetic energy and eddy heat fluxes as well as a relevant forcing for the ACC path.

The aim of this study is to evaluate the actual efficiency of mesoscale eddies to exchange heat and other properties across the different ACC fronts and to describe the vertical properties of the eddies, their tracks and evolution. To this end, we used in-situ and satellite data in conjunction with a hindcast simulation from 1958 to 2018 performed with a 1/10° ocean biogeochemistry model.

Eddies are identified and tracked in both the model output and altimetry data while their thermohaline properties and vertical extension are described using model outputs and in situ data, which include available repeated XBT sections (i.e. New Zealand – Antarctica and Hobart – Antarctica) and Argo float profiles located inside these structures.

Thanks to the joint analysis of model and observational data, we are able to 1) assess the ability of the 1/10° ocean model of simulating the eddy field properties, and to 2) better interpret the spatial and temporal variability of the observed eddy characteristics in the larger and longer framework of the ocean simulation.

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