

Interannual surface variability of the Southern Pacific Ocean in relation to the SAM pattern

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Drifter and satellite data are used to define the response of the Pacific Sector of the Southern Ocean (PSSO) to the large scale climatic pattern (Southern Annular Mode index - SAMI) in the period 1995-2015. The SAMI, defined as the mean sea level pressure difference between the 40° S and 65°S latitudes (Marshall et al., 2003), affects the eddy activity of the Southern Ocean and consequently the large-scale zonal transport in the Antarctic Circumpolar Current (ACC; Meredith and Hoggs, 2006; Hogg et al., 2014).

Drifter data were primarily corrected for the wind-induced slip and currents (Ekman), then used to estimate annual values of the Eddy Kinetic Energy (EKE) fields in bins of 2°x2° over the PSSO. Time series of the drifter EKEs were compared with the EKEs derived from altimeter data over the entire study area and with the temporal evolution of SAMI.

A more quantitative evaluation of the surface eddy field response to the SAMI was performed counting the number and type (cyclonic or anticyclonic) of eddies produced in the whole PSSO and in correspondence of the Sub-Antarctic Front (SAF) and Polar Front (PF). The mean latitude of each front was determined using thermal criteria applied to a long time series of in situ XBT data collected by the Italian Antarctic Programme along the track between New Zealand and Antarctica from 1994 to 2016. Eddy counting was based on the results of the identification and tracking method performed by Chelton et al. (2011), retaining only those eddies with lifetimes of 4 weeks or longer.

The drifter derived EKE shows a similar and quicker response to the SAMI variability with respect to the altimetry derived EKE; the time lag is of one year for drifters and of two years for the altimetry. Both the datasets reveal an anomalous behaviour of the EKE during the period 2003-2006. The SAMI variability induces a specific effect on the different frontal zones with changes in the number and type of eddy generated. Moreover the anomalous behaviour showed by the time series of EKEs in the period 2003-2006, is observed close to the SAF and PF as well.