



Instrumented seals help refining the Polar Front mapping in the Southern Indian Ocean.

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The Kerguelen Plateau obstructs the eastward flowing Antarctic Circumpolar Current (ACC) in the Indian sector of the Southern Ocean strongly interacting with the frontal structure. While the Subantarctic Front (SAF) lies north of the plateau and the Southern ACC Front (SACCF) is deflected southward by the Fawn Trough, the position and structure of the Polar Front (PF) in the Kerguelen region remains ambiguous given the intense current-topography interaction and the paucity of oceanographic observations. Since 2004 southern elephant seals, instrumented with CTD data loggers, have provided new temperature-salinity profiles, especially over the Kerguelen Plateau at unprecedented spatial and temporal resolution (MEOP database, 261 tags and >76000 profiles in the Indian sector). These observations are used here to resolve the uncertainty around the PF definition. We propose to define objectively the ocean zonation by analyzing the shape of temperature and salinity profiles up to 300m using a functional Principal Component Analysis (PCA). This statistical method decomposes the thermohaline structure and describes 93% of the variance with two modes only. These two modes present circumpolar patterns that can be closely related with standard frontal definitions. The method is applied on the MEOP database combined with profiles of the World Ocean Database and model outputs (e.g. SOSE, GLORYS) adding more insight on the spatio-temporal variations of the fronts over and near the plateau. It is found that the PF tends to meander seasonally by up to 5° of latitude west of the Kerguelen Plateau, before it becomes steered by the southeastern edge of the Kerguelen Islands.