Impacts of meso- to submeso-scale features on the ocean circulation in the Coral Sea

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ABSTRACT

As part of the South Pacific subtropical gyre, the encounter of the South Equatorial Current (SEC) with the complex bottom topography and numerous islands of the southwest tropical Pacific results into a series of zonal jets, flowing mainly westward off the tip of archipelagos. Moreover, the mesoscale activity at basin scale is dominated by westward-propagating nonlinear eddies, with a strong impact on the ocean circulation, the mixing of water masses and tracers' distribution. Eddy-jet interactions are studied here with the data collected in September 2012 during the BIFURCATION cruise in the Coral Sea, under the auspices of SPICE (Southwest PacIfic Ocean Circulation and Climate Experiment). We analyze and explain *in situ* data with the help of satellite-based remote sensing data (altimetry, SSS, SST, ocean color), and we estimate the mass transport budget within the Coral Sea. We show that the mesoscale activity is a significant contributor to the 0-600m transport estimates (5-10 Sv) and is essential for the interpretation of hydrological observations. A specific mesoscale eddy is identified as responsible for the connection between the North Vanuatu Jet (NVJ) and the North Caledonian Jet (NCJ). By using a Lagrangian technique, we are able to confirm the long-term connection between the NVJ and the NCJ through mesoscale activity. At a smaller scale, our analysis shows that surface temperature and salinity gradients can be associated with hydrodynamical submesoscale features depicted by Finite Size Lyapunov Exponents (FSLE). These structures can also be linked to the presence of diazotroph species, in contrast with the general oligotrophy of the area. This study offers interesting outlooks for the use of FSLE to study the distribution of biogeochemical elements.