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Intermediate and deep zonal jets properties in the tropical Pacific ocean from high-resolution in-situ data

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The study of deep ocean circulation revealed the presence of different systems of alternating zonal jets in the tropical Pacific ocean below the thermocline. The origin and transport properties of these prominent flow features of the oceanic circulation remain in many ways an open question; all the more crucial since its usual underestimation in ocean global circulation models has been identified as a potential bias for transport of tracers, impacting the representation of some important regions such as the oxygen minimum zones.

In this study, we analyze the water mass properties associated with these zonal jets using full-depth and high-resolution velocity and hydrographic sections. Data acquired during a research cruise carried out in 2015 between 10°S and 2°N along three meridional sections: 165°E, 157°E and 152°E are analyzed, supplemented by historical high-resolution, cross-equatorial sections in the central and eastern part of the basin.
While it is confirmed that the near equatorial jets carry oxygen maxima, contributing to the ventilation of the eastern part of the basin, the data also revealed more unexpected features. In the western part of the basin, oxygen profiles show the presence of two fronts (variations of about 20 umol/kg within a few tenth of degrees in latitude) extending from 500m to 3000m coïnciding with eastward jets, and homogeneous regions within westward jets. Such meridional staircases profiles in the tracer fields (oxygen, salinity and potential vorticity) are also found in the off equatorial deep tropical ocean with a zonal and temporal coherence throughout the basin.

These observations are discussed in the light of existing fundamental theories explaining the creation and maintenance of zonal jets by turbulent motions on a beta plane.