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Lagrangian variability of the Eastern Tropical Pacific Oxygen Minimum Zone

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We study the variability of the Eastern Tropical Pacific Oxygen Minimum Zone (OMZ) developed off Peru, using Lagrangian tools based on the dynamical systems theory. We focus on the identification of dynamical mechanisms, pathways and barriers to transport water masses with high/low oxygen content inside and outside the OMZ, using the concept of Lagrangian coherent structures (LCS) and residence times. The finite-size Lyapunov exponent (FSLE) is used to identify the relevant LCSs within the OMZ area.
Our preliminary results show that the core of the OMZ is characterized by weak circulation while the boundaries of the OMZ have shorter residence times with a complex spatial distribution, consisting of filaments with low and high residence time. Incursions of low residence time into the OMZ core also present a filament shape.
In addition, the middepth mean FSLE and dissolved O_2 fields indicate a clear correlation between the northern and southern OMZ boundaries and high mean FSLE zones. These zones, so-called ‘corridors’, are thought to signal the pathways of mesoscale eddies from where they were originated - the coastal upwelling areas.
The instantaneous FSLE field is organized into thin regions of high values within a low FSLE background field. These high FSLE regions are related to the boundaries of mesoscale and submesoscale eddies and fronts occupying the Eastern Tropical Pacific, released in the near shore upwelling zones. On the boundaries of the OMZ, these high FSLE lines are seen to separate waters with dissimilar dissolved oxygen content. Eddies of extreme low dissolved oxygen concentrations that penetrate the OMZ tend to remain coherent and do not mix with the surrounding waters; this is due to the existence of LCSs that form barriers around the eddies. This mechanism could contribute to the maintenance of the OMZ off Peru.