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Coastal upwelling south of Madagascar: temporal and spatial variability

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Abstract

Madagascar's southern coastal marine zone is a region of high biological productivity which supports a wide range of marine ecosystems, including fisheries. This high biological productivity is attributed to coastal upwelling. This paper provides new insights on the structure, variability and drivers of the coastal upwelling south of Madagascar. Satellite remote sensing is used to characterize the spatial extent and strength of the coastal upwelling. A front detection algorithm is applied to thirteen years of Multi-scale Ultra-high Resolution (MUR) Sea Surface Temperatures (SST) and an upwelling index is calculated. The influence of winds and ocean currents as drivers of the upwelling are investigated using satellite, in-situ observations, and a numerical model. Results reveal the presence of two well-defined upwelling cells. The first cell (Core 1) is located in the southeastern corner of Madagascar, and the second cell (Core 2) is west of the southern tip of Madagascar. These two cores are characterized by different seasonal variability, different intensities, different upwelled water mass origins, and distinct forcing mechanisms. Core 1 is associated with a dynamical upwelling forced by the detachment of the East Madagascar Current (EMC), which is reinforced by upwelling favorable winds. Core 2 appears to be primarily forced by

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