A Statistical Consideration of the Interaction of Oceanic Mesoscale Variability with the Benguela Upwelling System

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The Agulhas Leakage provides the bulk of the return flow of the global meridional overturning circulation (MOC). Agulhas rings and eddies shed from the retroflection (AREs) enter the Cape Basin interacting with each other and topography, splitting and merging. The AREs occasionally impinge on the Benguela upwelling system (BUS), draw surface water from the upwelling front, and affect the ecosystem of the southwestern African shelf. New data show that other mesoscale features affect shelf circulation; baroclinic and barotropic cyclones and anticyclones have been observed in the vicinity of the shelf and slope and our hypothesis is that all of these types of features may significantly influence the upwelling system.

We use satellite-derived sea-surface height (SSH) and an upwelling index (UI) in the BUS (in the area designated by the box) to examine the interaction between mesoscale features observable in the satellite SSH record and the upwelling system. We discuss the implications for the upwelling response and the possible effect on the Agulhas-derived features in terms of their contribution to the global MOC. Together with field data from a mooring array deployed from 2003–2005 (ASTTEX project, red stars) and cruise data from the St Helena Bay Monitoring Line (SHBML, blue dots), we assess the contribution of the mesoscale variability in the Cape Basin to the shelf/ocean exchange.

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The upwelling front is thus ~2%. All vortices that might influence the BUS by interacting with the mean upwelling front are within 500km of the coast. The proportion of all vortices that might influence the BUS by interacting with the mean upwelling front is thus ~2%. 15% of Agulhas eddies may undergo interactions of the type described in the case study, losing mass and energy in the interaction.

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