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Revisiting the eddying Indo-Atlantic exchange

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The global ocean is filled with mesoscale eddies that are supposed to highly influence the ocean circulation. In this talk we will present the lessons learned by concomitantly using in situ and satellite data and by taking advantage of very high-resolution modelling experiments at regional scale towards an improved knowledge on the Indo-Atlantic exchange achieved by eddies. In particular, we will make use of the newly TOEddies eddy detection algorithm developed at LMD-IPSL that is able to take into account also eddy splitting and merging events. We will show that both, anticyclonic and cyclonic eddies, originating in the Cape Basin, follow a rather similar propagation route. In particular Agulhas Rings form an intense "eddy-highway" that connects the South Indian and South Atlantic western boundary currents. Agulhas rings are made by anticyclonic eddies that do not remain isolated vortices, but they split and merge with other eddies a number of times in their life span. Our results suggest that, in average, their trajectories and lifetime are more complex and longer than previously thought. Near the eastern boundary, their water cores undergo to in-route transformations under the influence of intense air-sea interactions. These result in Subtropical Mode Water formation in the core of Agulhas Rings and in a densification of their upper layers. The latter induces a subduction of the rings under the warmer and lighter upper water of the South Atlantic subtropical gyre. Also, near the eastern boundary, Antarctic Intermediate Water of Indian origin conveyed by Agulhas Rings and cyclonic eddies undergoes to substantial modifications while still at depth. Our results suggest that both, Agulhas Rings Mode Water formation and subsurface AAIW transformation happens through submesoscale instabilities of the mesoscale eddies.