



Sources and fate of the off-equatorial undercurrents in the Atlantic Ocean

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In the eastern equatorial oceans upwelling regions are found. The cold upwelling waters not only interact with the atmospheric circulation via changing the sea surface temperatures (SSTs) but also influence the biological activity via affecting the nutrient and oxygen contents. While the sources of the equatorial upwelling associated with the Equatorial Undercurrent (EUC) appear well understood, the sources of the waters feeding the northern and southern off-equatorial undercurrents (NEUC, SEUC) and their relevance for the off-equatorial upwelling regions have remained unclear. In this study we use output from a high-resolution, $1/12^\circ$ -model (FLAME) and calculation of Lagrangian trajectories to investigate the pathways of the waters in off-equatorial zonal currents and their connection to the upwelling regions in the eastern tropical Atlantic. In the model solution the sources of the both the SEUC and the NEUC (as well as those for the EUC) belong almost exclusively to the southern hemisphere. The pathways in the equatorial regime are found to be governed by strong interactions between the different eastward and westward zonal currents, due to intense eddy motions associated with the tropical instability wave activity induced in the upper-layer equatorial current regime. The eddies effectively cause a repeated recirculation between the different current features. For the SEUC, for which no direct link with the western boundary regime was found, this meridional eddy-related transport in the interior appears as the main watermass supply mechanism; for the NEUC there exists a link with the western boundary current (the NBC), but the eddy-related recirculations appear to play a major role for the pathways in the interior. The analysis of the pathways supplying the eastern upwelling regions revealed the NEUC to partly feed into the Guinea Dome, but also into the equatorial upwelling (via recirculation into the EUC) as well as into the upwelling along the African coast, whereas the bulk of the SEUC waters appear to recirculate westward with the South Equatorial Current.