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# Interannual Variability of Red Sea Overflow Water Pathways in the Western Arabian Sea in an Eddy Rich Ocean Reanalysis

**Viviane Menezes**
Woods Hole Oceanographic Institution, Physical Oceanography, Woods Hole, United States of America (vmenezes@whoi.edu)

The present study investigates the interannual variability of the advective pathways of the Red Sea Overflow Water (RSOW) in the western Arabian Sea using Lagrangian particle tracking simulations as a proxy indicator for the poorly understood RSOW spreading. The RSOW, formed in the Red Sea interior, is the primary source of salt for the Indian Ocean intermediate layer and very likely an important source of oxygen for the oxygen-depleted mid-depth water of the Arabian Sea. However, the RSOW pathways and their interannual variability in the open ocean are barely understood. Here, we focus on the western Arabian Sea. The study is based on the Eddy rich Mercator GLORYS12 ocean reanalysis (1/12$^{o}$horizontal resolution; ~8 km in the Arabian Sea), which assimilates most satellite and in-situ observations collected between 1993 and 2018 and reproduces relatively well the climatological seasonal cycle of the RSOW to the Gulf of Aden, essential characteristics of the exchange at the Strait of Bab al-Mandab, and the Gulf's intermediate circulation. For evaluating the pathways interannual variability, tens of thousands of particles were released each year between 1993 and 2013 (every 5-days) in the westernmost part of the Gulf of Aden within the RSOW isopycnic layer (27-27.6 kg/m$^{3}$; ~600-1000 m). These particles were tracked over five years using the Parcels toolbox. Transit times from the outflow area to the western Arabian Sea are around three years. Statistical analysis of trajectories reveals a strong interannual variability in the RSOW pathways for the first time. The interannual variability of the western boundary undercurrents (Socotra and Somali) is evaluated in characterizing the pathways variability. Impacts on the intermediate-depth salinity are also investigated, although the scarcity of in-situ observations posed a significant limitation for the salinity analysis.