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Meso- and submesoscale features of upwelling filaments off Namibia

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The exchange of heat, properties and tracers across upwelling fronts found close to the eastern boundaries of the oceans is governed by meso- and submesoscale processes. Prominent features occurring at the front are upwelling filaments, which are of intermittent character and found on various scales. They provide an effective mechanism for the spreading of upwelled waters, thereby extending the influence of the upwelling region into the interior ocean. Filaments influence the local stratification offshore, as well as the regional biological production and the lateral transfer matter.

Here, we target upwelling filaments at the southern Benguela upwelling system, which is one of the four strongest upwelling systems in the world. Using satellite data of sea surface temperature more than 450 filaments were identified and used for an extensive statistics of the scales, the occurrence frequency and the location of filaments in the Lüderitz upwelling cell. Furthermore, the average vertical structure derived from observations taken at multiple ship cruises is presented; and the impact of filaments for the lateral exchange is assessed.

Detailed observations of the vertical structure of upwelling filaments at the eastern boundary of the South Atlantic were performed in November/December 2016 during a 26-day cruise on R/V Meteor. Hydrographic, current and microstructure measurements were performed in a high resolution set-up, while the ship was crossing a filament several times. In addition, Lagrangian surface drifters were deployed at several positions within filaments. Using these data we address the distribution of properties within filaments, as well as the mixing and stratification in the upper layer. The findings are discussed in combination with the sea surface height distribution and mesoscale eddy field during the cruise, thus connecting the observed submesoscale features to the larger scale circulation.