RV SONNE

Cruise SO285 „TRAFFIC 2“
Emden – Emden,
20th August – 2nd November 2021

5. Weekly report

Reporting period: 13th– 19th September 2021

During this week, we finally reached our working area, but before the start of our scientific program, we first had to secure the trip back to Emden: We had to call at Cape Town to bunker fuel. This was a challenge for our guests from Cape Town. They had to leave Cape Town about 6 weeks ago to come to Emden in order to participate in the RV SONNE cruise. Now, RV SONNE is in the port of Cape Town with a direct view of the city. How much easier would it have been for our guests from Cape Town, if they could have boarded directly here? However, to preserve our COVID-free isolation here on board, this was not possible. The long detour via Emden was therefore unavoidable, and apart from the fuel, there was nothing left also for us but the beautiful view of the skyline of Cape Town (Figure 1).

Figure 1. View from RV SONNE on Cape Town. (Picture: Knut Heinatz)

The need to bunker fuel in Cape Town and to recover the second PIRATA buoy in the large subtropical gyre of the South Atlantic Ocean beforehand resulted in a limited time window for us to conduct research during this week. We devoted our time window to so-called mesoscale eddies. Their impact on the plankton development as well as their influence on the productivity of marine ecosystems is poorly understood and thus subject of various studies. One of the difficulties regarding eddies and their influence on marine ecosystems is the existence of left-

and right-turning eddies, which have an opposing influence on the nutrient supply into the euphotic zone. In the southern hemisphere, right-turning eddies cause upward movement of water masses in their center and thus the input of nutrient-rich deep water into the euphotic zone. Left-turning eddies have the opposite effect on the water mass transport and the associated nutrient supply.

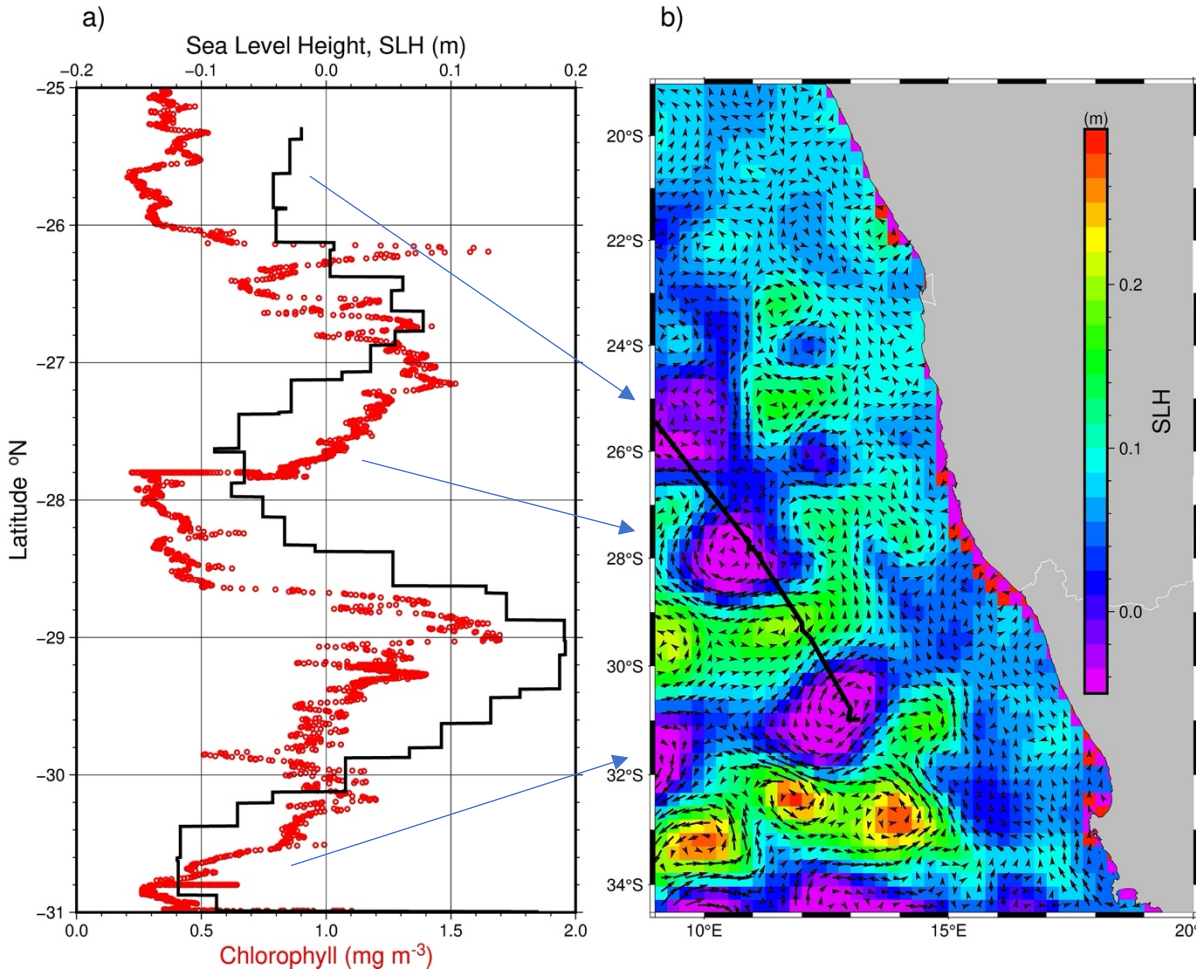

Figure 2. (a) Sea Level Height (SLH) (from satellite data, black line) and Chlorophyll (own measurements, green Line) along the cruise transect, plotted against latitude. (b) SLH and resulting currents (black arrows). The bold black line depicts our cruise track.

Since vertical transports are associated with variations in water level, eddies can be identified on satellite images, showing small-scale spatial variations in sea level heights (Figure 2). In this context, clockwise eddies are characterized by a lower sea level, while counterclockwise eddies rise the sea level at their center. Accordingly, strong eddies are visible as magenta and red areas on the map in Figure 2b. From these horizontal variations in sea level, our partners at the Plymouth Marine Laboratory in England and the Oceanic Observatory of Madeira, Portugal have calculated currents, that give us an idea of the current behavior of the Benguela Current along the South African continental slope.

Contrary to what is shown on schematic maps, the flow of the Benguela Current is not as straight as the few arrows on these maps suggest. Mostly, they show the main direction of flow, namely how the Benguela Current splits off to the north at the edge of the Southern Ocean and follows the South African continental slope before leaving it on its way across the South Atlantic Ocean. Satellite maps suggest that the Benguela Current meanders strongly, especially off the South African continental slope, with left and right turning mesoscale eddies

established in the meander bends. This results in a mosaic-like pattern of counter-rotating eddies and filaments meandering between them, making it difficult to identify the main flow of the Benguela Current.
In order to get a first glimpse on effects of eddies on plankton development along the South African continental slope, we first selected a largely north-south oriented transect, marked as a black line on the map in Figure 2b. This transect included several meander arcs and crossed three right-turning eddies and two left-turning eddies. To compare the satellite data with our underway measurements, we extracted sea level elevations from the satellite data along the transect and compared them to the concentration of chlorophyll in the surface water, which we measure continuously during our cruise with RV SONNE. The comparison shows that similar to the sea level also chlorophyll concentration rise and fall implying close links between the ocean's physic and pelagic ecosystems. To better understand this relationship and the influence of the eddies on the ecosystem, plankton nets and CTD devices were also deployed at the eddy locations. However, the analysis of the data and samples will take some time. In view of the rest of the cruise, it will be interesting to see, how the eddies of the Benguela Current interact with the coastal upwelling, which is strongest in the shadow of the Benguela Current on the shelf and at the coast, and how these systems interactively influence the dynamics of the ecosystem in southern Benguela Upwelling System.

RV SONNE, at 32°S / 15°W, 19th September 2021

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