

4th Weekly Report SO284, Emden-Emden

Jul. 19 - Jul. 25, 2021

Our fourth week was all about the mooring work off the coast of Brazil. At around 11°S, we have been operating a mooring array continuously since 2013. It consists of 4 moorings, which mainly measure the flow velocities of the western boundary current. In the upper 1200m, the North Brazil Undercurrent flows to the north and below, from 1200m to 3800m, the deep western boundary current flows to the south. Both currents are part of the Atlantic-wide overturning circulation and are connected via the Gulf Stream and the deep-water formation in the North Atlantic. Since we had already deployed a similar mooring array here off Brazil from 2000 to 2004, we can now study more than 20 years of changes in the ocean-wide circulation in the Atlantic Ocean. All moorings could be recovered completely. All devices measured very well. The redeployment of the moorings also went without any problems. The next recovery of the moorings is planned for 2023. With the mooring work off Brazil, the main task of our cruise "Mooring Rescue" was completed very successfully. In parallel to the mooring work, a dense grid of CTD stations was conducted in order to determine long-term changes in the water mass composition or the biogeochemical and biological characteristics of the water (Fig. 1).

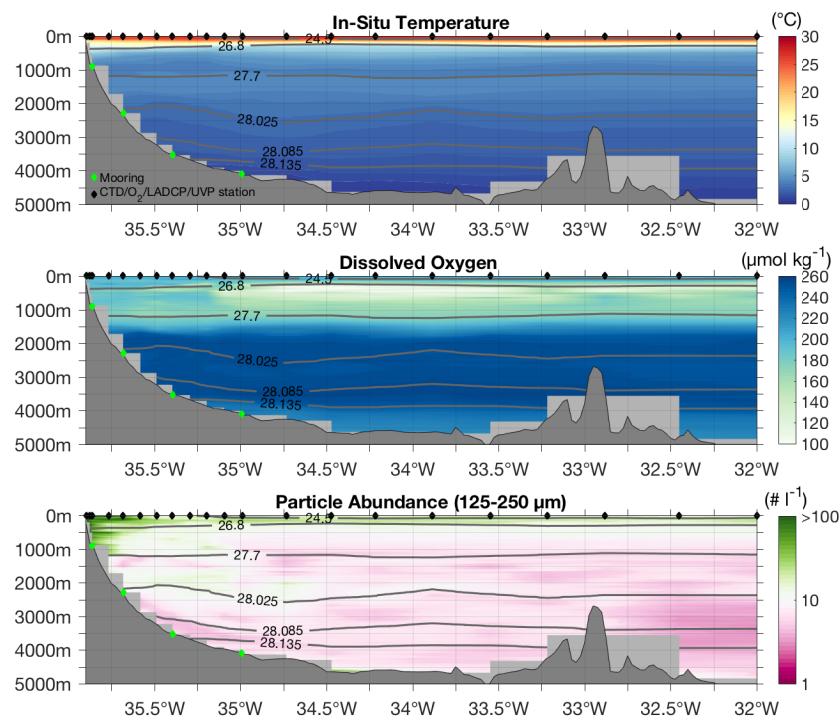


Fig. 1: Section measured with the CTD / UVP along about 11°S. The CTD is a device to which various sensors are connected (including temperature, salinity, oxygen) and which, together with a water sampler and an UVP, is lowered to the sea floor at each station. The UVP optically measures the number of particles in different size classes: there is a high particle density near the surface and near the coast (Fig. Philip Tuchen).

On the 22nd of July, we were able to use the opportunity for the third time to carry out validation measurements with the ESA satellite Aeolus. By slightly correcting our route, we drove exactly along the specified satellite track and started a radiosonde. The acquired data will contribute to the validation of the satellite measurements.

Aeolus is a research satellite that was launched in 2018 and can measure vertical profiles of the zonal wind component on a global scale from a height of around 320 km with the help of Doppler LIDAR technology. This data is incorporated into the short-term weather forecast almost in real time. However, since Aeolus is a so-called "Earth Explorer Mission", validation data is still being collected around the world. These validation measurements are particularly valuable over the ocean, where radiosondes are launched relatively rarely. The current comparison from July 22nd is shown in Fig. 2. In the context of the specified measurement errors of the satellite data, one can speak of good agreement here. For example, the trade winds on the ground and the "jet stream" at an altitude of 14 km were well recorded by the satellite.

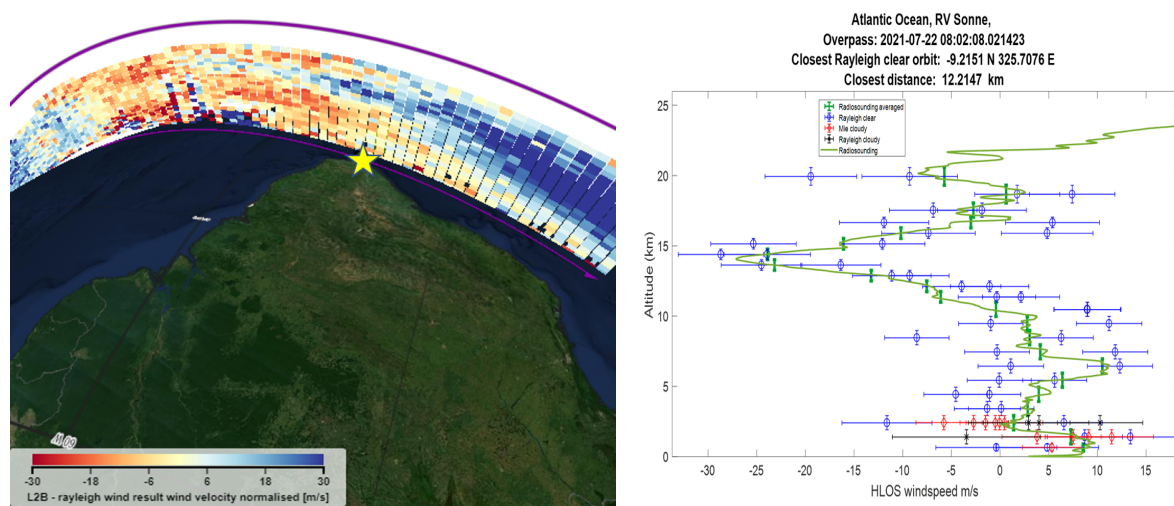


Fig. 2: Left: Profiles of the zonal wind speed (up to 20 km altitude) during the satellite overpass off the Brazilian coast on July 22, 2021 around 8:00 UTC, measured by Aeolus. The star marks the position of RV Sonne. Right: Comparison of the zonal wind speed profile of the radiosonde (green) with data points from Aeolus (blue, black and red, different measurement methods) within 100 km of the ship's position (Fig. Ronny Engelmann).

The mood on our already quite long journey is still very good and after finishing the mooring work we could celebrate the half time of our journey. The motivation and solidarity in our research work were particularly evident during the mooring work. All have tried to help to meet the tight schedule of mooring recovery and deployment. Together with the ship's crew, the meteorological team and the GEOMAR team, the work could be well distributed and carried out very successfully on deck, often under very hot tropical conditions. Many thanks to everyone involved.

In the meantime, we have also completed the 5°S section through the western boundary current. This section ended about 12nm before the Brazilian city of Natal, which we could already guess at the horizon (Fig. 3).



Fig. 3: City of Natal about 12 nm away as seen from aboard RV Sonne (Photo Ronny Engelmann).

Greetings from the tropics in the name of the cruise participants of SO284,

Peter Brandt, GEOMAR Helmholtz Centre for Ocean Research Kiel and
Julia Windmiller, Max-Planck-Institut für Meteorologie, Hamburg