FS METEOR M207

04.01.-11.02.2025
Belém – Mindelo

3. Weekly Report
13.01. - 19.01.2025

The beginning of the 3rd week of M207 was still heavily characterized by mooring work. On Sunday we recovered the two longer deep-sea moorings of the mooring array at 11°S. In the night from Sunday to Monday, all instruments were then read out and equipped with new batteries so that both moorings could be re-deployed again directly on Monday. The work progressed very well and we have been able to scan through all the recorded data files. The output is great, especially for the current meters, which had no losses in any of the four moorings (see table). With the MicroCats, which measure salinity, temperature and in some cases pressure, we only had 2 out of 19 instruments that had issues. All in all, a very good result.

sensor type / mooring	T (%)	C (%)	P (%)	U,V (%)	O_2 (%)	other (%)
KPO 1260	100	100	100	100	-	-
KPO 1261	84	84	89	100	-	-
KPO 1262	88	88	94	100	-	-
KPO 1263	100	100	100	100	-	-
all moorings	**93**	**93**	**96**	**100**	**-**	**-**

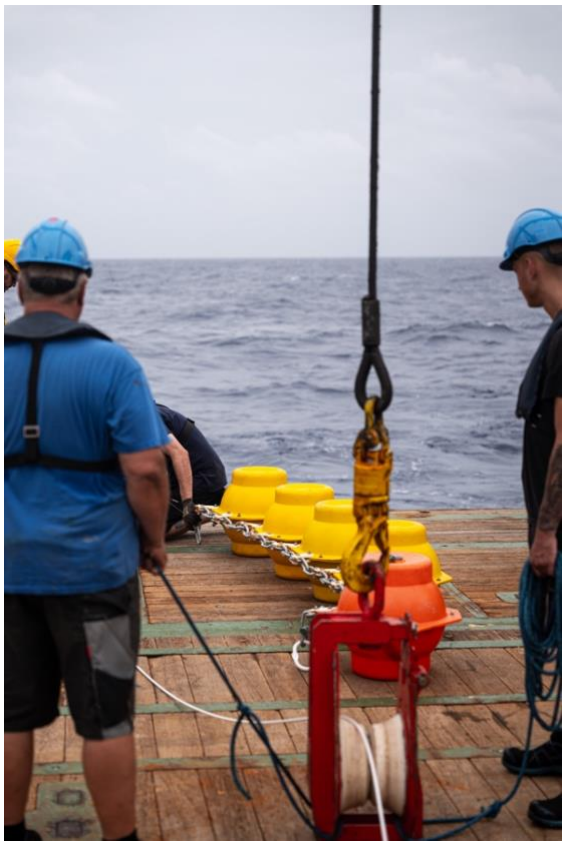


Fig. 1: Top: Completed table of instrument performance of all moorings of the 11°S mooring array. Bottom: Mooring deployment on Monday, 13 Jan 2025. Photos: David Menzel.

While we usually schedule mooring work on the section at 11°S during the day, we run CTD (Conductivity, Temperature, Depth) stations at night to record as many different parameters as possible over the entire section. The CTD probe is supplemented by oxygen sensors, an OPUS sensor to measure nitrate, an UVP (Underwater Vision Profiler) to determine plankton and particle size and distribution, and a lowered ADCP (Acoustic Doppler Current Profiler) to record the currents from the surface down to the seafloor. We also have a rosette of water samplers attached to the CTD with which we can take water samples from different depths. Most of these are then analyzed directly on board in the laboratory. On the one hand, the salinity is measured using a salinometer and on the other hand, the oxygen concentration of the water samples is determined using oxygen titration. This way we can calibrate the electronic sensors of the CTD probe, which record an entire depth profile for us, with these discrete and very precisely determined samples.

Fig. 2: Deployment of the CTD probe at dusk. The actual CTD is located at the bottom of the CTD rosette. Above it one can see the water samplers arranged in a circle and in the foreground the two yellow lowered ADCPs, one of which 'looks' upwards and the other downwards. Photo: David Menzel.

On the 11°S section, the northward-flowing North Brazil Undercurrent (NBUC) is clearly visible with red colors in the upper 1500 m close to the continental shelf (Fig. 3). This relatively strong current with velocities above 0.5 m s^{-1} can also clearly be seen in the data recovered from the moored ADCPs (Fig. 4). With the help of the moored observations, we can capture the variability of the NBUC relatively well over time. As already marked in the section with the green diamonds, the 2nd mooring (K2) is located directly in the core of the NBUC. The strength of the flow in the direction of K3 and K4 decreases significantly and also changes sign frequently at K4 (Fig. 4). These strong changes result from the variability of the NBUC and the adjacent recirculation cell. At greater depths below 1500m, blue colors dominate, which in this case represent more southerly velocities and can be attributed to the deep western boundary current (DWBC, Fig. 2).

Both, the NBUC as well as the DWBC are part of the global overturning circulation in the ocean, which is known as the AMOC (Atlantic Meridional Overturning Circulation) in the Atlantic. Whether this overturning circulation will weaken or even collapses at some point is a widely discussed topic. With our observations at 11°S, we hope to make a

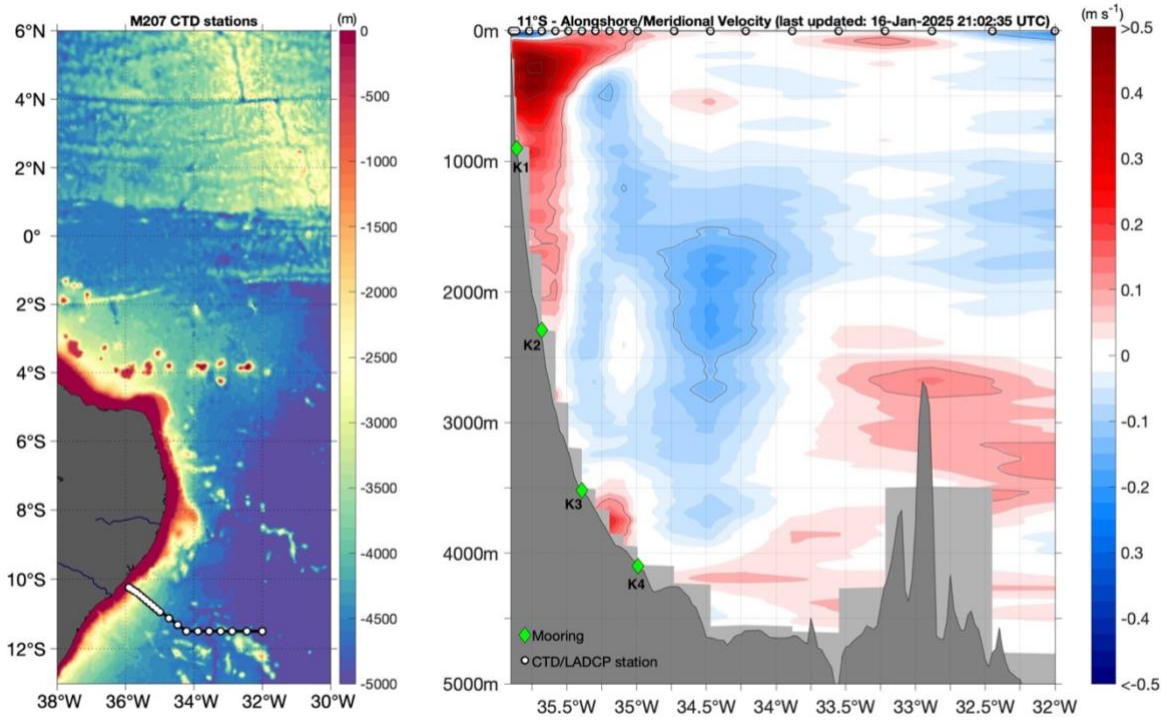
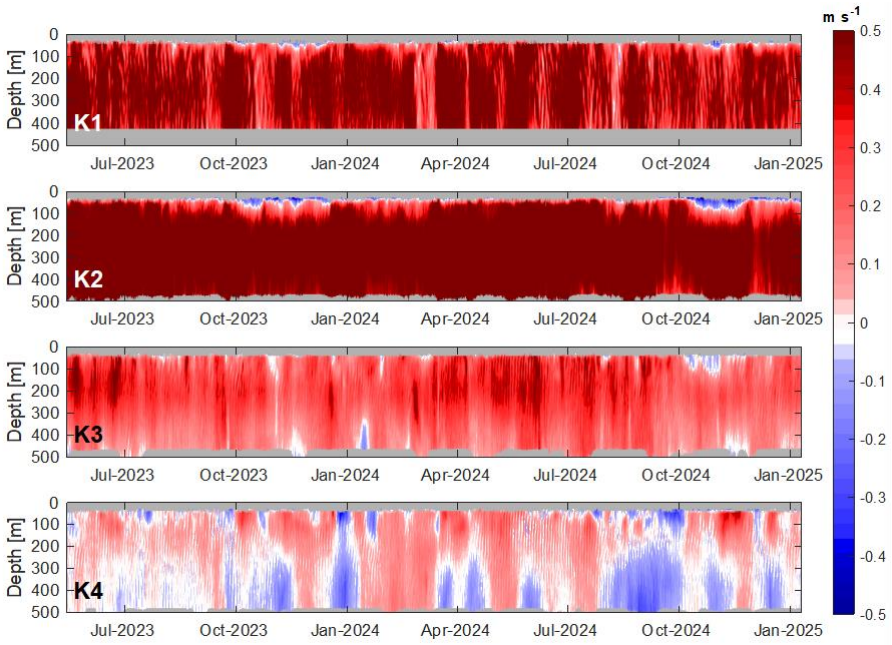


Fig. 3: Left: Map of the bathymetry with the CTD stations (white circles). Right: Velocities across the section recorded by the lowered ADCP, which is lowered to the seafloor with the CTD probe. Graphic: Philip Tuchen.

contribution to this discussion by analyzing the variability of these currents (NBUC, DWBC) as part of the AMOC on different time scales.



The NBUC also represents a part of the so-called subtropical cell of the South Atlantic. As a current at the western boundary, it connects the subduction areas in the subtropics with the equatorial Atlantic and

Fig. 4: Currents in the upper 500 m water depth along the coast from the 4 ADCPs recorded along the 11°S section. Graphic: Rebecca Hummels.

feeds the Equatorial Undercurrent (EUC), which supplies the upwelling areas in the eastern Atlantic. By subduction we mean that surface water is separated from the surface - usually due to the wind field conditions that exist specifically in the subtropics - i.e., it reaches deeper water layers and then spreads out on the corresponding density surfaces without having contact with the surface again. We want to investigate how signals propagate within this subtropical cell by jointly analyzing the NBUC at 11°S and the EUC at 23°W at the equator. Observations of the EUC by a mooring at 23°W have been carried out in changing configurations since 2002 and we will also recover and redeploy this mooring in the further course of this cruise.

The moral on board is very good. We are enjoying the warm weather and the good food, and are making good progress with our CTD program along 5°S.

You can follow the progressing measurements along 5°S here, on Instagram and read the blog about the meteorological measurements Met_Blog!

Rebecca Hummels on behalf of the team of M207
(GEOMAR Helmholtz Center for Ocean Research Kiel)