RV METEOR M207

04.01.-11.02.2025
Belém – Mindelo

4. Weekly Report
20.01. - 26.01.2025

On Monday, January 20, 2025, we completed our CTD section at 5°S and moved almost seamlessly into the 35°W section. Like the already completed 11°S section, the 5°S section is an almost zonal section that extends from the Brazilian shelf into the deep ocean. It shows a very similar circulation system to the one we saw at 11°S, but there are also differences.

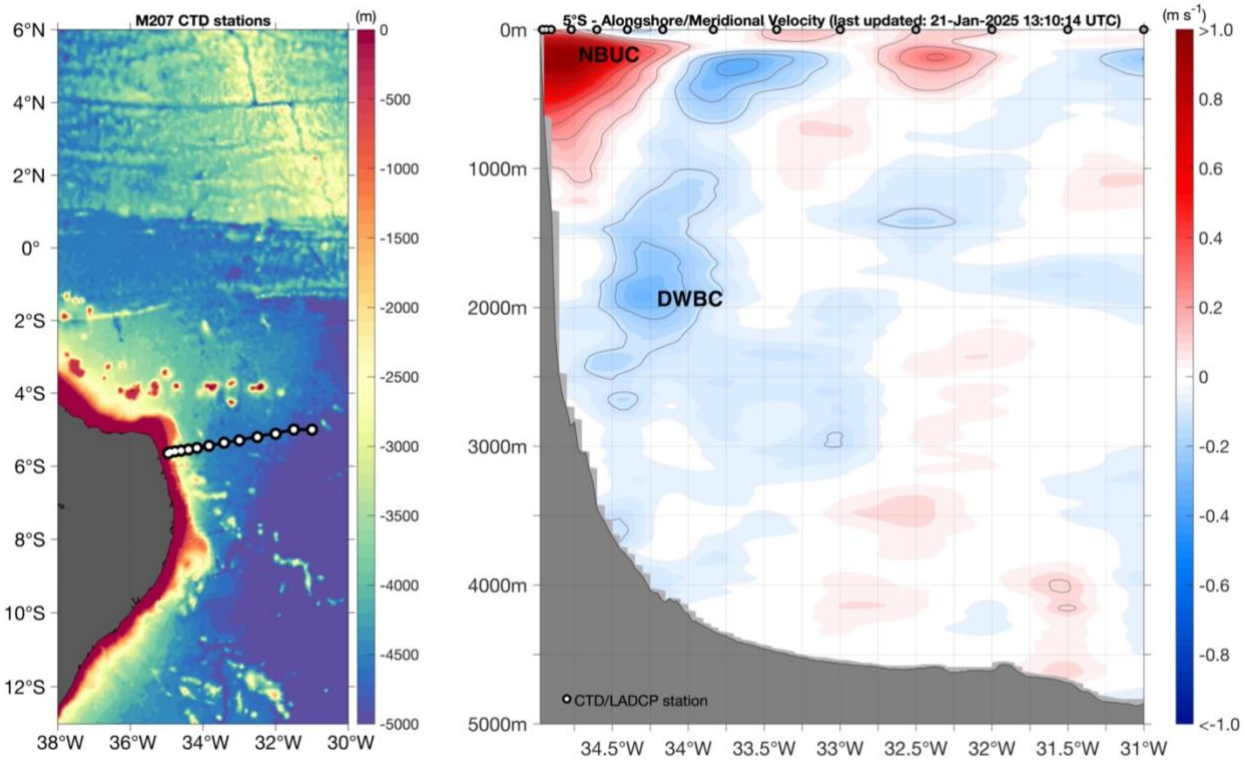

Fig. 1: Left: Map of the bathymetry with the CTD stations (white circles). Right: Velocities across the section recorded by the lowered ADCP, which is driven with the CTD probe to just above the sea floor. Graphic: Philip Tuchen.

The North Brazil Undercurrent (NBUC) is even more pronounced at 5°S than at 11°S with velocities of over 1 m s^{-1}, but it has lost its undercurrent character and continues virtually to the surface. At 11°S, we had observed negative velocities (i.e., to the southwest) at the surface directly above the NBUC at this time of year, whereas here at 5°S positive velocities are evident right up to the surface. An even more pronounced recirculation cell can be seen east of the NBUC than at 11°S. The deep western boundary current (DWBC) can also be observed more strongly at 5°S than at 11°S. At 5°S, it still has the character of a laminar, i.e., a rather uniform flow, while at 11°S it is characterized by the passage of deep eddies. So here it always depends on whether you “catch” an eddy on the section or not and accordingly the flow speeds in this depth range are much more variable. In contrast to 11°S, where we were still able to observe positive velocities between 3500m and 4000m on the shelf, which can be associated with the Antarctic Bottom Water, this northward deep current is absent at 5°S.

After we had completed this section, we started directly with the 35°W section on Monday, which, unlike the previous two sections, is a meridional section, i.e., has a north-south orientation. The southern part of the 35°W section is still strongly influenced by the circulation on the Brazilian shelf.

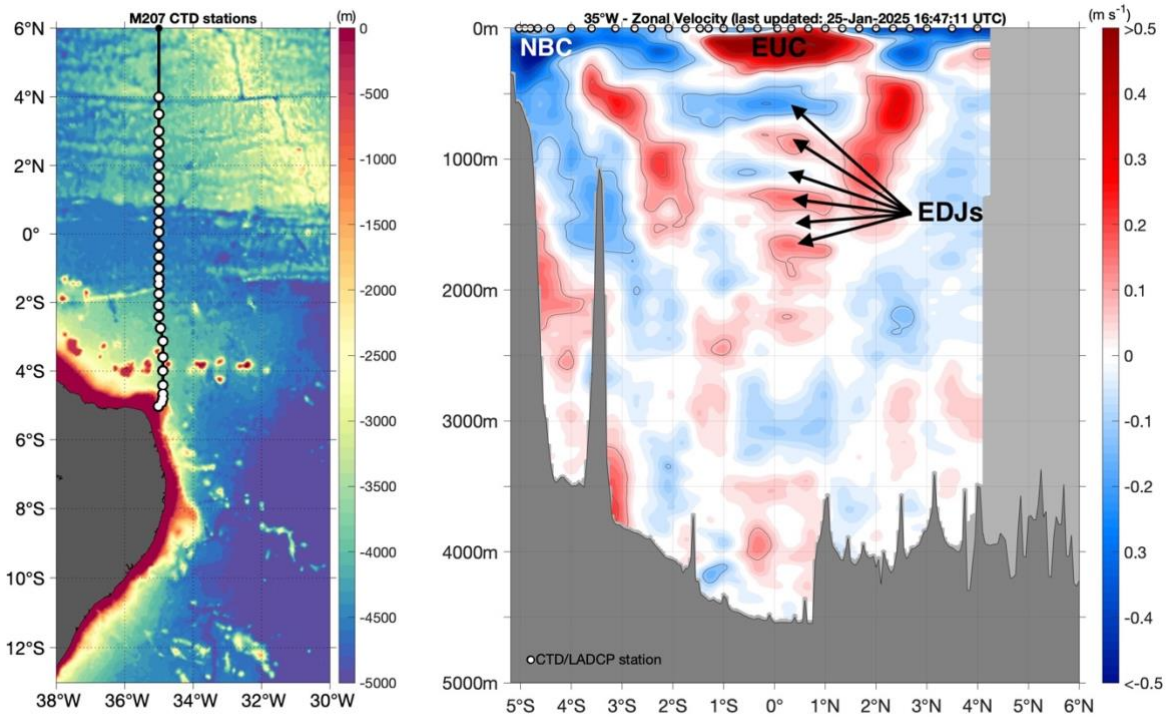

Fig.: 2: Current status of the 35°W section. Left: Map of the bathymetry with the CTD stations (white circles). Right: Velocities across the section recorded by the lowered ADCP, which is driven with the CTD probe to just above the sea floor. Graphic: Philip Tuchen.

Here, the so-called North Brazil Current (NBC), which develops from the near-surface intensification of the NBUC, flows first to the north and then mainly to the west along the shelf. Towards the equator, the currents become increasingly zonal, i.e., they mainly run from west to east (positive velocities) or from east to west (negative velocities). In particular, we observe a strong eastward current of up to 1 m s^{-1} in the upper 500 m directly at the equator. This current is known as the Equatorial Undercurrent (EUC) and is an important component of the equatorial circulation system. Among other things, the EUC transports oxygen-rich water from the western Atlantic to the eastern Atlantic. Below the EUC, we observe a complex sequence of stacked eastward and westward currents, collectively referred to as equatorial deep jets (EDJs). The regular measurements of these sections help us to determine the temporal and spatial variability of the currents and to document and understand long-term changes.

In the night from 22.01. to 23.01. we left Brazilian territorial waters and were able to switch on some additional instruments such as the X Band radar to measure surface currents, an aerosol sampler and the Seasnake to measure the sea surface temperature in the upper about 10 cm of the ocean, for which we had not received permission in the diplomatic follow-up application. In addition, we started with the deployment of SVP drifters at the equator at 35°W. In contrast to the previous current measurements on M207, which were taken at fixed positions such as moorings or CTD stations, the drifters will follow the currents freely. In total, we will deploy 10 surface drifters in the equatorial regions along 35°W and 23°W on this cruise. The drifters consist of a surface buoy connected by a cable to a kind of underwater sail. The near-surface currents flow to the underwater sail in such a way that the drifters follow the mean currents in the upper ocean. This reduces the direct influence of the wind on the drifters at the surface. The drifters transmit their position once an hour by satellite. The mean current is determined from the distance travelled within an hour. The drifters deployed during M207 contribute to the global drifter program (Global Drifter Program), which coordinates drifter deployments worldwide and has thus ensured global coverage by drifters for several decades.

Fig.3: Deployment of an SVP surface drifter over the stern of FS Meteor. Photos: David Menzel.

The principle of “freely following the currents” also applies to the Argo floats, of which we deployed two this week, one on the 5°S and one on the 35°W section. In contrast to the drifters, which capture the surface current with their “drift”, Argo floats typically “park” at greater depths around 1000m. They follow the current at this depth for about 10 days. They then sink to 2000m and typically measure temperature, salinity and oxygen as they ascend to the surface. At the surface, they transmit the recorded profiles and their position via a satellite and start the cycle all over again. There are now also Argo floats that can

measure other parameters. All this data is collected and made available for international research. On 22.01.2025, 4120 Argo Floats were active in the global ocean (Argo_BSH).

Fig.4: Left: Argo Float with temperature, salinity and oxygen sensors. The white antenna can be seen at the top. Right: Argo Float being deployed over the stern of FS Meteor. Photos: David Menzel.

The morale of the M207 team is still very good. Thanks to the excellent cooperation with the crew of FS Meteor, we are making very good progress with our work program and have now completed half of our research trip in terms of time. This had to be duly celebrated on Saturday with the so-called “mountain party”!

You can follow the progressing measurements along 35°W here, on Instagram and read the blog about the meteorological measurements Met_Blog!

Rebecca Hummels on behalf of the team of M207
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