RV METEOR M207

04.01.-11.02.2025
Belém – Mindelo

5. Weekly Report

27.01. - 02.02.2025

In the early hours of January 27, we were able to complete the 35°W section with a final CTD at 6°N. By now we have collected 291 salinity samples and 365 oxygen samples, which were analyzed in the labs on the vessel and used to calibrate our electronic CTD sensors.

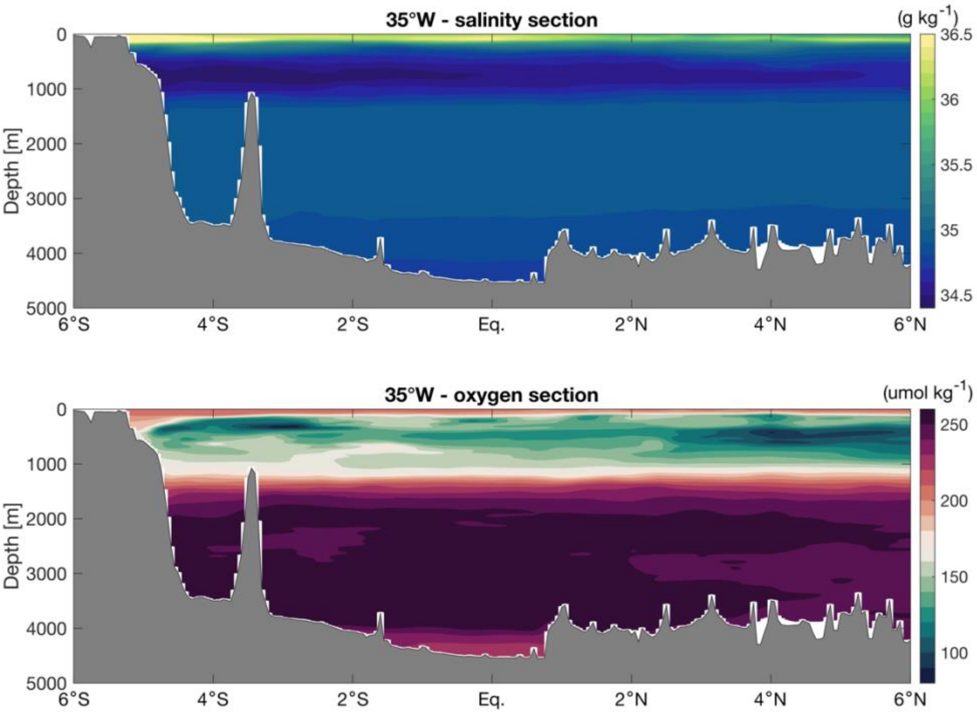

Fig. 1: Salinity (top) and oxygen content (bottom) along the 35°W section across the equator. Graphic: Anna Christina Hans.

These electronic sensors then provide us with an image of these parameters over the entire water column (Fig. 1). Characteristic in these images is, for example, the salinity minimum, which spreads from south to north at a depth of around 1000m and can be associated with the Antarctic Intermediate Water (AAIW). At greater depths between 1500 and 3500m is the North Atlantic Deep Water, which has a higher salinity than the AAIW and is characterized by a high oxygen content. By repeatedly measuring these characteristic parameters, we try to detect changes and link them to changes in the water mass formation areas or to changes in the circulation that distributes these water masses in the world ocean.

At the end of the 35°W section, we were also able to carry out validation measurements from the ship for ESA's EarthCARE satellite, which was sent into space last year. These measurements are performed by upward looking LIDAR measurements at a location the satellite is overpassing. They act as an additional check on the satellite's LIDAR instrument's performance and data quality.

Leaving the ITCZ going north along 35°W, we headed east under a layer of dust brought in from the Sahara on our way to the 23°W section. The dust layer and the low and high clouds made the sky appear milky white, especially on Tuesday and Wednesday.

Fig. 2: Milky-white coloration of the sky due to a layer of dust aerosol in the early afternoon of 29.01.2025. Photo: Franz Kanngießer

Dust layers in the atmosphere can be identified using LIDAR measurements. A LIDAR emits a pulsed and highly polarized laser beam. When the laser hits aerosol particles, precipitation, cloud particles or even air molecules, a part of the signal is scattered back. In the case of non-spherical particles, such as desert dust, the polarization state of the backscattered signal changes, it gets depolarized. Desert dust has a distinctive depolarization signature.

In addition, sun photometer measurements provide information about the size of the aerosol particles. As is typical for dust particles, the sunlight was absorbed and scattered by large particles. For the measurement of aerosol particles with the aid of sun photometers, it is necessary that the solar disk is not obstructed by clouds. Due to the milky-white appearance of the sky, it was not always easy to tell whether the sun was only obscured by the dust or also by clouds. Each measurement required a precise search for the “fluffy” structures of clouds near the sun.

We use different types of aerosol samplers. A high-volume aerosol sampler sucks air through a filter on which aerosol particles are left behind. To prevent ship exhaust fumes or deck work from distorting the measurements, the pump is automatically switched off when the wind blows from the direction of the ship. The filters with the trapped aerosol particles are later chemically analyzed at GEOMAR.

While the high-volume aerosol sampler actively pumps air through the filter, the passive flat-plate sampler only “captures” particles that are carried by the wind onto an adhesive surface. These measurements are later analyzed in the laboratory by colleagues from TU Darmstadt to determine their composition and shape.

Fig. 3: Preparation of the aerosol filters. Photo: Franz Kanngießer

In addition to these filter samplers, we also measure the particle size distributions and the particle mass concentration by means of optical particle counters. Such devices are also used for routine environmental monitoring. Although this device allows us to continuously measure the number of particles, it does not give us any direct information about the composition. By combining the different aerosol samplers, we are trying to get a more complete picture of aerosol transport in the tropical Atlantic.

On the afternoon of January 30, we reached the 23°W section at 7°N and headed south towards the equator. This section was also frequently measured with CTD stations in previous years. On M207, however, we limited the observations along this longitude to underway measurements of on the one hand the meteorological parameters and on the other hand the current velocities from the shipboard ADCPs and the hydrographic parameters with the thermosaliograph at the surface. The route to the south leads us through the ITCZ again, which is surveyed with 3-hourly radiosonde ascents, and in addition were getting back to clearer skies leaving the area of the Saharan dust layer.

On Saturday, February 1, we reached the equator on the 23°W section and were able to successfully recover the mooring there.

You can follow us 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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