FS Meteor
Expedition **M206**

01.12.2024 (Fortaleza) –
30.12.2024 (Belém)

M206, 2. Weekly Report 02.12.-08.12.2024

On the way to Station 1, we could already see from the salinity data of the thermosalinograph that the salinity of the surface water increased the closer we got to the coast (the maximum value was 37.5 PSU) and decreased the further we travelled towards the shelf edge (here the values are 26.2 PSU). This trend continued throughout the journey along the mangrove coast between stations 1 and 14, during which we repeatedly changed the distance to the coast. This shows that the freshwater input from the coast, which was clearly measurable on the M147 during the rainy season due to reduced salinities, is not measurable on our cruise during the dry season, but on the contrary, the nearshore water becomes more saline due to the high evaporation rate in relation to the low freshwater inflow. While this general trend is a natural cycle between the rainy and dry seasons, the salinities measured here appear to us to be unusually high, possibly as a result of the severe drought in the entire region in recent months. However, this assumption still needs to be tested by further research into data from the past. However, there were already indications of this during the mangrove sampling campaign carried out in the two weeks prior to M206 by some members of our German-Brazilian research team at a research station at the University of Bragança as part of our joint exchange project PROBRAL (funded by DAAD and CAPES). Water and sediment were sampled along the entire Caeté River as well as in intact and degraded areas of the mangrove belt. Here, too, very extensive seawater intrusion into the river and high salinities in the mangrove samples were detected. Further information on this campaign can be found here: https://andrea-koschinsky.org/research-projects/probral-2024/

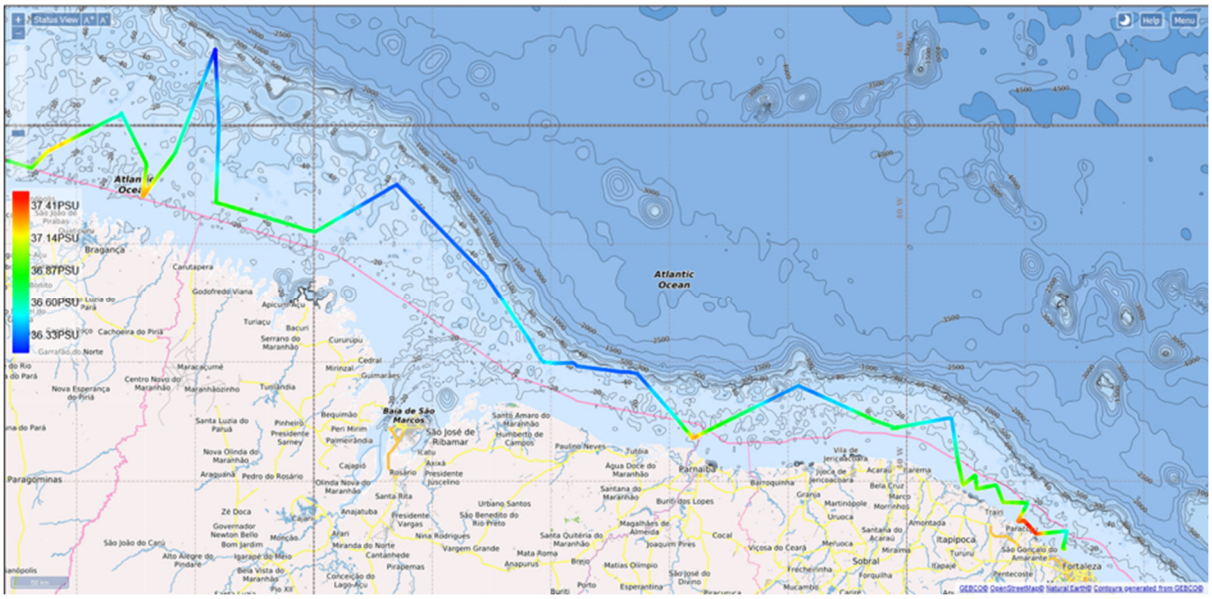

Fig. 1: Salinity data on the route along the mangrove belt between Fortaleza and Station 14 (DSHIP data from Meteor's own thermosalinograph, displayed with Mapviewer (DSHIP)); the yellow and red colours indicate a higher salinity (up to 37.5 PSU) near the coast compared to the 'normal' seawater salinities in this area (approx. 36.2 PSU) in blue colours.

While some technical adjustments still had to be made to some of the equipment at Station 1 approx. 100 nautical miles north-west of Fortaleza, the following equipment sequences were generally used successfully at each station from Station 2 onwards: Meteor's own CTD rosette (for sampling e.g. organic substances (DOM) and for large volumes of water for isotope analyses), trace metal-clean mini-rosette with CTD logger (autonomous on an aramid cable; for trace metal analyses), pump for approx. 150 litres of surface water for radium isotopes, and Tow-Fish (operated on the crane boom for pumping surface water via a hose system directly into the clean room laboratory set up in the universal laboratory). The bottom water sampling system and the multicorer (Fig. 3) were also used at some stations, although no sediment cores could be obtained at first due to the hard subsurface, which appears to consist of a largely closed layer of carbonate crusts. The Parasound data also indicated such an impermeable layer, only at station 12 in the region in front of the Caeté outflow did the Parasound recordings give a slightly different picture and the MUC station yielded the recovery of at least partially filled liners; however, the sediment was sandy and unstructured and made depth-resolved pore water sampling impossible.

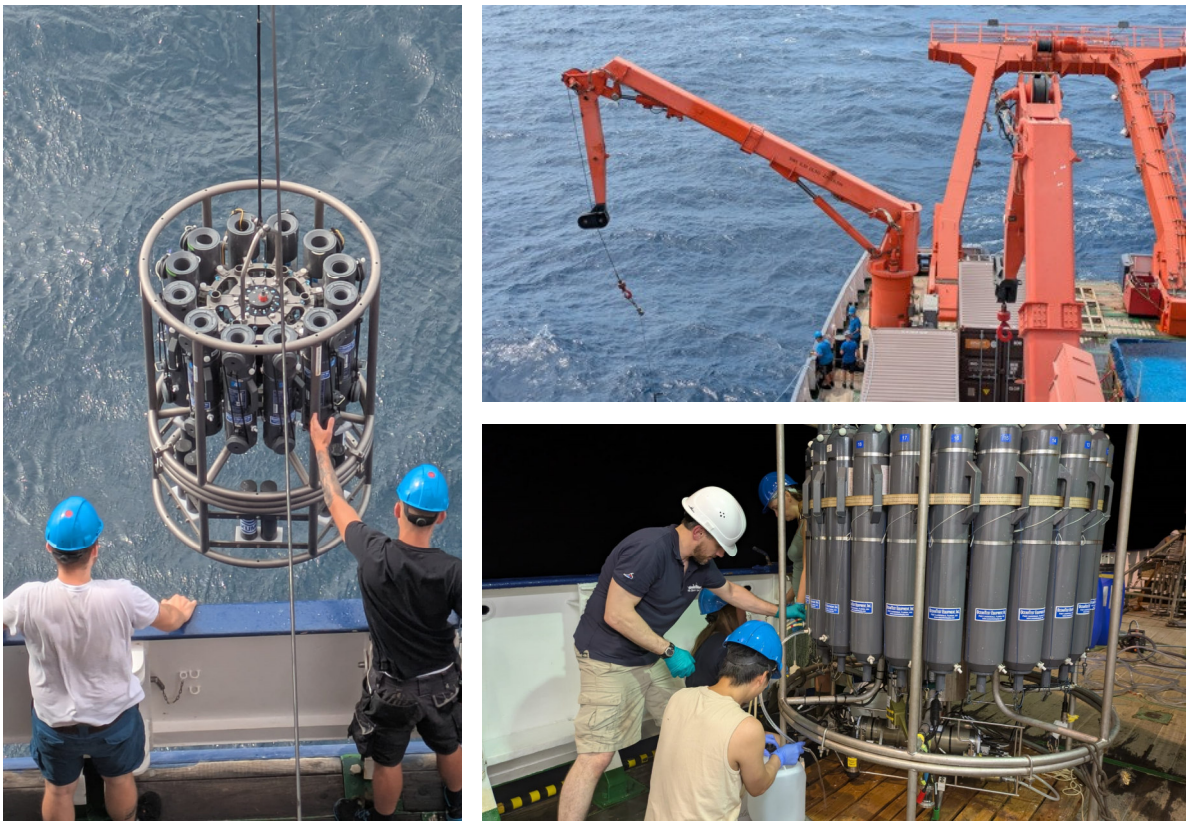

Fig. 2: left, trace metal-free mini-rosette during deployment; top right, Tow-Fish deployed on a crane for sampling surface water; bottom right, water sampling from the ship's own rosette.

The water samples obtained were taken directly from the CTD rosette immediately after the end of the station and taken to the laboratories for further processing, or in the case of the trace metal rosette and the bottom water system, the bottles were removed and taken directly to the clean room laboratory to avoid any contamination. The preparation of the water samples includes filtration with 0.2 µm pore size Acropak filters and subsequent distribution to the working groups, sequential filtration (membrane filters with pore sizes of 0.8 and 0.2 µm as well as ultrafiltration) at selected stations for trace metal analyses, preconcentration of the substances to be analysed or separation of the salt water matrix using ion exchange column extraction as well as acidification or freezing to preserve the samples for analysis in the home laboratory. Some trace metal analyses are carried out directly on board by Brazilian colleagues using the electrochemical method of voltammetry.

After completing the mangrove belt transect at station 14 on the evening of 7 December, we entered the mouth of the Rio Pará in the early morning of 8 December, heading towards Belém. Even though the Rio Pará only carries about 1/10th of the water volume of the Amazon, it is still one of the most water-rich rivers on earth and the two banks remain so far away from us that it still feels like being on the ocean; only the water is now milky green (Fig. 3), whereas in 2018 it was intensely muddy brown in the rainy season. We reached sampling point 15 at low water with a minimum salinity of 3.2 PSU; due to the relatively low freshwater discharge, we cannot reach the true end member of the river water here with a salinity of <1 PSU. After all devices have successfully brought water and sediment samples on board (Fig. 3), we will now take several surface water samples during the exit from the Pará while the water is rising and salinity is continuously increasing, in order to resolve the mixing processes in the low-salinity range, in which the most important geochemical reactions in estuaries take place.

Fig. 3: left, bottom water sampler during recovery; center, Multicorer recovery at the Rio Pará station; right, sampling the muddy sediment at the Rio Pará station.

Even though the dense sequence of stations with a high workload is slowly becoming noticeable after a week's journey, everyone on board is still in good spirits and the cooperation within the scientific team and between the scientists and the Meteor team is friendly, constructive and a lot of fun.

Best regards from Andrea Koschinsky and Martin Frank (co-chief scientists M206) and the entire M206 team