RV SONNE

SO308 “South Indian Ocean GEOTRACES GI07”

31st October – 22nd December 2024

Durban (South Africa) – Fremantle (Australia)

3rd Weekly Report

Reporting Period: 11th November - 17th November - 2024

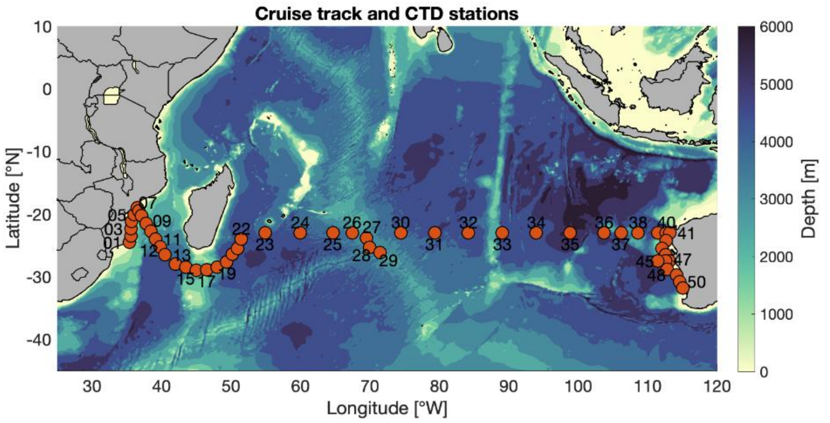

Fig. 1. The planned cruise track with 51 stations (red dots).

The GEOTRACES research cruise SO308 is two weeks underway, and we just finished sampling at station 21 (Fig. 1), to the east of Madagascar. Over the last 7 days we have sampled the waters of the Mozambique Channel with its large and dynamic mesoscale features, and we skirted around the EEZ of Madagascar. We are not allowed to work in the waters of Madagascar, which is a pity as we are interested in the supply of iron to the Indian Ocean waters to the southeast of the island, where every couple of years a massive phytoplankton bloom develops in the period January-March which is visible from space. There are a range of hypothesis about the supply of nutrients (nitrogen, phosphorus and iron) to support the bloom, but there is a paucity of biogeochemical data for the region. Run off from Madagascar, supply by shelf sediments and/or atmospheric dust inputs may potentially contribute to the development of the blooms. We have been able to sample slope sediments, dissolved and particulate iron on the water column and atmospheric deposition along our expedition track over the last few days. Whilst we do not get as close to Madagascar as we wished, we have obtained valuable data to assess the nutrient supply from the island which will help to assess conditions in case a bloom develops in a few months time.

The waters along our cruise track are now more than 3000 m deep and therefore the stations take much longer (up to 12 h). As from today, the distances between stations is also greater (12-16 h typically), which allows the researchers more time between the stations to handle their samples and rest.

All the little issues with malfunctioning equipment have gradually been fixed, and everyone has gained experience in their tasks. The team is working in a very efficient manner, and the spirit is high.

We celebrated today the 10th anniversary of the RV SONNE with a wonderful lunch prepared by our outstanding cooks. This was a very pleasant meal on this excellent vessel.

Light measurements above the ocean

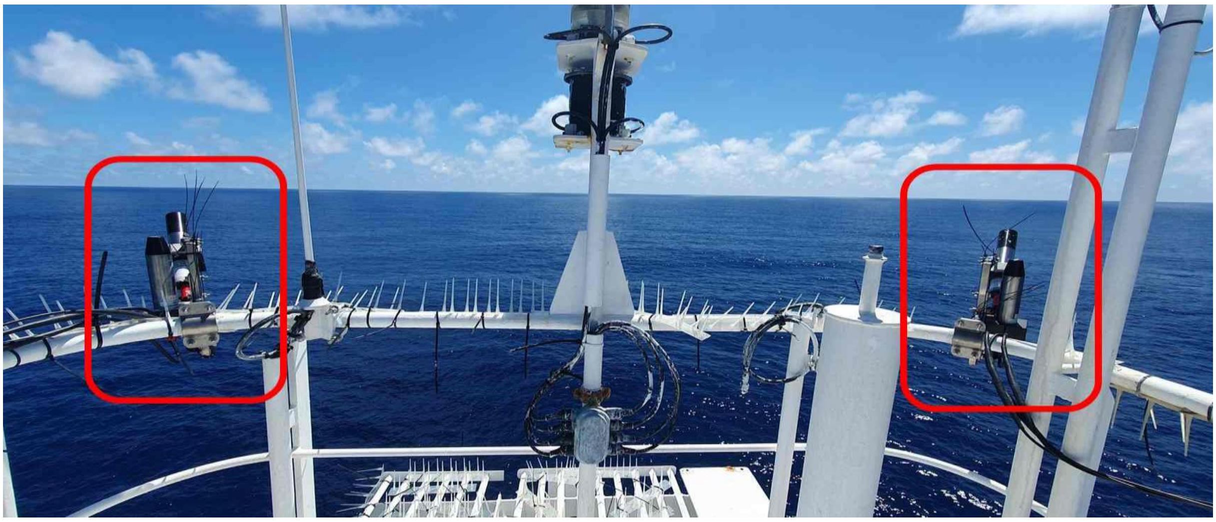

Figure 2: Radiometer on the mast at the front of the RV Sonne. Photo Brandy Robinson.

As a part of the European Research Council project of Tom Browning (GEOMAR), called 'Ocean Glow', we are deploying multiple sensors (radiometers and irradiance meters; Fig. 2) to measure the passive fluorescence signal coming out of the ocean. Brandy Robinson is using the radiometers to measure the radiant flux (power) of electromagnetic radiation, i.e., the energy of the light. Brandy deploys hyperspectral radiometers which measure a range of wavelengths in the electromagnetic spectrum from 300 nm to 900 nm, and obtain a very high resolution signature of the light coming from the ocean. We also have radiometers pointed at the sky and irradiance meters measure the total amount light coming in. This information is used to calculate the fluorescence light (Fig. 3) being emitted by phytoplankton in the surface ocean from their photosynthetic pigment chlorophyll a.

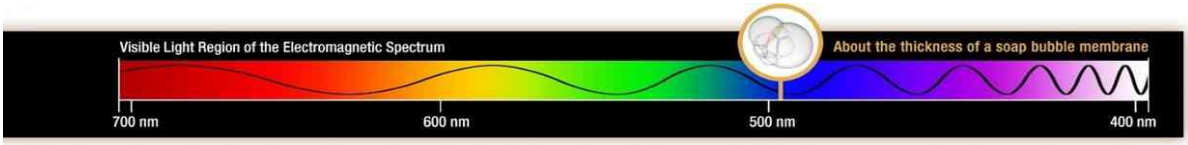

Figure 3. Visible region of the electromagnetic spectrum. Credit: NASA.

During photosynthesis, phytoplankton re-emit light and the specific fluorescence characteristics of the light can be used to assess whether phytoplankton are stressed by a low supply of iron. During the SO308 cruise Brandy is recording the passive fluorescence signature coming from the ocean as we move through the iron and also nitrogen limited waters of the south Indian Ocean and assess how the fluorescence signature changes. The plan is to use this data in future, in combination with satellite data to obtain global assessments of different nutrient regimes in the ocean via phytoplankton fluorescence signatures.

Sediment sampling

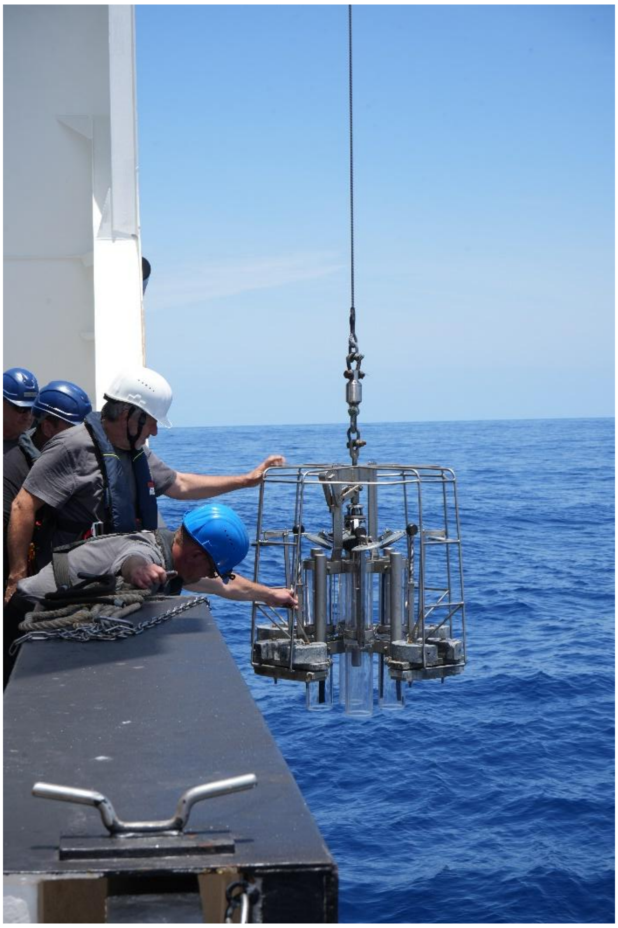

Fig. 4: Mini MUC hanging on crane, before attachment to CTD frame. Photo E. Achterberg.

On our expedition we are also sampling ocean sediments at most stations. We are using the GEOMAR mini multicorer (MUC). At the first couple of shallow stations we deployed the MUC on its own, which is obviously the common way of deployment. In order to save time, we are deploying the mini MUC at the deeper stations underneath the CTD frame. The bosun and his team skillfully attach a 13 m long cable underneath the CTD frame and attach the MUC.

The MUC deployments have been very successful and for most stations we have now cores, which have been handled and slices in a temperature controlled room (now set at 3°C, the temperature of our deep ocean waters). The team led by Zvi Steiner are also sampling porewaters, which will allow us to calculate the sediment water fluxes and hence assess the benthic fluxes along our track.

Nutrients, including ammonium, are analysed on board and this allows us to establish the redox status of the cores and the fluxes.

The cores have been very different at each station, varying from coarse sediments to red deep ocean clays. At a station 2 days ago, we even had manganese nodules on the sediment core, and some nodules at 20 cm depth.

Fig. 5: Deep ocean sediment samples obtained at station 19. Team collecting sediments from the mini MUC, and close-up of core. Photo E. Achterberg.

RV SONNE at sea 25°29 S/51°19 E

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