RV MARIA S. MERIAN - Expedition MSM114
Las Palmas - Mindelo, 15. - 21. January 2023
"MOSES Eddy Study IV"

2nd Weekly Report (16. – 21.01.2023)

After a longer transit we arrived on Wednesday morning (18. January) in our working area E2, which is located 160 km northeast of the Cape Verde island Sal. The station program started with the recovery of our observation lander that has been deployed at 3300 m water depth during the RV Meteor cruise M182 to visually monitor the deep-sea floor and to measure organic deposition on the seabed. Despite several trials to release the ballast weights of the lander using hydro-acoustics, the lander did not respond. Hence, we interrupted the working program and started a search campaign using the towed camera system OFOS (Ocean Floor Observation System), which unfortunately was not successful. The next day at 07:00 we started with the recovery of the Deep-Sea Rover (DSR) Panta Rhei, which was located close to the lander. After two hours ascent the Rover arrived at the sea surface and was safely recovered, Figure 1.

Fig. 1: Recovery of the Rover

A brief check of the data revealed that over a longer time period the Rover was working well and successfully recorded oxygen data, which allow to calculate a time series of benthic oxygen respiration. From the oxygen consumption, the organic carbon degradation of the deep-sea benthic community can be calculated, which ultimately depends on the deposition of organic carbon exported from the sunlit surface ocean on the deep-sea floor. We hope that such unique data sets will allow us to better understand and quantify the coupling of the benthic deep-sea ecosystem with processes at the surface ocean.
During these flux measurements, the Rover covered a distance of about 43 m and performed 52 flux measurements in specially designed flux chambers at the front of the Rover, Figure 2.

Fig. 2: Cylindrical flux chambers at the front of the Rover are inserted into the sediment to measure the total oxygen consumption of the enclosed sediment community. Some crustaceans escape these measurements and critically observe what happens.

Subsequently to the Rover recovery, we mapped its tracks in order to relate the flux measurements to specific features on the sediment surface.
At Friday morning (20. January) we searched again for the lander. Due to our experience with the mapping of the Rover track in relation to the ship and USBL position we were able to strongly improve our search strategy and after two hours we found the ballast weights of the lander. Apparently, the lander became detached from the ballast weights and got lost. Despite this unfortunate loss, we nevertheless obtained a unique data set to better understand organic matter turnover of the deep-sea benthic ecosystem.

A radiosonde was launched on Jan 19 to validate atmospheric wind profiles of AEOLUS. AEOLUS hosts the first space-based Doppler lidar and the retrieved wind profiles over the last years have improved weather forecasts via data assimilation, in particular over remote regions such as oceans. To assure continued data, quality regular monitoring is necessary. However, due the limited spatial coverage covered by a lidar on specific tracks each week, as illustrated in Figure 3, matching overpasses in space and time are rare.

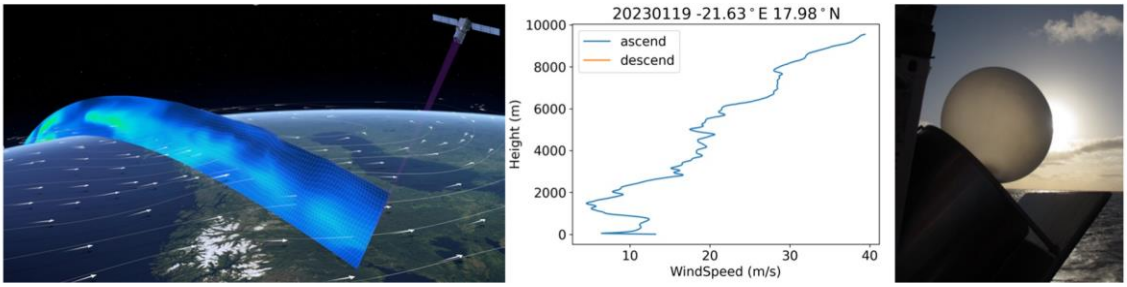

Fig. 3: The AEOLUS flight track (left) illustrating the lidar's limited spatial coverage and the measured wind-profile (center) measured by a radiosonde released on Jan 19 (right).

One of those rare events occurred on Jan 19 at 18N/22W. For a better temporal match for upper tropospheric winds the radiosonde was launched at 18.20UTC, thus about 1 hour before the actual AEOLUS overpass. Unfortunately, the data transmission failed at only 9.5km in altitude, so that for this particular wind-profile the data of the upper atmosphere and from the descent of the radiosonde are missing. As we expect to fix the data-receiving problem the participating meteorologists plan continue this AEOLUS validation activity on the upcoming MSM114/2 cruise.

Another important atmospheric activity aspect is the collection of new aerosol reference data to NASA's openly accessible Maritime Aerosol Network (MAN) database (https://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network_v3.html).

For MSM114 larger atmospheric aerosol loads were expected, as mineral (sand) dust from the Sahara desert is frequently blown off the western African coast onto the Atlantic – and often transported as far as the Americas. Due to limited national permissions, the sampling could only start in the afternoon on Jan 17, when faded colors of sky and sun and reduced visibility during the day already indicated the presence of dust. The sampling near 20N/20W confirmed elevated aerosol loads – consistent with dust forecasts by the NRL aerosol forecast model (https://www.nrlmry.navy.mil/aerosol). Over the following days (during the station stop near 18N/22W) the aerosol loads continually decreased to reach oceanic background conditions on Jan 20. For Jan 22 the NRL model predicts a larger dust event near Mindelo.

To improve the management of the scientific devices, in collaboration with the crew, all permanently installed devices were inventorised including their metadata and are available in the device data bank. A bathymetrical map has been implemented in the ship data management system. In future, scientists can use their own maps in the ship data management system to improve their cruise and station planning.

All on board are well, presently we arrived Mindelo. We are grateful to the entire crew of the MARIA S. MERIAN and the German Research Fleet Coordination Centre for their excellent support.

With best regards on behalf of the MSM114 team,

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