

Weekly Report 4: 9.-15.12.2019: Great finale with a thrilling final spurt

In the 4th weekly report, I report from our big final spurt, which we are doing here in the eddy southwest of Fogo. We had already monitored this cyclonic eddy since late summer on its way from West Africa to the open Atlantic and visited it right at the beginning of M160 for a first large scale survey. Now it is still very pronounced, especially since it has experienced a clear intensification due to the strong jet and wind shade effects in lee of the almost 3000 meter high volcanic island Fogo. In it we find striking signals and structures in almost every respect: high surface currents at the edge, which make navigation and especially crossing with autonomous devices difficult or even impossible, clear signatures of the upwelling of cold, nutrient- and CO₂-rich and oxygen-poor water in the eddy centre, primary production ten times higher than in the other eddy, beautifully staggered fronts at the edges, and much more. This means that all working groups can expect highly exciting results and put everything they have into action again – a real finale with a thrilling final sprint.

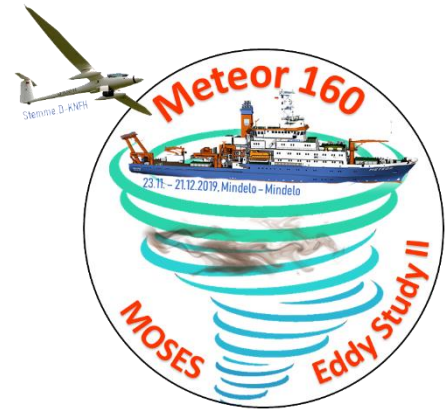


Photo: Arne Körtzinger, GEOMAR

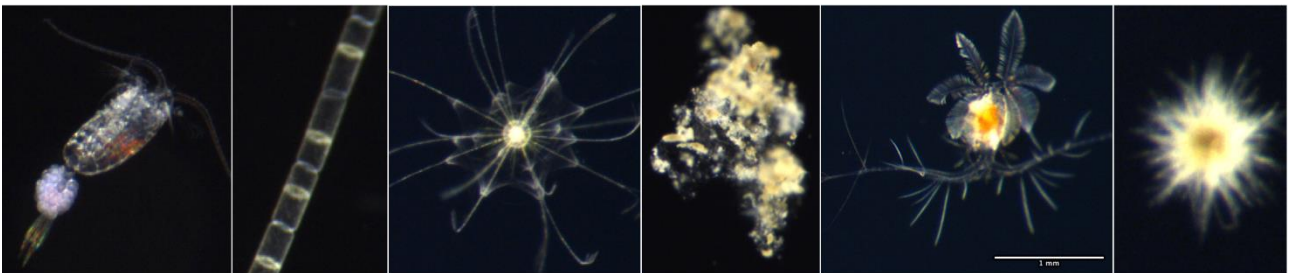


Photo: Burkard Baschek, HZG

The research motor glider plane during overflight of RV Meteor: View from the Meteor (left) and from the plane (right).

Since yesterday, the second dye experiment is also running near the eddy. This afternoon the last research flight with the motor glider Stemme took place. In addition to the station work still to be done and the repeated measurement of the position of the rapidly shifting and spreading dye streak, we are also slowly starting to recover the various autonomous devices that we have been using again in this eddy. The work program remains correspondingly tightly timed and intensive. Since the transit from the working area to Mindelo/Cape Verde is very fast and the program ends only shortly before, there will be no relaxation at the end of the trip. For the working groups, all of which have already completed an impressive workload, the task will then be to clean and dismantle instruments and gear and pack them in crates so that we can stow the containers as quickly as possible at sea and in the port.

The entire concept of the M160 expedition aimed at applying physical, biogeochemical and biological expertise to our research object, the ocean eddies, in an interdisciplinary manner and with closely interlinked and concerted observations. We have thought a lot about how the instruments can be used synergistically to create added value. For example, we also use the CTD rosette water sampler, which is primarily used to obtain water samples and vertical profiles of temperature and salinity, as a measuring platform. For this purpose, we have installed additional physical and chemical sensors (light, oxygen, nitrate, chlorophyll, colored dissolved organic matter) as well as special camera systems for photographing particles. Whenever the CTD is used, it brings up water samples and hydrographic profiles as well as a wealth of other information.



Photos of the CPICS camera, about ten of which are taken every second during lowering of the CTD rosette samples (from left to right): copepod, diatom, radiolarium/acantharium?, particle aggregate with zooplankton fecal pellets („marine snow“), copepod of genus Calocalanus, and Trichodesmium (filamentous cyanobacteria). (All photos from Daniel Blandfort, HZG)

We follow a similar approach with our gliders and wave gliders. Their measurement capabilities were also significantly extended by additional sensors. Sometimes we drive them in tandem, where one glider carries out turbulence measurements while the other glider records vertical profiles of oxygen and nitrate in parallel. If the data that could not be collected from a single glider are brought together, vertical fluxes of oxygen and nitrate can be determined – important parameters in biogeochemistry.

Sometimes one only encounters such synergy potential when the working groups meet on board and explain each other's work in detail. We have found that the drifting sediment traps from MARUM, which we always let drift for 24 hours at different depths under a surface buoy to determine the vertical particle flux and capture intact particle aggregates, can be married wonderfully with GEOMAR's biogeochemical sensor package, which also drifts. The latter was also intended for parallel 24-hour drift mission. With a few tricks both could be combined and thus we not only save time and effort in deployment and recovery, but can also combine and interpret the data much better.

The expedition thus remains a constant learning process full of surprises, which bring with them our dynamic eddies and the results of the various working groups.

With warm advent greetings from all of us,

Arne Körtzinger

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Photo: Andreas Raeke, DWD