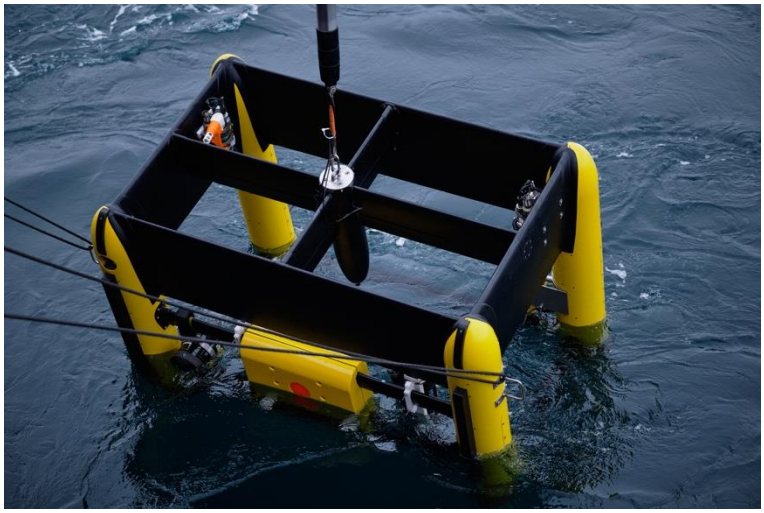
MSM93 Emden-Emden

Weekly report 3

06.07.2020-12.07.2020

After five days in the working area, we were able to successfully finish our mooring operations (recoveries and deployments) in Fram Strait. Since then we have turned our attention to the other part of the planned work. We would like to understand how variable physical and biological properties of the ocean really are, especially on horizontal scales of meters to several kilometers. Often that is not considered, but the changes at a few small areas of the ocean are particularly strong and have an influence on the whole ocean.

For that purpose, we started by towing the Triaxus along a distance of 100km through the ocean. Just a few days prior, the ice edge had been blown far to the west. As a result we could study the ocean which had been covered by sea ice previously without our operations being inhibited by ice. The Triaxus (photo 1) is a vehicle which is towed behind the ship. We can set the depth (or depths) where we would like to measure. With the sensors on the Triaxus we can measure e.g. physical parameters such as temperature and salinity as well as biological and chemical parameters such as nutrient and algae concentration.



Photos 1: The Triaxus when it is being lowered into the water. The Triaxus is a vehicle that is towed through the water and almost all modern oceanographic sensors are mounted to it. (Photo: T. Kalvelage)

Already during the long section along the ice, we noticed straight lines on the ice radar of the ship. The lines were approximately perpendicular to our transect. Those slick lines (photo 2) are caused when water subducts below the surface. During the subduction, material, which normally is distributed regularly at the water surface, is accumulated in the areas where water dives down. In those locations, the concentration of the material becomes much larger than what is typical at the sea surface. This material is formed by e.g. bacteria and it makes the water surface appear smoother (photo 2). In the marginal ice zone, the same process often also accumulates small ice floes.

Photo 2: Slick lines on the ocean which indicate the subduction of water. At times those slicks appeared as straight lines of several kilometers which could be seen visually. (Photo: T. Kalvelage)

The data from the long transect with the Triaxus also showed very fast transitions from one water mass to another. We oceanographers call that a front. We therefore decided to return to the front and to survey it in depth. Among others activities, we deployed 30 surface drifters (photo 3) on straight lines with 2km distance to each other. Those drifters move in a similar manner as the material which forms the slicks. We distributed the drifters at regular distances, but within 24 hours some of the drifters had approached each other. Four to five were a few hundred meters apart and two came within 5 meters of each other. By this the drifters showed us where the water subducts.

Photo 3: A surface drifter shortly before being released. Only the right part looks out of the water and measures its position every 10 minutes and sends us the position via satellite.
(Photo: T. Kalvelage)

Since then we have meticulously surveyed the locations where subduction takes place. Among others we used the underway CTD (Photo 4) which shows us temperature and salinity in the water column. Based on that data we then defined a few stations at which we collected samples, took photos of particles in the water column with multiple camera systems, and measured the distribution of algae in the water column.

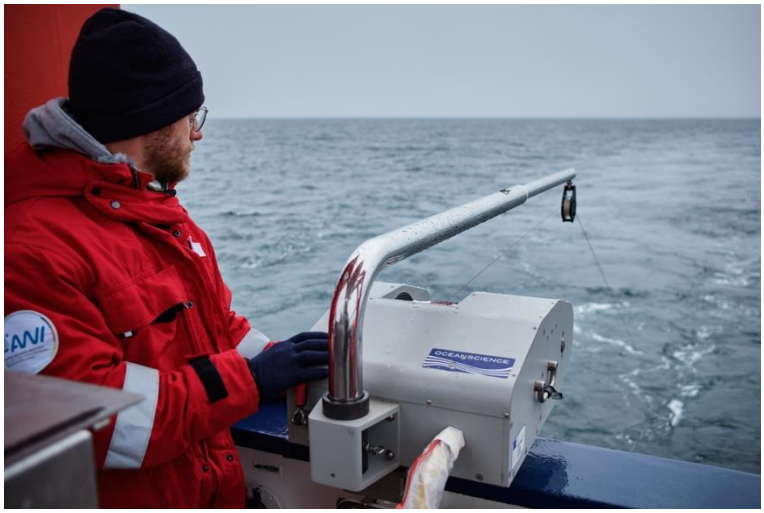


Photo 4: The underway CTD (conductivity, temperature, pressure sensor) is operated with a winch from the stern of the ship. (Photo: T. Kalvelage)

Our work at the front was made easier by good weather and a great team effort. Trying to find, and then sample, the locations where the large changes in the water column take place has kept us all quite busy. But we are more than happy with the already collected data and samples.

Let’s see what will happen during the rest of our cruise. Until then, happy greetings from far north,

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