

**Maria S. Merian    MSM05/5    Weekly report 2**

The second week of our cruise with Maria S. Merian was characterised by mooring work in the central Greenland Basin. After having approached the central gyre while performing a radial CTDO<sub>2</sub> transect, the area where the autonomously profiling moorings operate was reached under extremely favourable weather conditions. This is much appreciated, as these moorings require partially quite careful handling during recovery and deployment.

The EP/CC-Jojo Moorings (Externally Powered/Compressibility Compensated Jojo) represent a mechanical solution to autonomous deep sea profiling. The in house developed and produced system (AWI) consists of a buoyant vehicle which contains a self contained CTD attached to a buoyancy module and a control unit which dispenses weights to the top of the vehicle. With such a weight, the vehicle dives to the ocean bottom, where the weight is taken off and the vehicle moves back to the control unit on top of the Aramid rope subsequently. For each profile one weight is dispensed and profiles are performed every other day. Thus, the roughly 180 profiles per year reveal a complete annual history of the hydrographic development, containing the otherwise unattainable but important winter convection history. Energy management is the most demanding challenge of such a system, but numerous design trade offs interact closely with respect to weights, volumes and dimensions. The vehicle must be balanced in the ocean and the compressibility of the vehicle has to be adjusted to resemble that of sea water. The latter is necessary in order to avoid a buoyancy increase under the high pressures in the great depth the system approaches because small driving forces are used for the downcasts (ca. 450g) and even more tiny ones (147g) for the upcasts. With this forcing, a downcast speed of 1 m/s is attained.



Deployment of control unit of EP/CC-Jojo (Foto O. Zenk)

We recovered and deployed three systems successfully without any loss or damage. Position accuracies are so exact nowadays, that the foggy conditions, which were combined to the low wind situation, did not hinder the work at all. A few moments after the acoustic release of the moorings, the top buoys appeared at the surface exactly at the expected positions where they had been moored with Maria S. Merian during the previous year. The update of the mooring winch to a speed of 1 m/s facilitated the mooring works greatly.

The measurements of these systems include the entire water column from about 100 m to the full ocean depth of 3700 m. Naturally, the systems cannot be placed at the sea surface due to eventual ice occurrence in winter and rigorous wave action all the year round. Previous attempts to place the control unit closer to the sea surface resulted only in partial damage of the equipment. Nevertheless, measurements right into the surface are strongly demanded in order to include the fresh water cycle in the field observations. The latter controls largely the type and depth of winter convection and is in fact more important than the strength of a particular winter.

An additional mooring, dedicated to the challenge of surface measurements, was therefore put out. An underwater winch by NGK, Japan, is combined with a customized CTD by Optimare(Bremerhaven)/SBE(Seattle, USA). The winch pays out rope as long as it feels the tension of the strongly buoyant instrument (8 kg) and takes the rope back in when the tension is missed. Both parts are deployed by us for the first time. Obeying Murphy's law, the email interruption on Friday hit us at a critical moment when we urgently needed a software update from Bremerhaven. As this was not attainable, we had to use a work-around to overcome the software problems. The succeeding deployment was a delight, and the instrument represents an exiting new method for near surface measurements.



Underwater winch (Foto O. Zenk)

The overall hydrographic situation is characterised by huge amounts of warm and saline Atlantic waters all over the place, and it is the Atlantic waters proper in the eastern part of the basin where we are sailing at present. Even a few hours of a visible sun were granted to us as a diversion from the otherwise continuously grey skies and oceans. For the first time we experience considerable winds and waves as we are heading towards Bear Island now.

With best wishes on behalf of the scientific crew,

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Gereon Budéus