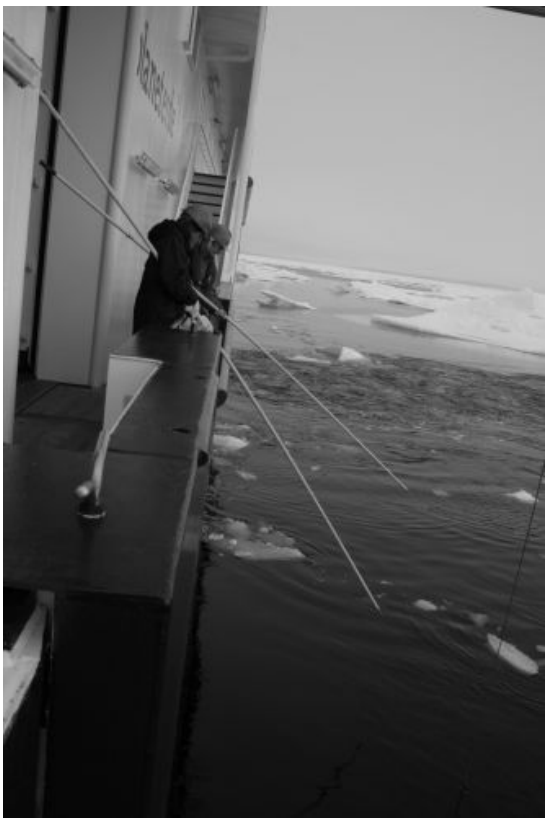
Maria S. Merian MSM05/5 Weekly report 1

At Reykjavik it was easy for everyone to find the ship in the harbour as this is a comparatively small area where the shape of Maria S. Merian stood clearly out. Embarkment was perfectly in time, but our departure was not. A delay of about eight hours had to be accepted because the luggage of six participants got stuck in Amsterdam and did not arrive with the passengers. With only one flight per day from Amsterdam we were lucky to depart on the 18th of July with such a small delay.

The first days were occupied with unpacking, installing the labs, taking part in security trainings &c. and thus went by quickly. The norwegian, spanish and german work groups set up their equipment rapidly to operational status. Heading was north into the Greenland Sea. First ice contact was encountered already at 70°N, somewhat east of Scoresby Sound, where the satellite images displayed no ice at all. This was a first warning that the attempt to enter the ice at 74°N might take more effort and time than originally expected. This was indeed the case. The recovery and redeployment of three moorings belonging to ZMAW Hamburg went well, nevertheless. All three were situated in dense pack ice with little space to move the ship (Foto O. Zenk). Patience was needed partially to wait for ice floes to drift off from the mooring's position or to surround large ice floes in the foggy conditions that were prevailing. The tube-mooring's instruments and the ADCP are in the process of being downloaded and evaluated at the present moment. The main aim of these measurements is the assessment of fresh water fluxes in the East Greenland Current.



It became quickly evident that a second trip into the ice would consume too much time to be feasible and consequently the trip's schedule was modified. Instead of moving to 75°N and start a hydrographic transect there as was originally planned, the way out of the ice at 74°N was used to perform a $CTDO_2$ transect. Again, dense pack ice reduced the ship's speed effectively. At 10°W, now in open waters, we changed from the zonal eastern direction to a heading in the direction of the central Greenland Basin, where the autonomously profiling deep sea moorings of AWI are located. They will be exchanged during the next few days, interlaced with $CTDO_2$-stations and drifter deployments. The data of the moored profiler will give a detailed record of the last winter's convection history which cannot be judged yet from the data gained up to now, as we reside still on the rim of the Greenland Basin.

Weather conditions are extremely favourable with little wind and small waves only, so we expect the best progress. With best wishes on behalf of the scientific crew,

25.07.2007 Gereon Budéus

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 $CTDO_2$ 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 occurance 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,

01.08.2007

Gereon Budéus

Maria S. Merian MSM05/5 Weekly report 3

Finally, the sea showed us that it can indeed be rough when we were sailing close to Bear Island. After two weeks of calm winds, wind force 8 and up to 9 in gales hit us during the last $CTDO_2$ stations on the large zonal transect at 75°N. The ship behaved well, and the stations could be done. Overall results are excellent.

On our way to Longyearbyen we planned to deploy the exciting and innovative sea glider which sails in the water just like a glider in the air, the only difference being the fact that the sea glider can move both up and down while the air gliders do not move upwards. The instrument moves forward during both downcast and upcast and measures a number of physical parameters on its way. Up to 5 months endurance time can be attained, and the glider can be steered remotely to a new direction each time it surfaces and communicates with its home lab at Seattle. Despite considerable efforts, it was not possible to deploy this instrument due to software and hardware problems. This was the first serious failure we experienced during our cruise. The performance control of this fish is done remotely via Iridium from Seattle, USA, and the search for failures was hindered considerably by the slow and individual email transfers between the Seattle lab and Maria S. Merian. The glider will be brought home now and be serviced on land.

Our 'touch down' at Longyearbyen, scheduled to last only one or two hours, took some more time as a diver had to inspect the propellers. This time was appreciated much by the new scientific crew members. The geologists had to put up their equipment under great time stress, as the sailing time to their investigation sites was extremely short. The small delay took off a little bit of this stress. A number of sediment cores has been collected up to now. There are different types of corers, and the sampling strategy also varies. But before one can take a sediment core, the ground has to be checked by specialized sediment echosoundigs which reveal the bottom structure in order to detect ideal places for sediment sampling.

We had to deviate from our original plans which included sampling in regions, where 100% ice cover inhibited our visit of these areas. Having learned that one needs to be cautious about the interpretation of remote sensing ice data, we had a try nevertheless to reach them, but gave up quickly and switched over to an alternative sampling scheme. This brought us to the ice free waters north of Spitzbergen, where we are sailing at present. Certainly, this is the northernmost point Maria S. Merian has reached up to now: We stay only three miles south of 81°N. (Regrettably, this weekly report cannot contain any image to illustrate the ongoing work because the Iridium satellite connection, which is the only existing one in these high latitiudes, inhibits the transfer of such larger data volumes.)

We are heading for Longyearbyen soon again, where our cruise leg will finish on Friday, the 10^{th} of August. From there, not only the scientists will go home, but also Maria S. Merian will steam towards Germany to get repaired in a ship yard. Superfluous to state that this is a serious drawback to the next planned cruise leg.

Everybody on board is well being, and I send the best greetings on behalf of the scientific crew,

Gereon Budéus, 08.08.2007