TransBrom Sonne

Weekly report No. 1 (9.10.-11.10.2009)

RV Sonne now at 28°10,5'N/145°21,5'E

The japanese seaside town of Tomakomai (42°35,4'N/ 141°37,5'E) was starting point of our expedition with 'RV Sonne' which will take us 4030 nm (7.500 km) and 60 degrees latitude towards Townsville (19°06,6'S/ 146°50,5'E**)** in Australia. Already on our way to Japan on 6 Oktober, Melor was the key conversation topic of the 24 marine and atmospheric chemists, biologists and meteorologists from IFM-GEOMAR, the Alfred-Wegener-Institute, the Meteorological Service of Germany and the Universities of Bremen and Heidelberg.

Typhoon Melor (source: NOAA).

Super-Typhoon "Melor" with a minimum pressure of 910hPa and a maximum speed of 155kn during gusts, had already been a dangerous feature in the Western Pacific several days before. It was supposed to reach Japan from 7 to 10 October and frighten us in the harbor of Tomakomai on 8 October.,

After all the scientists had reached Tomakomai safely on 7 October, while enjoying a delicious Japanese dinner, we discussed many strategic moves of container unpacking the next morning. We especially discussed how to get our electronic equipment, dry, into the laboratories during Melor's rain showers. We were lucky after all. Instead of rain setting in at 9 am to herald Melor's approach, showers didn't occur until 3 pm, when everything had already been stored in the laboratories below deck. Also, the airfreight, the chemicals, the gases, and the liquid nitrogen that we had to obtain from Japan reached the ship in time, thanks to our very active and reliable agents. All scientists immediately found suitable lab space for the 32 analytical devices on board and, in the afternoon the first instruments were already operational.

The liquid nitrogen is filled into our containers in front of the Sonne.

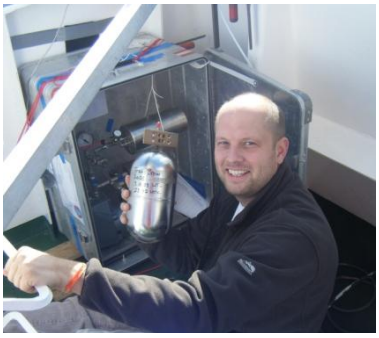
After everything seemed to have worked out so well, despite complex logistics from the beginning, an unpleasant surprise occurred during the late afternoon. Four of the delivered special gas regulators didn't suit our gas chromatographic systems. Luckily our agent, and our Japanese colleague, Prof. Uematsu from Tokyo, who visited us in the early evening along with his colleague Prof. Fujiwara from Sapporo, were able to find the correct regulators at the last-minute. Thanks to Melor – Oliver Meyer, captain of 'RV-Sonne', had thoughtfully postponed the ship's departure for another 4 hours to Friday noon. Therefore, the regulators from Prof. Kawamura from Hokkaido University reached the ship the next morning, just in time. Thank you very much!

As Melor actually reached us during the night of 9 October, its power had decreased to an extra tropical storm system with pressures of 980 hPa. Winds of 7 Bft, with 10 Bft during wind gusts, reached us within the safe harbour area. After departure, we reached Tomakomai's pilot station at 1pm. There the plate for the hydrographic shaft, which had been adjusted to our pump systems and sensors by the excellent sedulous working crew, was let into the water. With the help of the friendly deck crew, all sampling tubes were soon installed and we could start water pumping beyond the 12-mile-zone. The wind awaiting us at sea had decreased in strength (5 Bft, north-easterlies) and we had an abaft swell of about 2-3 metres, causing the 'Sonne' to roll, and unfortunately making some of us sea sick.

In the meantime, all measuring systems are installed and deliver the first results – some still with a few "KINKS" – which could partly be fixed by the professional, enthusiastic commitment of the 'Sonne's scientific technical crew. Since all of us have now gotten used to the waves and the ships roll, we began our investigations concerning the location and flux of short-lived halogenated trace gases from marine sources entering the stratosphere (heights of 15-50km).

Herbert, Christian and Peter watch the lowering of the pump plate into the hydrographic shaft.

According to new findings, natural, short-lived halogenated hydrocarbons play an important roll within the stratospheric ozone budget. In addition to anthropogenic, long-lived chloro- and bromo-fluorohydrocarbons, which are primarily responsible for the chemical ozone depletion within the stratosphere, (e.g. ozone hole above Antarctica), very short-lived bromine compounds (e.g. bromoform ($CHBr_3$)) can enhance chemical depletion of ozone. The tropical Western Pacific is of great importance concerning this issue, since strong marine sources are assumed to be there and, simultaneously, it is the main entry point, globally, for trace gases into the stratosphere.



Arne is taking his first air sample.

The expedition's main goal is to quantify the actual effect of bromine-containing oceanic emissions on the stratospheric ozone budget. The composition and physiology of phytoplankton are simultaneously being measured to understand their role as a producer of bromoform and other trace gases, which are also investigated within the surface waters and the atmospheric boundary layer. During our research cruise fluxes of very-short lived halogenated species will be quantified in the tropical Western Pacific for the first time. Additional atmospheric samples are taken for partners at the Universities of Hamburg, Frankfurt, Utrecht as well as at the 'Rosenstiel School of Marine and Atmospheric Sciences' (RSMAS) in Miami.

During the first 2 ½ days we successfully launched 9 radiosondes, measuring the atmosphere up to an altitude of 30 km height. The atmospheric profiles of temperature, pressure, wind, water vapour and ozone will later be used as an input for trajectory calculations in order to investigate the air mass transport from the ocean to the stratosphere. The analysis of air chemistry along these paths (WGL-project TransBrom, IFM-GEOMAR, Kiel) will also be included. These model calculations will be related to other trace gases from the TransBrom Sonne cruise, such as marine bromoform fluxes (IFM-GEOMAR) and the atmospheric columns of BrO and IO (Universities Bremen and Heidelberg). Perfect starting conditions with abaft winds, calm conditions on the working deck and a forecasted change of weather conditions, lead to an early ozone sonde launch in the afternoon of 11 October. Instead of the expected "normal" profile typical for mid-latitudes or subtropics, a surprise occurred. The sounding showed a massive 2 km thick isothermal stratified inversion at 3-5 km height. We could instantaneously follow on the monitor how the incoming data of the sonde continuously showed clearer tropical conditions, especially along the tropopause, although one would expect a sub-tropical transition for this position at 30° north. These could possibly be the post effects of super typhoon Melor on the tropopause region. Based on these exciting measurements we expanded our radiosonde program at once, which was initially planned for the tropics. At 9 pm we started our first pair of a special water vapor sonde and an additional sonde, which measures the content of aerosols and cloud particles. This sonde launch is still running and will give insights into the dehydration processes of air masses transported into the stratosphere.

The radiosonde group at the start of the first ozonesonde (Sebastian, Vicky, Susann, Markus und Franz).

On our way south, temperatures and air pressure continuously rise. By now we are enjoying sunshine and temperatures way above 20°C, although a considerable change of weather might occur. We are supposed to approach 'Nepartak', a tropical storm, during the night of 13 October. Fortunately, it hasn't evolved into a typhoon to date. More to come in the next weekly report.

Birgit Quack (12.10.2009)