

TransBrom Sonne

Weekly report No. 2 (11.10.-18.10.2009)

RV Sonne now at $\sim 3^{\circ}50'S/153^{\circ}57'E$



Since the last report, average temperatures of water and air have reached more than 28°C (82°F). Fortunately, 'Nepartak' only developed to become a tropical depression. During the night of 13 October, we passed our ship's wind maximum of 20.45 m/s. Wave heights of only 2-3 metres allowed us to take measurements at night without having further difficulties.. During this time, we decided to double our air sampling frequency from 6 to every 3 hours. Thus we were able to take measurements before, during and after the storm very well and hope to be able to quantify the gas transfer of marine trace gases due to short-term wind velocity changes. After all we were glad to have overcome another tropical storm. The collected air samples are analyzed by the working groups of Doug Wallace et. al. from IFM-GEOMAR, Kiel, of Elliot Atlas from RSMAS, Miami as well as of Andreas Engel at the University of Frankfurt. The analyses will cover more than 50 natural occurring and man-made trace gases released into the atmosphere. The additional series of measurements will provide an excellent supplement to our on-board in-situ measurements of short-lived halogenated compounds of marine origin.

14 October was taken as another special sampling day with clear skies and intensive solar irradiation. We again doubled the air sample and radio sonde frequency to be able to distinguish between production, and mixing processes. The FTIR (Fourier Transformation Infrared Spectrometer) group from Bremen, who uses sun spectra to investigate the amount of trace gases in the atmosphere, optimized their instruments during a 30 minute stop on sea.



Tine Weinzierl on top of the FTIR-Container, Theo Ridder inside. Tilmann Dinter in front of RAMSES.

Theo Ridder and Christine Weinzierl, the FTIR-group from the Institute of Environmental Physics at the University of Bremen, lead by Justus Notholt, participates in the TransBrom-Sonne campaign with one spectrometer container. High resolution sun absorption spectra are measured, which provide a basis for investigating the total column of more than 20 trace gases and vertical profiles of 10 of these gases. Besides this Bremen technique, an FTIR analyzer, developed in the working group of Prof. Dr. David Griffith at the University of Wollongong, Australia, continuously analyzed ground level trace gas concentrations. was

Continuously measured carbon monoxide data (CO) caused extraordinary enthusiasm since they showed clear diurnal cycles with maxima being detected around noon. We might be able to quantify the transfer from ocean into the atmosphere by means of this data assuming a constant background atmosphere in the encountered steady north east trade winds. Results of these measurements can be directly compared to those of other working groups within the TransBrom-Sonne project and provide information about chemical and biological processes in ocean. The continuous measurements will help to understand the ITCZ (Inner Tropical Convergence Zone) conditions during the cruise, where the transition from northern hemispheric to southern hemispheric air masses took a couple of days. After initial difficulties due to adverse weather and bad wave conditions, all measurement systems are working satisfactorily and show the first interesting results.

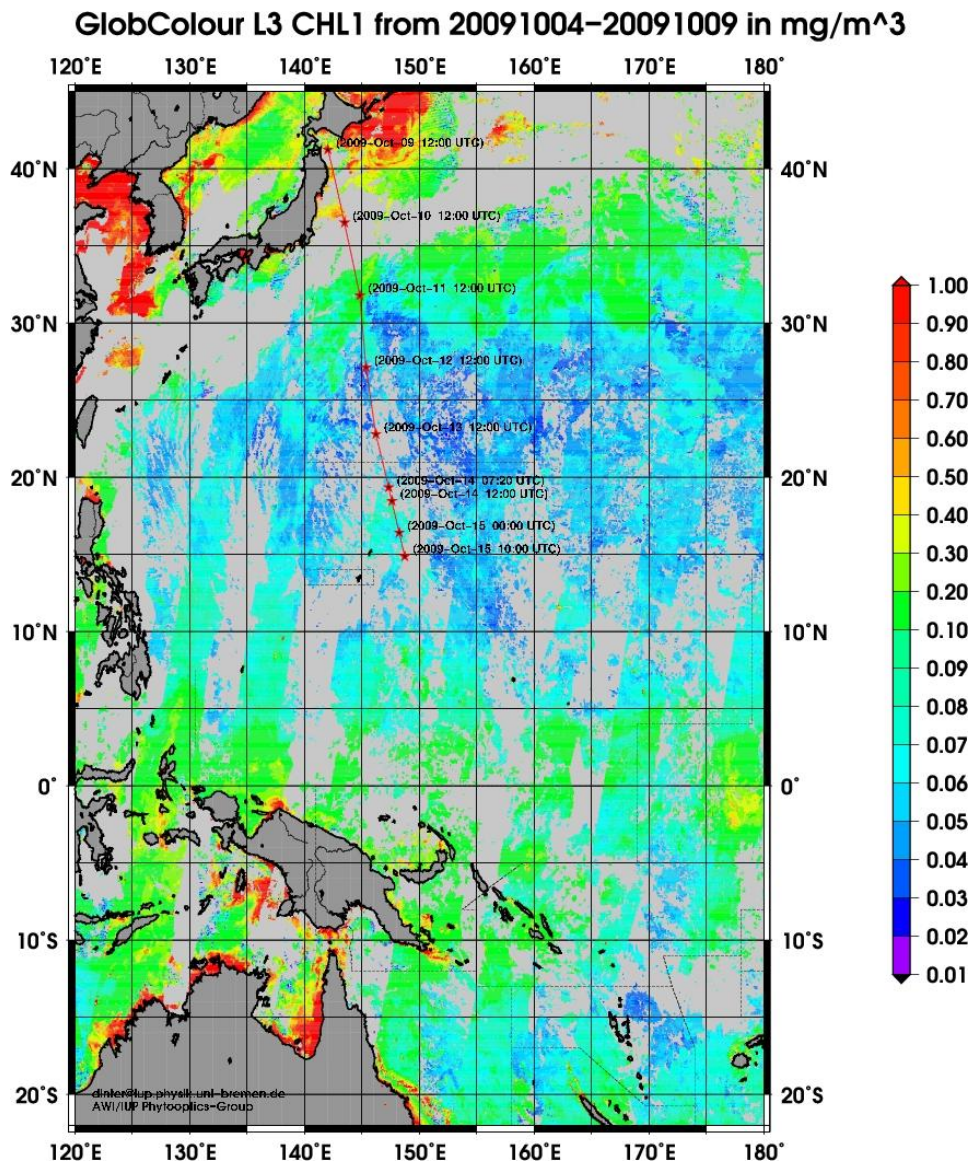


Panorama in the ITCZ Region from 16 October 2009. (Collage Folkard Wittrock)

In the afternoon of October 15th the weather obviously had it in for us as we encountered the third storm during the two-week transit through the tropical western Pacific. We passed only 125 miles east of ‘Lupit’s’ point of cyclogenesis, which resulted in short-term intensification of wind speeds and wave heights. ‘Lupit’ is heading towards the Philippines at the moment.

The radio sonde team, Kirstin Krüger, Franz Immler, Markus Rex, Susann Tegtmeier, Vicky Mohr and Sebastian Wache, has already carried out 46 balloon launches with differing sonde equipment. Highlights, among others, were the four hourly ITCZ – measurements, which lead to a 1°x1° spatial data resolution and a two-payload launch, which is used for the GRUAN validation. At present we are in the southern part of the ITCZ, accompanied by a change of wind direction from ENE to WNW. Since the weather forecasts and analyses from the European Centre for Medium Range Weather Forecast (ECMWF) don’t resolve this wind shift, our temporally high resolution radio sonde launches will be of essential use for meteorological analysis and forecast. Currently the sky is covered with convective clouds of great vertical dimension which are responsible for a few showers every now and then. Due to the fact that the sea has finally gotten calm, not only our FTIR-Team, but all of us, especially the PHYTOOPTICS team (Tilman Dinter, Anja Theis, Dörte Stange and Kim Quack), are able to bear up against the hard 24-hour sampling and analysis routine under milder conditions.

The PHYTOOPTICS group lead by Astrid Bracher from AWI Bremerhaven and University of Bremen, has continuously taken water samples every three hours for the analysis of phytoplankton. Most of the data will be analyzed after the cruise in order to validate daily satellite images. The high sampling frequency provides a basis for the detection of biological sources for the halogenated, marine trace gases which have also been measured on board in the same frequency.

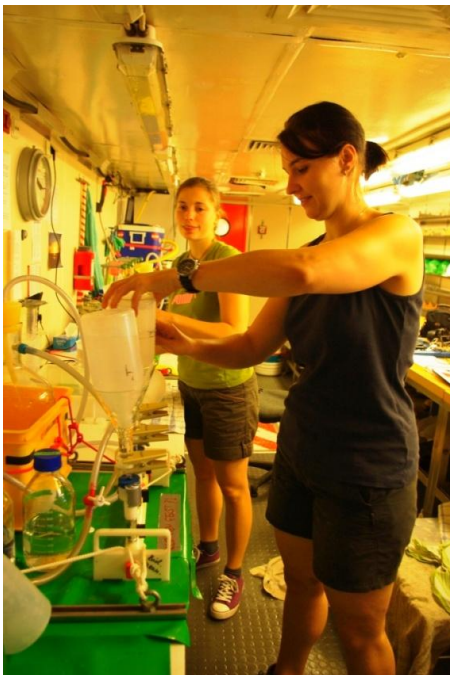


Colour-coded concentrations of chlorophyll [mg/m³]. The ESA GlobColour Product is merged from 4 satellite instruments (MERIS, SeaWiFS, MODIS Aqua/Terra), yielding a resolution of 4km². Shown is a 5-day-average.

The optical properties of water depend on its phytoplankton content. Therefore, absorption, reflection and fluorescence of the water give insight into the phytoplankton speciation. The monads' fluorescence is being measured in surface waters during the transit by the so-called FRRF (**F**ast **R**epetition **R**ate **F**luorometer) which is, after initial software problems, operating continuously now. Every three hours, commencing at midnight, water samples are filtered for

later pigment analyses in the laboratory. In contrast to this, absorption measurements are done directly on board. Roughly 3500 litres of water will be filtered in total between Tomakomai and Townsville. As expected, the phytoplankton density in the surface layers of the open blue sea seems to be very low. We expect a rise of phytoplankton concentration near Papua New Guinea.

In addition to the mentioned measuring techniques, the PHYTOOPTICS group carries out radiation measurements with three radiometers at the ship's bow. The three instruments were installed on top of the bulwark at the ship's bow and measure the incoming global radiation, the diffuse sky radiation and the radiation reflected by the sea surface, between 9am and 16pm local time. The collected data will be analysed after the cruise and provide a basis for satellite validations and reflectance quantifications and therefore the seawater's optical properties.



The trace gas group (Birgit Quack et.al., IFM-GEOMAR, Kiel), measuring halogenated hydrocarbons in surface seawater and the atmosphere from natural and anthropogenic sources, is detecting a rise in brominated trace gas concentrations in the vicinity of atolls for the last two days. By referring to the phytoplankton data we will be able to differ between local phytoplankton producers and, an up to now unknown coral source. Since we are getting closer to the Coral Sea and, therefore, to the end of our cruise at the Great Barrier Reef, known for its low phytoplankton concentration and great amount of coral reefs, we are very excited to see what we will measure.

Anja Theis and Dörte Stange during pigment filtrations in the lab.

This morning, at 1:38 (local time) we crossed the equator. We symbolically jumped over the imaginary equator line to celebrate this event befittingly. In as little as 5 days we will reach Townsville (Australia). We will get to this in our next and already last weekly report.

Birgit Quack and the TransBrom-Sonne Team (19.10.2009)