# ANT XXIII/1 Weekly Report No. 4 3 November - 13 November 2005

The last part of our cruise track crossed the Angola Basin. The Inter Tropical Convergence Zone, where the northeast and southeast trade-winds meet, gave us some severe rain showers, but then we had a period of hot and sunny weather. On the 5th of November we crossed the equator, celebrated with sparkling wine on the observation deck. But for many this was the first equator crossing, and Neptune did not let this go unnoticed. Two days later 31 of us – crew and scientists - were baptized in a traditional rather dirty ceremony that could be performed in the bright sun on deck. It was enjoyed by baptized and baptizers alike. The day ended with a delightful grill party attended with extra appetite by the newly baptized, who had not gotten food for lunch.

After the equator crossing we gradually entered a region of heavy clouds, a problem for those of us who need a clear view to the sky above us. The atmospheric scientists on board study changes in the composition and structure of the atmosphere that result from man-made emissions of gases. They use a wide range of techniques. One group uses chemical measurements: every day around noon a large helium-filled balloon is launched. This weather balloon rises to 30-35 km height before it explodes by its expansion in the thin upper atmosphere. On its way up it measures not only weather data but also the ozone concentration in the atmosphere. The data are transmitted to the ship and are used for our daily report to the Global Telecommunication System, the data system of all weather services.
All other groups use optical methods. Most of these complement similar measurements made by satellites (ENVISAT, in polar orbit since 2002) and thus serve as ground validation of these global satellite data. Three teams analyse the spectrum of the sunlight arriving on the ship. As I wrote last week, this spectrum carries information on the chemical composition of the atmosphere. A large part of the harmful ultraviolet radiation is absorbed by gases in the atmosphere, and as we all know this protection is threatened by changes in the atmosphere, especially in the ozone concentration. The first group tries to relate the ultraviolet spectrum measured on the ship to the ozone concentration measured with the balloons. A second instrument made to study the absorption of the sunlight is the FTIR. In a container situated on the observation deck, on top of the bridge, the direct sunlight is captured by a so-called “solar tracker”, a set of mirrors that are continuously adjusted to the ship’s movement in order to feed the sunlight into a spectrophotometer. This instrument records the infrared part of the spectrum of the sunlight. Missing components of sunlight point to absorption in the atmosphere by specific gases. One of the gases that can be observed in this way is carbon monoxide, typically originating from forest fires. On previous expeditions this could be clearly linked to forest burning in tropical Africa, and we expect to find similar signals on our expedition. The third instrument to measure gas concentrations in the atmosphere analyzes scattered light under various angles (MAX-DOAS). It does not require direct sunlight, a great advantage in the often cloudy weather we had this week.

The remaining two groups of atmospheric scientists are not dependant on sunlight and they are most active during cloudless nights. The LIDAR team uses the light of a powerful green laser to measure the distribution of particles (aerosols, water droplets, dust) in the atmosphere, as I already mentioned in the previous report. The last team uses the weak radiation specific to a thin layer of the atmosphere at a height of 87 km to derive the temperature at that height – a mere – 80 °C. They expect that a climate change is more readily detected in this layer than down on the Earth's surface.
The exchange of pollutants between air and surface water is the theme of the organic chemists on board. Persistent organic pollutants like the notorious PCBs but also less well-known chemicals used for example as fire retardants or additives to carpets and television sets and non-stick frying pans are distributed worldwide. Our team measures these components in the air and in the surface water to find out how rapidly these pools exchange. Our long North-South transect will also help to quantify the transport from the northern hemisphere, where the industrial pollution is largest, to the southern hemisphere.

We completed our geochemical program with three more deep stations, taking about 8 hours each, and allowing us to obtain all the water samples we had desired. Some analyses could already be done on board, and these showed the expected higher concentrations of iron, aluminium and titanium in the area of dust inputs. We will have to await the elaborate analyses of the many samples we take home to find out how the other trace elements behave in this part of the ocean.

The remaining days will be needed to pack our things and make the ship ready for the next leg. We will have to say goodbye to three crewmembers, among which the chief engineer, Volker Schulz, who has been with Polarstern from the beginning and is retiring now. Many of us have experienced how, together with his technical team, he solved our problems with malfunc---tion--ing sampling or measuring equipment and so saved a project, and how he helped create the excellent working conditions for which we so much value this ship. We wish to thank the captains Pahl and Schwarze and their crew for the extremely helpful and pleasant cooperation during this expedition.

With a last greeting from all on board,
Michiel Rutgers van der Loeff, Chief Scientist ANT XXIII/1