ANT XXIII/7 Weekly Report No. 6 (Cape Town - Cape Town)
25 September 2006 - 1 October 2006

During the past week we had to struggle with severe sea ice conditions. Strong westerly winds have pushed the ice floes together, and easy transit between the floes was not possible. We had to spend a long time in the ramming mode and progress towards the south was rather slow. Conditions improved significantly only at the weekend.

For our cruise planning the most important characteristics of pack ice are the thickness and the per-cent coverage. When both increase the speed of our icebreaker is reduced. Also in climate research these two parameters are the most important ones, because they restrict the heat and mass exchange between the atmosphere and the ocean.

The main task of our sea ice physicists is to measure the ice and snow thickness at many locations of the floes, both of which are usually rather variable. The goal is to measure level ice as well as pressure ridges. Typical ice floes consist of flat parts, where freezing processes have increased the ice thickness continuously, and of pressure ridges that have been produced by the deformation during collisions among the floes induced by the wind, which under stormy conditions is strong enough to break the ice floes and create ridges.

The sea ice thickness is measured with various techniques. The simplest, but most time consuming method is to drill holes through the ice and lower a measuring tape with a hook at the end through it that locks at the underside. A more elegant and faster method is to use electromagnetic (EM) sensors towed on a sled, which measure the distance from the ice surface to the salty, and therefore conducting, seawater at the underside of the floe. With these methods the ice thickness of a kilometre wide floe can be determined in an acceptable time. Longer thickness profiles can be obtained from an EM-Sensor built into a projectile (EM-Bird) that is towed by a helicopter at 30m height along a 100km section within one hour. With this method, a representative data set of sea ice thickness can be achieved over a broad area.

These activities are undertaken in preparation for the calibration of the first satellite (CryoSat), which will monitor the sea ice thickness from 2009 on in both polar regions from a height of 700km. The determination of sea ice thickness and its variability is of great importance in international climate research, because the sea ice plays a major role in the climate system and acts as a sensitive indicator of climate change. Also in the public media the decrease of Arctic sea ice has been discussed at various times. Whether the observed regional changes are indeed representative of the entire Arctic and Antarctic sea ice area will hopefully be clarified by CryoSat measurements. Interestingly, the sea ice extent in the Antarctic has increased slightly over the past 30 years, in contrast to the Arctic.

Parallel to the thickness measurements the per-cent-coverage of sea ice and its snow cover are determined with a digital video-camera and a radar, respectively, on long helicopter flights in order to calibrate various satellite sensors, especially the micro-wave sensors, which are not de---pen--dent on daylight and are not influenced by cloud cover or any weather disturbances. These sensors have delivered daily data on sea ice extent since 1973. The new sensors are very efficient, but demand a continuous improvement of the retrieval algorithms and their calibration and vali--da---tion.

Many greetings from the tip of the Antarctic Peninsula on behalf of all participants of the cruise,

Yours Peter Lemke
Polarstern, 62°57’S, 52°47’W