Weekly Report (Sept. 30 – October 7)

Geophysics Group
Belgica Station

The focus of work this week has been to characterize the snow and ice thickness and properties in two separate work areas of the Belgica Station. The first site (Fabra Site) is located approximately 200 meters off the starboard side of the NBP. The site typically contains thick snow cover over ridged and broken blocks of ice. Two geophysical transect lines were established approximately 100 meters apart and extended for 300 meters each. A level survey was performed at 1 meter increments along both transect lines to obtain snow surface elevation as referenced to sea level benchmark. Snow depths were also measured along the line at 1 meter increments. Ice thickness along both lines was measured using the EM-31 conductivity meter. The EM-31 meter calibration was based on the open water measurements obtained at Palmer Station. A 14m x 14m grid in which auger holes were drilled and ice thickness was gauged at 2 meter intervals will be used for further calibration of the EM-31 to local ice conditions. The measurements were used to construct transect profiles for the geophysical lines. The snow/ice interface was calculated based on surface elevation less the snow depth. Since the elevations are referenced to sea level, the snow/ice interface datum indicated the relative freeboard. Areas of negative freeboard were subsequently investigated by excavation of 12 snow pits along the lines in which the presence of flooded snow was verified and the thickness was measured. Based on these transects, it is estimated that 55% of Line 1 (man freeboard -0.006 cm) and 70% of Line 2 (mean freeboard -0.057 cm) are flooded at the snow/ice interface. Mean snow thickness of Line 1 is approximately 66 cm and Line 2 is approximately 73 cm. Mean ice thickness of Line 1 is approximately 2.45 m and Line 2 is approximately 2.40 m.
(see attached transect lines)

The second site (Brussels Site) is located approximately 1 km from the bow of the NBP. The site typically contains thinner (less than 1 meter) and relatively level ice with thin snow cover. Two geophysical lines were established at this site in the downwind location from the "clean" drilling operations. Again, level surveys of snow surface elevation, snow depth measurements and EM-31 ice thickness measurements were performed. Additionally, ice auger holes were drilled and ice thickness was gauged at varying intervals along the geophysical lines. The measurements were again used to construct transect profiles for the geophysical lines. Statistics on these lines are pending.

A number of snow pits were excavated to obtain snow temperature profiles, snow structure, and samples for analysis. Snow samples were analyzed for density, salinity, and O18 concentration (analyses pending). Snow wetness will be calculated based on the brine volume relation reported in Cox and Weeks.

The assessment of the temperature stability of the Iridium/GPS units for the drifter buoys was finalized this week with the downloading of the temperature record from three data loggers placed outside and within a buoy case. The case was deployed on the outside deck of the ship and allowed to transmit for approximately 5 days, during which time ambient air temperature ranged from -4 °C to -15 °C. The data record was sent to Cathy Geiger, the person responsible for monitoring drifter buoy tracks at CRREL and Helen Cusack of Trident Sensors (manufacturer of the drifter boards). Preliminary results indicated that insulating the unit retains enough internally generated heat to maintain board temperatures 5 to 6 °C above ambient air temperature. The issue of the instability of the electronics below -5 °C (sporadic and/or cessation of transmission) can, at the least, be partially addressed by enclosing the Iridium units in thermal insulation prior to deployment.