Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06923, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06923
EGU General Assembly 2008

Autonomous CTD and ice mass balance stations for the IPY

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The Arctic is one of the world's fastest warming regions, with both a marked decrease in sea-ice cover and an increasing freshwater input from river run-off. Despite this, the region is poorly measured and understood. During the IPY, a consortium of UK scientists plan to embark on a near-synoptic survey of the Arctic Ocean, under the recently funded Arctic Synoptic Basin-wide Oceanography (ASBO). The programme of *in-situ* observations, mounted from the Canadian heavy ice-breaker *Louis St. Laurent*, will be supported by the deployment of four autonomous stations specifically developed for the programme.

These free-drifting stations, tracked by GPS, will make observations of key environmental parameters above, within and immediately below the ice, and will feature a novel autonomous CTD package for making full-depth hydrographic measurements. At each station, near surface wind speed, direction, air temperature, pressure and humidity will be measured at a height of 2 metres above the sea ice surface using a Vaisala WXT510 multi sensor. Incident and reflected solar radiation, and incident and outgoing longwave radiation will be measured using Kipp & Zonen CNR net radiometers. These measurements will allow calculation of the sensible and latent heat fluxes. The meteorological measurements will be uploaded once an hour, with a subset of the data being distributed in real time to the global weather forecasting community via the GTS.

Three thermistor chains will be frozen into the ice: one to measure the diffusive heat flux within the floe, the other two to infer the position of the ice-water and ice-air inter-

faces respectively. These latter chains will also be operated in a ‘hot-wire anemometer’ mode to estimate boundary layer water and air speeds. The bulk ice and ice-air interface will be sampled every 12 hours, the ice-water interface every hour.

Daily CTD profiles will be performed using a sensor package attached to an autonomous winch, developed as part of the SAMS HOMER programme. The winch will lower the CTD from just below the ice to full ocean depth, using knowledge of its GPS position to consult a bathymetric look-up table. Data transfer between the CTD and the surface will be accomplished using an infra-red transceiver suspended below the ice. These measurements will be used to support oceanic heat flux determinations and to provide information on the halocline and deeper ocean.

The equipment will be powered for up to two years using conventional alkaline cells backed up by solar panels and lead-acid batteries. A webcam at each site will record twice-daily images of surface conditions. Data, commands, image ‘thumbnails’ and diagnostics will be transmitted in near real time via the Iridium satellite system, with the option to request full-resolution images as required.