

ARCTIC ICE RESEARCH BY SAMS FOR THE INTERNATIONAL POLAR YEAR

The Scottish Association for Marine Science (SAMS) is one of the partners of the International Polar Year. It has four autonomous stations to support in-situ observations of the Arctic Synoptic Basin-wide Oceanography program. The Kipp & Zonen CNR 1 net radiometer provides the four components of the radiation balance for every station.



The International Polar Year (IPY) is a large scientific programme focused on the Arctic and Antarctic from March 2007 to March 2009 (to cover 2 complete annual cycles). It represents one of the most ambitious coordinated international science programmes ever attempted. Over 200 projects are designed to explore the impact of climate change and the strong links these regions have with the rest of the globe. Previous IPYs were in 1882-3, 1932-3 and 1957-8. The Scottish Association for Marine Science (SAMS) is a partner in many of the Arctic IPY projects.

The Uncertainties Of The Arctic Environment

The Arctic has a major influence on global climate and is the fastest warming region of the globe. The delicately balanced¹⁰⁰⁰⁰⁰ eco-system is particularly vulnerable to natural and man-made impacts. In the summer of 2007 the ice shrank to the lowest area on record and in 2008 there was extensive open water less than 500 miles from the Pole at 83 degrees North.

Four Free-Drifting Stations

Every summer from 2003-2008 an international team of 24 scientists set out on a five week cruise on the Canadian Coastguard flagship, the heavy ice-breaker Louis S. St. Laurent. Their mission was to study sea ice in the Arctic Ocean, to monitor the effects of climate change and the shrinking ice cover. The major contribution of SAMS was to design and build a suite of instruments to measure the flow of heat between the sea, the ice and the atmosphere at temperatures down to -50°C.



SAMS deployed four autonomous stations to support in-situ observations of the Arctic Synoptic Basin-wide Oceanography program. These free-drifting stations are installed on ice floes to observe key environmental parameters, including the temperature at various depths in the ice, meteorological variables and solar radiation. Measurement of the four components of the radiation balance are provided by a Kipp & Zonen CNR 1 net radiometer mounted at a height of 2 meters above the ice. Two stations feature a novel Conductivity/Temperature/Depth (CTD) package with an automatic winch developed by SAMS to make hydrographic measurements from just below the ice to the ocean floor.

The equipment is powered for up to two years using batteries backed up by solar panels. A webcam at each site records twice-daily images of surface conditions. Data, commands, image 'thumbnails' and diagnostics are transmitted in near real time via the Iridium satellite system, with the option to request full-resolution images as required. The equipment was designed under the leadership of David Meldrum, who is a specialist in glaciology, oceanography and technology and is the only UK member of this IPY project team.

To quantify the energy balance David needed to measure incoming and reflected solar radiation, down-welling and up-welling far infrared radiation and to calculate albedo and energy fluxes. For this he required a high quality, reliable instrument with proven performance in polar conditions. Like many other scientists involved in research in polar regions and on glaciers, David chose the Kipp & Zonen CNR 1 net radiometer as a key component of the SAMS monitoring package.



The results of the project will be used to improve our ability to forecast the future of the sea ice and the resulting impacts on the animal and human population for whom the ice is the key to survival.

For more information on SAMS or the ice monitoring project go to www.sams.ac.uk or www.who.edu/beaufortgyre

