Arctic Ice, Atmosphere, Ocean Observing System : the EQUIPEX-funded IAOOS project

C. Provost[1], J. Pelon[2], J.C. Gascard[1], J.P. Pommereau[2], P. Lattes[1], M. Calzas[3], C. Drezen[3], A. Abchiche[3], N. Amarouche[3], A. Desautez[4], J. Descloitre[5]

[1] UPMC/LOCEAN, Paris, France; [2] UPMC/LATMOS, Paris, France; [3] INSU, Brest and Meudon, France; [4] IPEV, Brest, France ; [5] ICARE, Lille, France

The Arctic Ocean plays a very important role in climatology because of powerful feedback mechanisms such as the albedo, the main cause for global warming amplification in Arctic regions. The extreme reduction of the Arctic sea-ice cover at the end of the summer as observed recently, has a huge impact on the Earth radiative budget and fluxes at the air-surface interface. It is responsible for a warming of the upper ocean and of the lower atmosphere, a change of the atmospheric circulation (polar vortex and storm tracks), an increase of cold air outbreaks enhancing heat flux release and low cloud formation and sudden stratospheric warming events, an acceleration of Greenland ice melting and sea level rise and an increase of permafrost thawing releasing large amount of greenhouse gases into the atmosphere. There are lots of positive feedback mechanisms that are responsible for amplifying climate changes in the Arctic such as a shift in wind regime accelerating sea-ice motion and increasing sea-ice deformation, fracturing and ridging, producing more open waters, diminishing the albedo and increasing absorption of solar radiation by the upper ocean converted into heat melting more sea-ice.

The main objective and the most innovative part of the IAOOS project is to provide and to maintain an integrated observing system over the Arctic Ocean in order to collect simultaneously and in near real time, information related to the state of the upper ocean, the lower atmosphere and the Arctic sea-ice. The IAOOS main equipment is based on 15 autonomous platforms operating at any given time in the Arctic Ocean for a period of 7 years in total. Each platform is composed of 3 elements for oceanographic, sea-ice and atmospheric vertical soundings. Oceanic CTD profilers are derived from the ARGO float except they are tethered to a cable along which they can profile vertically from surface down to 1000m depth and transmit the data to the surface via inductive modems. The equipment for sea-ice is based on a combination of satellites (AMSR-E, Cryosat, ..) and ground based measurements collecting sea-ice thickness, snow depth and temperature profiles across the air-sea-ice interfaces. The equipment for the atmosphere is based on a combination of satellite (Calipso) and ground based measurements using autonomous and unattended microlidars and optical depth sensors. Arctic haze and aerosols layers are frequently occurring in the Arctic mid troposphere from early spring to summer but they are not easily detectable from space and would benefit from lidars and ODS ground based observations.

The fifteen IAOOS platforms will be drifting according to sea-ice motion, surface winds and ocean currents and it will be necessary to replace part of the fifteen platforms every year. It is anticipated that some of the fifteen platforms will be either drifting away from the central Arctic Ocean or being destroyed and lost every year. Replacing seven to eight platforms every year during five years following an initial deployment of fifteen platforms will amount to a total of fourty IAOOS platforms for the entire duration of the experiment.