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EGLACOM project: seismic and oceanographic data integration

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In the summer of 2008, a multidisciplinary combined offshore reflection seismic and oceanographic cruise was carried out along the southern Svalbard continental margin during the EGLACOM (Evolution of a GLacial Arctic COntinental Margin) project. This cruise was funded by the Italian Istituto Nazionale di Oceanografia e Geofisica Sperimentale (OGS) in the framework of the International Polar Year (IPY). The main objective of EGLACOM was the geophysical study of an ice-stream dominated marine depositional system of the Arctic margin. However, the high relevance of the area under the climatic and oceanographic point of view challenged the simultaneous acquisition of oceanographic data in order to study the overall thermohaline structures and ocean current circulation with a synergic seismic oceanographic approach. As documented by several recent papers (i.e., Holbrook et al., 2003, Nandi et al., 2004, Nakamura et al, 2006, Jones et al., 2008) and dedicated project (́Geophysical Oceanography (GO)ṕroject, 2007-2009, http://www.dur.ac.uk/eu.go), this approach allows to image oceanic fine-structures with greater horizontal resolution than traditional oceanographic methods.

The working area lies south of Fram Strait which is the only deep connection with the Arctic Ocean and the main entrance for the heat and salt flux associated to the northernmost part of the Atlantic Current. Ocean circulation has a fundamental role on the control of heat transport and on climate changes, which are particularly rapid and severe in the Arctic. In recent times, the Arctic ocean has undergone profound changes with dramatic reduction of ice cover and warming of its upper layers.

The hydrographic properties (i.e. temperature and salinity) and the circulation pattern (in terms of mesoscale features, vertical mixing and transport intensity) of the Atlantic Water (AW) inflow strongly influence the overall ocean circulation in the Arctic, which ultimately influences the climate. Recent studies show that the AW inflow is variable in nature, both in terms of heat content and of transport intensity, therefore a detailed study of its structure is of particular importance. In order to study the thermohaline structure and the spatial extension of the AW inflow with a seismic oceanography approach, about 1000 Km of multichannel seismic reflection lines were acquired simultaneously with several types of oceanographic data. Seismic data interpretation is supported by 60 XBT (Expandable Bathy-Thermograph) profiles obtained concurrently during the seismic acquisition, 6 additional CTD (Conductivity-Temperature-Depth) casts carried out within 10 days from the XBT launches and sea-surface temperature and salinity measured continuously by a thermosalinograph installed on the vessel prow. In addition, Vessel-Mounted Acoustic Doppler Current Profiler (VM-ADCP) data were acquired during navigation to continuously monitor the velocity distribution in the upper water column. The velocity field, together with the sea-surface temperature data from the NOAA-18 satellite were used to obtain information on the dynamic in the area.

The seismic data processing is still in progress as well as the elaboration of oceanographic data. The first results obtained display a good correlation between seismic reflectors and discontinuities in vertical temperature and salinity gradients. XBT sections and CTD profiles allow to recognise the spatial extension of the water masses of Atlantic and Arctic origin present in the area, and show the progressive cooling and shallowing of the warm and salty AW proceeding northwards.

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