

# **Special Issue: Proceedings of the Finnish National IPY Conference**

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## **Foreword**

The polar regions are facing increasing changes due to emerging resource exploitation, infrastructure development and the use of the Arctic Sea shipping route, as well as tourism and the predicted change in the climate. It is essential to investigate and understand how these environments respond to changes due to the complex interplay of biological, physical, chemical, and social processes. Only by understanding these systems will we be able to ensure their sustainable use and natural resource exploitation.

The Arctic and Antarctic areas are internationally important and attractive for scientific research because they are known to be the most sensitive areas to environmental and climate change. These areas have unique geographical locations and natural conditions, and therefore play a crucial role in various global-scale studies. Multi-disciplinary research on the polar regions is often emphasized. It improves our understanding of the interactions between all the components of Arctic and Antarctic systems, including the atmosphere, ocean, land, ice and biosphere, as well as social processes. Together, these studies will allow us to prepare for and adapt to the foreseen global impacts of future environmental and climate changes.

The First International Polar Year (IPY) from 1882–1883 was provoked by the Austrian explorer Karl Weyprecht, who believed that the fundamental problems of meteorology and geophysics were most likely to be found near the Earth's poles. Sodankylä and Kultala, at Ivalojoki River in Northern Finland, were among the original research sites of the First IPY. The Second IPY (1932–1933) was proposed by the International Meteorological Organization to promote advances in meteorology, magnetism, atmospheric science, and in the “mapping” of ionospheric phenomena. Arctic research escalated during the Second IPY. The International Geophysical Year (IGY) was held in 1957–1958 to celebrate the anniversaries of the First and Second IPYs, and it turned out to be a success. Among other achievements, the continental drift theory was confirmed, the world's first satellites were launched, and the first informed estimates of the total size of Antarctica's ice mass were yielded. The Kinnvika research station in Nordaustlandet, Svalbard, was originally built in cooperation between Sweden, Finland and Switzerland during the IGY. On 18 July 1957, the Finnish ship RV Aranda occupied Hydrographic Station No. 35 in Kinnvika, Murchisonfjorden during the first Finnish polar marine expedition.

Finnish Antarctic research intensified about 20 years ago, when the Finnish research station Aboa was built on Basen nunatak in 1988–1989, simultaneously with the Swedish station Wasa. Finland had signed the Antarctic Treaty a few years earlier (1984). The early days of Finnish Antarctic research included intense cooperation in geophysics and meteorology with Argentineans at Marambion (1988) on the Antarctic Peninsula, and in glacial and quaternary geology with Australians at Davis station (1988–1989) in Princess Elizabeth Land. Since then, more than ten scientific expeditions have been carried out in the Antarctic. In 1991, for example, there was Antarctic marine research expedition in the Weddell Sea. The Finnish Antarctic Research Program (FINNARP) has been responsible for arranging these expeditions, maintaining Aboa research station, and coordinating international logistic cooperation. On the other side of the globe, Finnish research in the Arctic and northern regions emerged in the 1980s because of fossil fuel resource exploitation in cooperation with former Soviet Union. Also in the 1980s, Finnish researchers were involved in the Marginal Ice Zone Experiment –program and joined the Arctic Ocean Science Board. The Arctic Centre in Rovaniemi was established in 1989, and the Arctic Council was established in 1996 (<http://www.arctic-council.org/>). Environmental protection and enhanced sustainable development, climate change, and natural resource exploitation have been the main objectives of Finnish activities in the Arctic and northern regions.

The IPY 2007–2008 was, once again, an international effort to coordinate and promote scientific research on the polar regions (<http://www.ipy.org>). Thousands of researchers from more than 60 countries and from a wide range of disciplines studied the Arctic and Antarctic, aiming to expand our current understanding of environmental and climate change and their global significance. So far, the IPY has highlighted the global importance of polar processes and the urgent need to understand and track the extremely rapid changes occurring at high latitudes. An additional and important mission of the latest IPY was an active promotion of science education and outreach. Finland's IPY 2007–2008 activities (<http://www.ipy-finland.fi>) included a variety of multinational collaborations, such as the Kinnvika (<http://www.kinnvika.net/>), DAMOCLES (<http://www.damocles-eu.org/>) and ICESTAR (<http://www.sos.siena.edu/~awetherwax/icestar/>) projects.

The research papers presented here are based on presentations given at the Congress of the International Polar Year (IPY) 2007/08, held at the Geological Survey of Finland from 12–13 November 2008. The congress covered a wide range natural sciences, including geology, geophysics, hydrology, atmospheric sciences, geography, marine research, geodesy, glaciology, and arctic geotechnics. It was organised by the Geological Survey of Finland, the Geological Society of Finland, the Geophysical Society of Finland, the Finnish National Committee of Quaternary Research (INQUA), and the Finnish National Committee on Arctic and Antarctic Research. The outcome of the conference was somewhat comforting, as the situation facing the continental glaciers in Greenland, Antarctica and the northern tundra in Siberia seems to be less dramatic than is often presented in the media. However, the climate and environment is changing, and there are many open questions and challenges concerning the behaviour and

responses of polar systems. Young scientists are urged to pack their rucksacks and travel to the remote Arctic frontiers to seek scientific facts, to face nature and our mother Earth and to gain some extraordinary experiences.

This publication contains 13 peer-reviewed papers that are based on presentations given at the Congress. The first paper by *Vihma et al.* introduces highlights of atmospheric surface layer research in the Finnish Antarctic programme during the last 20 years. A paper by *Sutinen et al.* suggest that snowmelt infiltration contributes significantly to ground water reserves. *Pirazzini and Meinander et al.* then discuss about challenges related to of snow and ice albedo measurements and parametrization. *Ruotoistenmäki and Lehtimäki and Korhonen et al.*, as well as *Vanhala et al.*, present the applicability of geophysical measurements in permafrost related studies. *Immonen et al.* and *Valppu et al.* discuss about interglacial-glacial climate change based on marine sediment records from Antarctic and Arctic sites. *Paatero et al.* presents results from recent ARCOS expedition, and *Virkkula et al.* introduces a review of aerosol research at the Finnish Antarctic research station Aboa. Finally, *Marnela et al.* and *Rudels et al.* present results from studies of circulation and water mass transformation and double-diffusive convection of the Arctic Ocean, respectively.

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