Periglacial and Permafrost Research section

A prominent feature of the cold and glacier-free land areas, the periglacial realm, is the presence of deeply and permanently frozen soils and sediments. Such permafrost underlies around a fourth of the Earth's land surface. The working group on periglacial research applies a geoscientific and biological approach, to study climate-relevant environmental processes in permafrost regions of Siberia and North America. The main goal is to infer their role in the course of global change

▲ *Reticular structures of ice-wedge polygons in the permafrost landscape. (photo: K. Piel)*

during the present and past. The investigations are mainly carried out within the framework of German-Russian and other international cooperations.

A major contribution is the reconstruction of the Siberian geoecosystems during the last approximately 200,000 years. Climate-relevant information is stored in ice-rich permafrost and in lake deposits of the periglacial regions. It is decoded through sophisticated dating methods and a multidisciplinary analysis of the ground substrates, comprising soils, ground ice, lake muds, and preserved microfossils. These efforts provide insights into the nature of periglacial conditions through space and time, with special emphasis on landscape development, changes in ecology, vegetation history, carbon dynamics, and fluctuations in temperature and precipitation.

Investigations on the present-day processes acting in the periglacial environment provide the know-

▲ *Frozen Lake Billyakh in the wintry Verkhoyansk Mountains of eastern Siberia. The tripod is used for coring and sampling lake mud (photo: B. Diekmann)*

ledge for the interpretation of the information obtained from the environmental archives. Focal points concern small-scale permafrost dynamics, coastal erosion, submarine permafrost distribution, river discharge, as well as microbial trace-gas release of methane and carbon dioxide from permafrost soils and its climatic role for the globally increasing greenhouse effect.

Cover photo: Atmospheric observatory of the French-German research base on Spitsbergen, with balloon hangar and tethered balloon (photo: A. Hoffmann) ▶

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Research Unit Potsdam

Alfred Wegener Institute
for Polar and Marine Research
in the Helmholtz Association

HELMHOLTZ ASSOCIATION

Research Unit Potsdam
Alfred Wegener Institute for Polar and Marine Research

The Potsdam Research Unit was established as a branch of the Alfred Wegener Institute for Polar and Marine Research (AWI) in 1992. The AWI has its headquarters in Bremerhaven and is an institution of the Helmholtz Association of German research centres. The Potsdam Research Unit is located on Telegrafenberg, a site with a long scientific tradition. Together with the Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences, the Potsdam Institute for Climate Impact Research, and the Astrophysical Institute Potsdam, it constitutes the 'Albert Einstein' science park. The AWI scientists in Potsdam deal with climate processes in the polar atmosphere and the environmental conditions and changes in ice-free permafrost regions of Antarctica and the polar to subpolar Arctic. These topics broaden the research profile of the Alfred Wegener Institute in Bremerhaven, which concentrates on sea and glacial ice.

The Potsdam Research Unit coordinates the programme of the French-German Arctic research base AWIPEV in Ny-Ålesund on Spitsbergen. The extensive array of equipment available there for measuring meteorological, atmospheric physical and chemical parameters is used, among other things, to investigate processes in the Arctic ozone layer and the climate effectiveness of tropospheric aerosols.

In the Lena Delta (northeast Siberia) the Russian-German Samoylov research station is being operated jointly with the Lena Delta Reserve as a base for geoscientific and microbiological process studies, meteorological observations, and long-term studies on local trace gas and energy flows from permafrost since 1998.

Atmospheric Circulation section

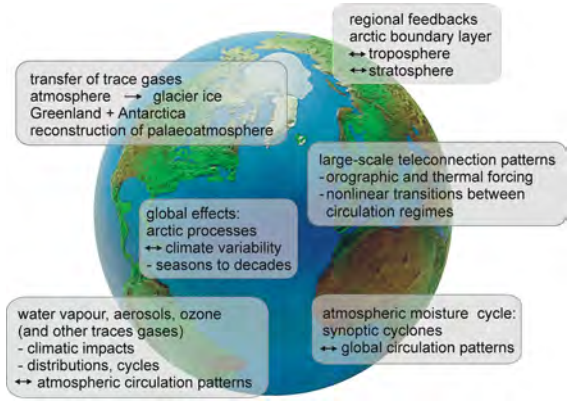
The main objective of the atmospheric research working group is to measure and model the key physical and chemical processes of the polar atmosphere in the atmosphere-ocean-ice system and assess their role in the development of the global environment and climate.

◀ *Expedition to the Arctic: start of an ozone probe on ice floe NP-35, in the foreground a red tethered balloon. (photo: J. Graeser)*

Since understanding of the causes of natural climate variability and the complex interaction with the current anthropogenic changes in the composition of the atmosphere is inadequate, it is possible to forecast the climate only to a limited degree.

Climate and tracer studies on the polar troposphere and stratosphere are aimed at a better understanding of the regional and global mechanisms driving climate change.

Close interlinkage between pilot studies and observation is necessary in order to analyse dynamic and chemical processes in the Arctic atmosphere, examine the influence of changes in sea ice cover and in the ocean and understand the natural variability of the system.



▲ Focal points of atmospheric research

In addition to long-term observations at the AWIPEV research base on Spitsbergen, expeditions to the central Arctic in particular provide major contributions in this context. Data acquisition regarding atmospheric parameters from drifting stations in the ice or in connection with measurements with the Polar 5 research aircraft concentrates on processes in the Arctic boundary layer that represents the link of the coupled atmosphere-ocean-sea ice system.

The high-resolution regional climate model HIRHAM is the most important tool for precise examination of climate processes in the Arctic atmosphere and is used in connection with observations to interpret consistent climate data in regions that are not easily accessible.

A hierarchy of climate models with increasing complexity from simplified models of the atmosphere all the way to global models of the coupled atmosphere-ocean-sea ice system is used to detect signals of natural variability and understand the influence of large-scale dynamic variability. The pilot studies are supported by atmospheric measurements in the polar regions. Continuous measurements at the AWIPEV research base permit conclusions to be drawn about long-term changes. Measurement campaigns are conducted with aircraft and ships as well as at ground stations for a better understanding of the key processes.