

# Research aircraft Polar 5 returned from spring measurements in the high Arctic

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The research aircraft Polar 5 of the Alfred Wegener Institute for Polar and Marine Research in the Helmholtz Association returned to Bremerhaven from a six-week expedition in the high Arctic on May 6. Joint flights with aircraft of the European and American space agencies (ESA and NASA) were a novelty in sea ice research: Simultaneous measurements with a large number of sensors on three planes underneath the CryoSat-2 satellite led to unique data records. Furthermore, the international team composed of 25 scientists and engineers collected data on trace gases, aerosols and meteorological parameters that will be evaluated at the research institutes involved in the coming months.

The route of the Polar 5 of the Alfred Wegener Institute for Polar and Marine Research in the Helmholtz Association took it from Barrow (Alaska) via Inuvik, Resolute Bay, Eureka, Alert (all in northern Canada) and Station Nord (Greenland) all the way to Longyearbyen on Spitsbergen. These sites were the base stations for the measurement flights to the uninhabited Arctic areas. The total flight time, including measurements and travel time, came to 130 hours. Temperatures below minus 30°C in some cases were a challenge for both team and material.

One of the key aspects of the expedition were large-scale [sea ice](#) thickness measurements in the inner Arctic, in which researchers of the Alfred Wegener Institute and the University of Alberta cooperated closely. For this purpose they used a four metre long electromagnetic ice thickness sensor, called EM Bird. The Polar 5 towed the sensor on an 80 metre long rope at a height of 15 metres above the ice surface for the

surveys. A preliminary evaluation of the measurement results shows that one-year-old sea ice in the Beaufort Sea (north of Canada/Alaska) is about 20-30 centimetres thinner this year than in the two previous years. In 2009 the ice thickness was 1.7 metres on average, in 2010 1.6 metres and in 2011 around 1.4 metres. "I expect that this thin one-year-old sea ice will not survive the melting period in summer," Dr. Stefan Hendricks assesses the situation. In several weeks his colleagues from the sea ice group at the Alfred Wegener Institute will present their model calculations for the sea ice minimum in 2011, which will also include the data now collected.

Joint flights with other polar research aircraft below the orbit of the ESA (European [Space Agency](#)) CryoSat-2 satellite marked the highlight of the sea ice thickness measurements. This satellite has been surveying the Arctic sea ice from an altitude of 700 kilometres since summer 2010. The coordinated measurement flights with ESA and [NASA](#) aircraft served the purpose of examining the accuracy of CryoSat-2 [ice thickness](#) measurements in spring.

Arctic [aerosols](#), which play a role in the formation of clouds, among other things, were another key aspect. Aerosol distribution and the carbon content of the particles in the Arctic were mapped by means of several vertical and horizontal profiles at a low altitude of 60 metres and at a normal flight altitude of 3000 metres. The aircraft measurements were coordinated with the overflights of the CALIPSO satellite, which records global aerosol and cloud distribution data from space. Moreover, meteorological soundings in the central Arctic as well as measurements of trace gases, such as ozone, were carried out. They confirmed the measurements of 2009 that showed very low ozone concentrations over large sections of the Arctic Ocean covered by sea ice. By combining all trace gas measurements in connection with meteorological measurements, it will be possible to better understand the processes of ozone depletion in the air layers up to an altitude of approx. 15

kilometres (troposphere).

"Only through close international cooperation between all partners was it possible to successfully implement this logistically complex campaign with sites in four Arctic bordering states," summarises Dr. Andres Herber, the leader of the expedition. The PAMARCMiP project (Polar Airborne Measurements and Arctic Regional Climate Model Simulation Project) has been running since 2009 and involves regular aircraft measurements in the [Arctic](#). The institutions taking part were: the Alfred Wegener Institute, Fielax, Jadehochschule (Germany), Environment Canada, University of Alberta, York University (Canada), National Oceanic and Atmospheric Administration, NASA, University of Alaska Fairbanks, National Science Foundation (USA).

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