DACEE

Declining Arctic sea ice cover and its effect on the frequency and severity of weather extremes in Central and Eastern Europe

Principal investigator

Maciej Miernecki
maciej.miernecki@gmail.com

DEPARTMENT OF POLAR AND MARINE RESEARCH, Institute of Geophysics Polish Academy of Sciences

Areas of contribution

Polar-lower latitude linkages
Policy-relevant / cultural aspects
Economic aspects

Summary

In this project, we will focus on the changes in frequency and severity of weather extremes in Central and Eastern Europe induced by the rapid transition in the Arctic environment. Special attention is given to the events with high social and economic impact, such as extreme precipitation events, cold surges and heat waves.

Description

DACEE is a two-year project financed by Foundation for Polish Science (FNP) and/or National Science Centre (NCN) carried out at the Institute of Geophysics Polish Academy of Sciences (IGF-PAS) in the Department of Polar and Marine Research. The project aims to quantify the effects of changing Arctic-midlatitude linkages and connections to the weather extremes.

The pace in which Arctic environment is changing due to global climatic forcing is especially visible with
Arctic sea ice. The rapid decline in sea-ice thickness and summer coverage in recent decades had sparked a vivid discussion in the scientific community, as what implications it will have for the mid-latitudes. DACEE will contribute to the polemic by analysing past and future teleconnections between the Arctic and Central and Eastern Europe. The project is based in three work packages.

The first Work Package is dealing with “The Past”, namely it is concentrated on the analysis of the available remote sensing data concerning sea-ice concentration (SIC), sea-ice thickness (SIT), sea-surface temperatures (SST), sea-ice drift, and the reanalysis with a focus on the Central and Eastern Europe. The objective is to identify the most prominent teleconnections in the existing data. In this step, the ECMWF „YOPP Dataset“ (coupled analysis and forecast, including model tendencies) will prove a valuable tool, as it is designed to accommodate the extensive measurements carried out during YOPP. This specific, short-term reanalysis will contain intermediate fields which can prove vital for the short-term forecasting. The high temporal resolution of this data will allow for investigation of the weather pattern connections on the day to weeks scale which is the scale of interest for the operational weather services. Applications such as forecasting weather extremes and prediction of particular storm tracks will benefit from this approach.

The second Work Package is concentrated on “The Future”. This part of the project is dedicated to the analysis of the CMIP6 model experiments. The objective is to investigate the influence of the shrinking Arctic sea-ice cover on the Central and Eastern Europe weather extremes under different climate scenarios. The analysis will be done with the emphasis on indices for monitoring changes in the extremes – the ETCDI (named after Expert Team on Climate Change Detection and Indices), for instance, the cold spell duration indicator, the growing season length, the number of very heavy precipitation days. This part of the project bears a special significance for stakeholders, as the information of the severity and frequency of extreme climate events is essential for long-term planning and funds allocations by local governments and industries.

The third Work Package is focused on improving the measurements of sea-ice properties entitled: “Improving the Measurements”. The core activity in this work package is to establish a year-round marine surveillance radar station at the mouth of the Spitsbergen fjord Hornsund, as a part of existing infrastructure of the Polish Arctic research station “im. Stanisława Siedleckiego”. Preliminary studies with the device at this location show the possibility of tracking sea-ice movement up to 20 nautical miles off the coast. This location will also allow for observation of glacial ice originating from the fiord. The systematic information on sea-ice movement, carried with the Sorkapp current, will serve for validation of the sea-ice drift derived from Sentinel1. An optional, secondary activity in this work package is connected to the validation of remote sensing measurements of snow and ice properties during the MOSAiC experiment. This project part depends on third-party financing, therefore is not considered as a core activity. The objective of this part is the improvement of sea-ice thickness and snow thickness retrieval algorithms from L-band radiometry. These are two factors crucial to sea-ice growth and heat transfer from the ocean.

**Timeline**

2019-01-01 - 2020-12-31

**Regional emphasis**
Northern hemisphere: Yes

Southern hemisphere: No

**Key project deliverables**

- Is more data used in ECMWF „YOPP Dataset“ leading to more predictability of weather patterns in Europe?
- Regional map of predicted weather extremes for decades to come
- Local sea-ice drift maps from Sentinel 1 SAR

**Data management**

data will be available upon request from Institute of Geophysics Polish Academy of Sciences.

Is data provided to WMO Global Telecommunication System

No