ARCTIC CLIMATE AND ENVIRONMENT OF THE NORDIC SEAS AND THE SVALBARD - GREENLAND AREA (AWAKE)

(general information about project)

Atmospheric Reconstructions over the Earth (ACRE)
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Rajmund Przybylak[1], Jan Piechura[2], Andrzej Araźny[1], Marek Kejna[1]

[1]- Nicolaus Copernicus University, Institute of Geography, Department of Climatology, Toruń, Poland

[2]- Institute of Oceanology PAS, Sopot, Poland

e-mail: rp11@umk.pl

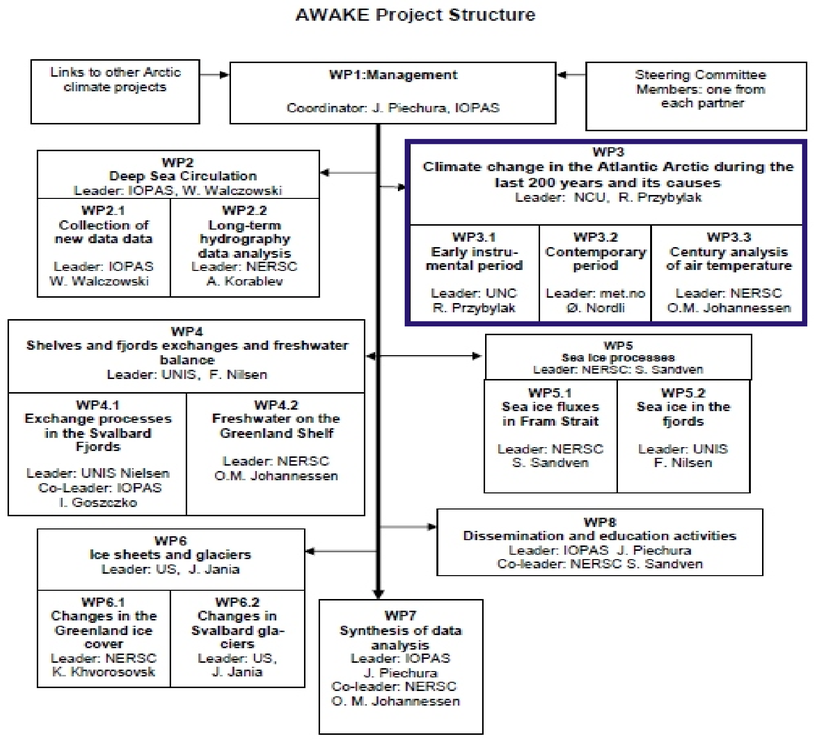
PROJECT OVERVIEW

The aim of AWAKE project is to study changes in atmosphere, ocean, sea ice and glaciers in the Atlantic sector of the Arctic in order to improve our understanding of the dramatic climate change in this region. Experienced scientists from Poland and Norway will join theirs resources, skills and knowledge to investigate key processes, links and interactions between atmosphere, ocean and glaciers. Climate change in the Arctic has large impact on environment, socio-economic conditions in Europe and world-wide. AWAKE will contribute to improved knowledge of Arctic climate processes, which is essential for climate change impact assessment and policies.

The main climate processes in the Arctic includes meridional overturning circulation, ocean-atmosphere heat exchanges including sea ice, and mass balance of glaciers. Northward transport of warm, salty Atlantic Water and export of the fresh water from the Arctic Ocean have impact on regional and global climate. The focus of AWAKE is to improve the observations of air-ice-ocean variables needed for understanding the present climate change.

The work tasks of AWAKE include studies of deep ocean circulation, exchanges of water masses between shelves, fjords and the deep ocean, long-term air temperature changes, sea ice processes, and changes of glaciers and ice sheets. Data from previous field experiments, historical records and new field observations will be compiled and analyzed. Special attention will be paid to the longest time series of air temperature records from Svalbard. Historical data sets will be validated and prolonged back to the XIX century. Also the oceanographic database for the Nordic Seas and the Arctic will be extended with new data.

AWAKE has a multidisciplinary approach where data from atmosphere, ocean, sea ice and glaciers are analyzed and compared with model results. Collection and analysis of more observational data from field observations will allow better processes parameterization and models validation. The work tasks of AWAKE will be carried out in close cooperation with other ongoing projects funded by EU and nationally. Existing research infrastructure and resources such as ships, field equipment and scientific personnel provided by the Polish and Norwegian partners will be basis for new field observations to be conducted in AWAKE.



WP 3. Climate Change in the Atlantic Arctic During the last 200 Years and its Causes

Work description (outline):

1. HISTORICAL DATA COLLECTION AND RECONSTRUCTION:

Two kinds of activities will be conducted within this part of the WP3:

1) reconstruction of historical climate for the entire study area based on documentary evidence, which will be gathered mainly in libraries and archives located in different institutions in Norway, Great Britain, Sweden, Denmark, Finland and Russia,

2) reconstruction of Svalbard climate for the turn of 19th and 20th centuries based on campaign measurements performed with automatic weather stations (AWS) in historical four sites, where meteorological stations previously have been operating.

Within the first activity, the standard climatological methods (including quality control and time-series homogenisation methods) will be used to check (data quality) and to conduct calculations of a number of statistics needed to describe climatic conditions. Metadata files collection will be created for comprehensive data quality control providing.

Both time and spatial changes of different climate and environmental variables will be investigated. Arctic climate reconstructions based on proxy data and inversions of equilibrium well temperature logs will be compared with the early instrumental data available from the project.

Similarities and differences between historical and modern climates will be identified and the probable causes of changes will be investigated.

Within the second activity, changes of the temperature climate of Svalbard will be carefully studied by use of campaign measurements performed with automatic weather stations (AWS). These will be located at historical sites at Svalbard, where old meteorological stations previously have been operating (Fig. 1, yellow circles). Based on the parallel measurements at the campaign sites and the currently running weather stations, statistical relationships will be established for various atmospheric circulation conditions. These relationships will be used to assess temperature conditions at the present weather stations in periods of the late 19th and early 20th century (i.e. before they were started), and to produce long (~100 years) monthly temperature series for the campaign sites.

1 - Mossel Bay
2 - Kapp Thordsen
3 - Hvalfiskpynt
4 - Andersonsøy
5 - Akseløya
6 - Treurenberg
7 - Kap Lee
8 - Zieglerøy
9 - Storøy
10 - Bjørnøya
11 - Svalbard Lufthavn
12 - Isfjord Radio
13 - Adventbai
14 - Halvmaanesøy

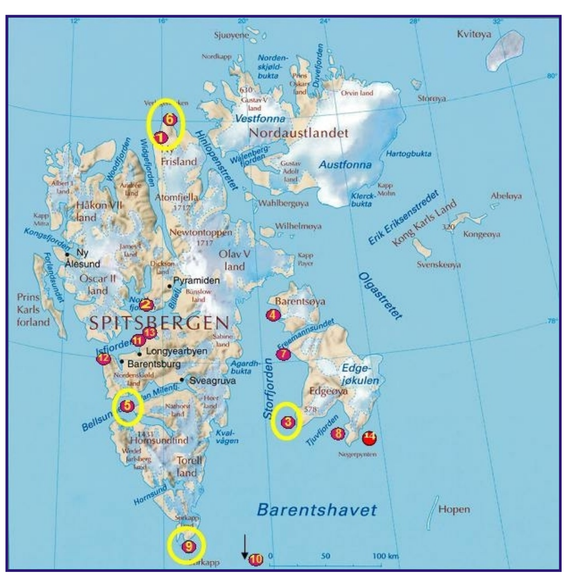


Fig. 1. Location of meteorological stations in Svalbard in the historical period

2. METEOROLOGICAL OBSERVATIONS AT THE WEST-EAST CROSS-SECTION THROUGH PRINS KARLS FORLAND, FORLANDSUNDET, KAFFIOYRA AND WALDEMAR GLACIER AS WELL AS IN THE ST. JONSFJORDEN REGION.

Objectives:

- **to describe topoclimatological differences in the western part of Spitsbergen,**
- **to establish the influence of Prins Karls Forland on the climate of central part of Spitsbergen,**
- **to determine the influence of the ocean on the Spitsbergen climate.**

Description of work:

10 AWS (Automatic Weather Stations) measuring main meteorological elements including solar irradiance will be established at a west-east cross-section through Prins Karls Forland, Forlandsundet, Kaffioyra and Waldemar Glacier (Figs. 2-6). Year round continuous measurements of temperature and humidity will be performed and compared with oceanographic, glaciological, and hydrological data. The role of the atmospheric circulation in shaping weather and climate in the study area will also be investigated using circulation types (Niedzwiedź's catalogue) and different circulation indices (e.g. NAO, AO).

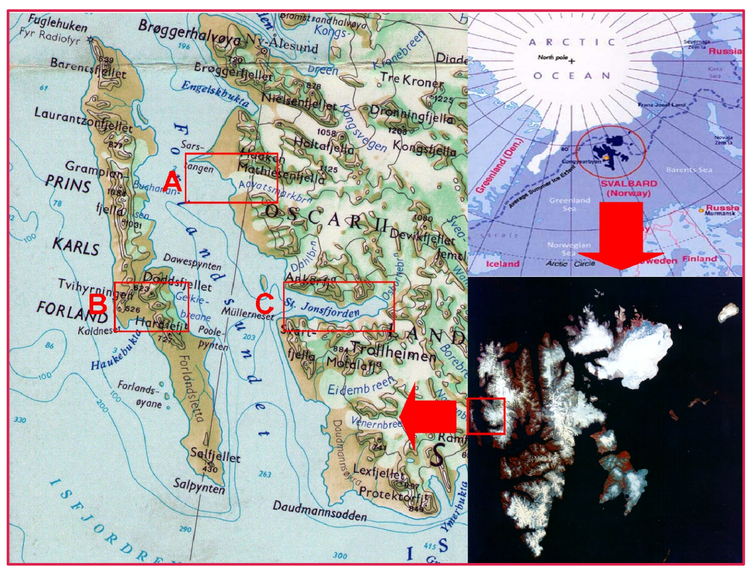


Fig. 2. Location of study area in NW Spitsbergen

Fig. 3. The main meteorological station on the Kaffioyra Plain (NW Spitsbergen)

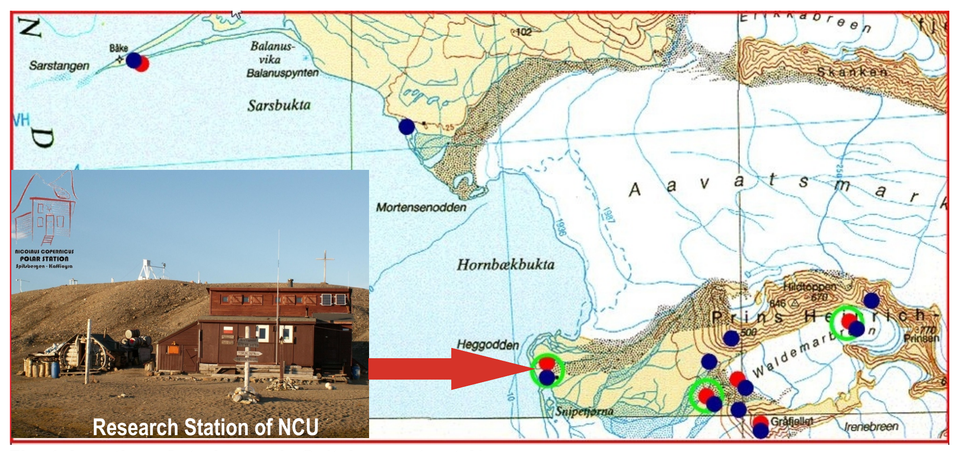


Fig. 4. Location of study area in Spitsbergen (part A)

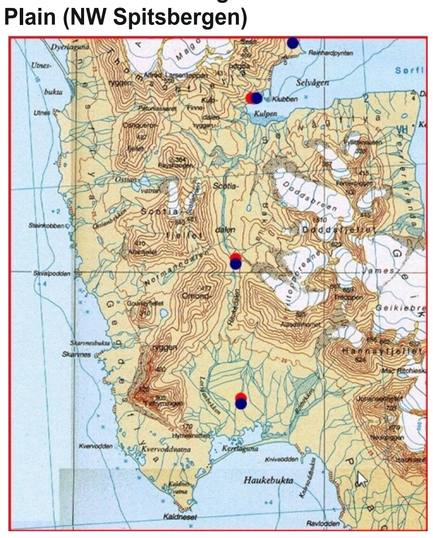


Fig. 5. Location of study area in Spitsbergen (part B)

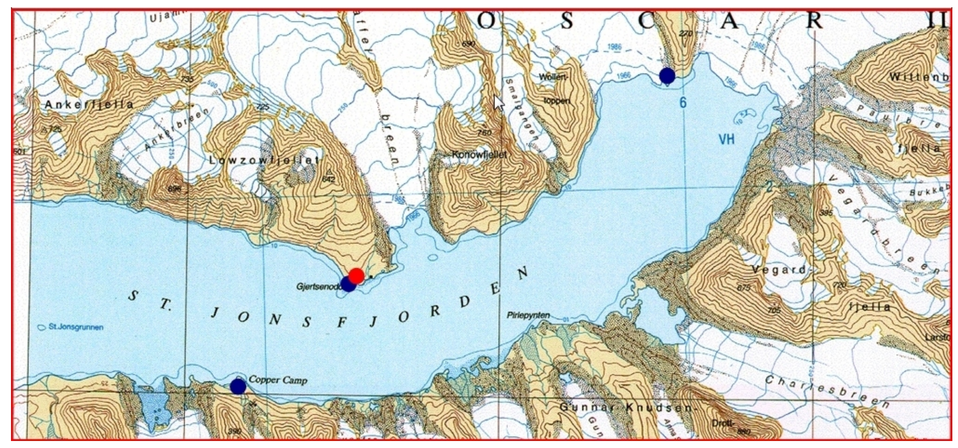


Fig. 6. Location of study area in Spitsbergen (part C)

- AWS (meteorological elements: T, H, AP, V, P etc) - summer season
- CNR4 (radiation balance - net radiometer) - summer season
- LM (meteorological elements: T, H) – whole year

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