

AWAKE-2

Arctic climate system study of ocean, sea ice and glaciers interactions in Svalbard area

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PARTNERS

- Institute of Oceanology, Polish Academy of Science, *Sopot* (project promoter)
- Nansen Environmental and Remote Sensing Center, *Bergen*
- Norwegian Polar Institute, *Tromsø*
- The Norwegian Meteorological Institute, *Oslo*
- The University Centre in Svalbard, *Longyearbyen*
- Nicolaus Copernicus University, *Torun*
- University of Silesia, *Sosnowiec*
- Institute of Geophysics, Polish Academy of Sciences, *Warsaw*



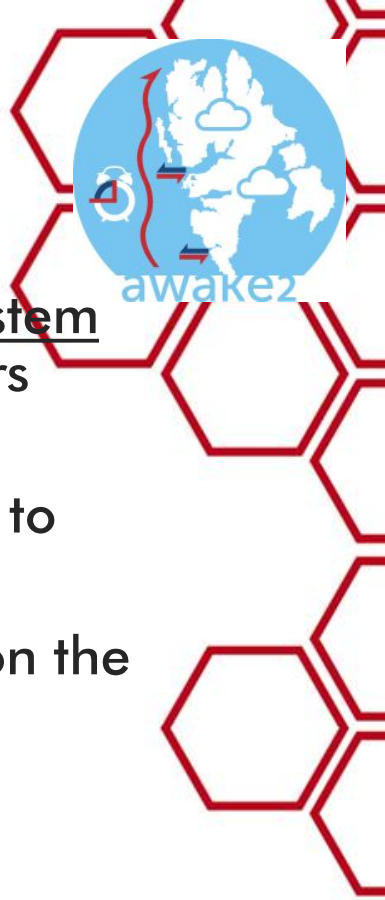
BASIC INFORMATION

- The implementation period: ` May 2013- April 2016
- Budget requested: 4098604 PLN
- Budget received: 4056284 PLN



OBJECTIVES

- AWAKE-2 is the multidisciplinary research project investigating the Arctic climate system where the ocean interacts with the atmosphere, sea ice, fjords and tidewater glaciers
- The aim of the AWAKE-2 is to understand the interactions between the main components of the climate system in the Svalbard area: ocean, atmosphere and ice to identify mechanisms of interannual climate variability and long-term trends
- The project investigate climate processes on regional scale which can have impact on the entire Arctic climate system.
- The interactions between hydrosphere, cryosphere and atmosphere is studied on regional scale and will be a contribution to polar research.



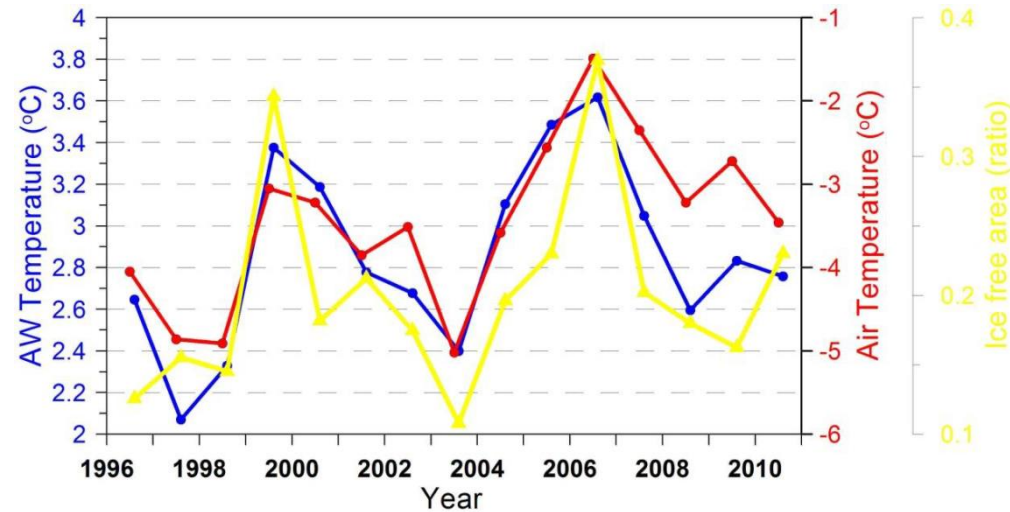
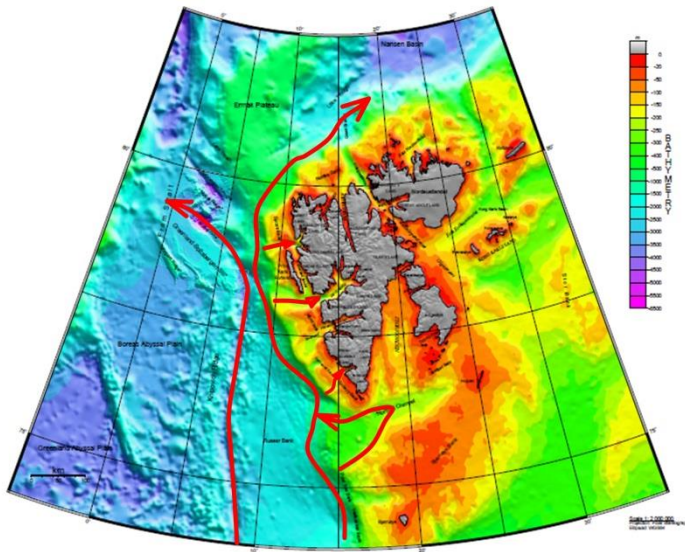
RESEARCH MOTIVATION

- Fjords - the regions where the interaction between the ocean and land is very strong;
- Arctic fjords - especially important because of the glaciers descend to the sea (tidewater glaciers);
- Retreating of Arctic glaciers is getting faster, glaciers are an important source of freshwater;
- Extremely important role of fjords as life habitats;
- Very fast environmental changes observed in recent years;
- Lack of multidisciplinary programs.



RESEARCH ASSUMPTIONS

- The significant role of the ocean (West Spitsbergen Current) for creating a climate of Western Svalbard;
- The significant role of the Atlantic origin waters inflow in the shaping of the physical conditions in the fjords (temperature, salinity);



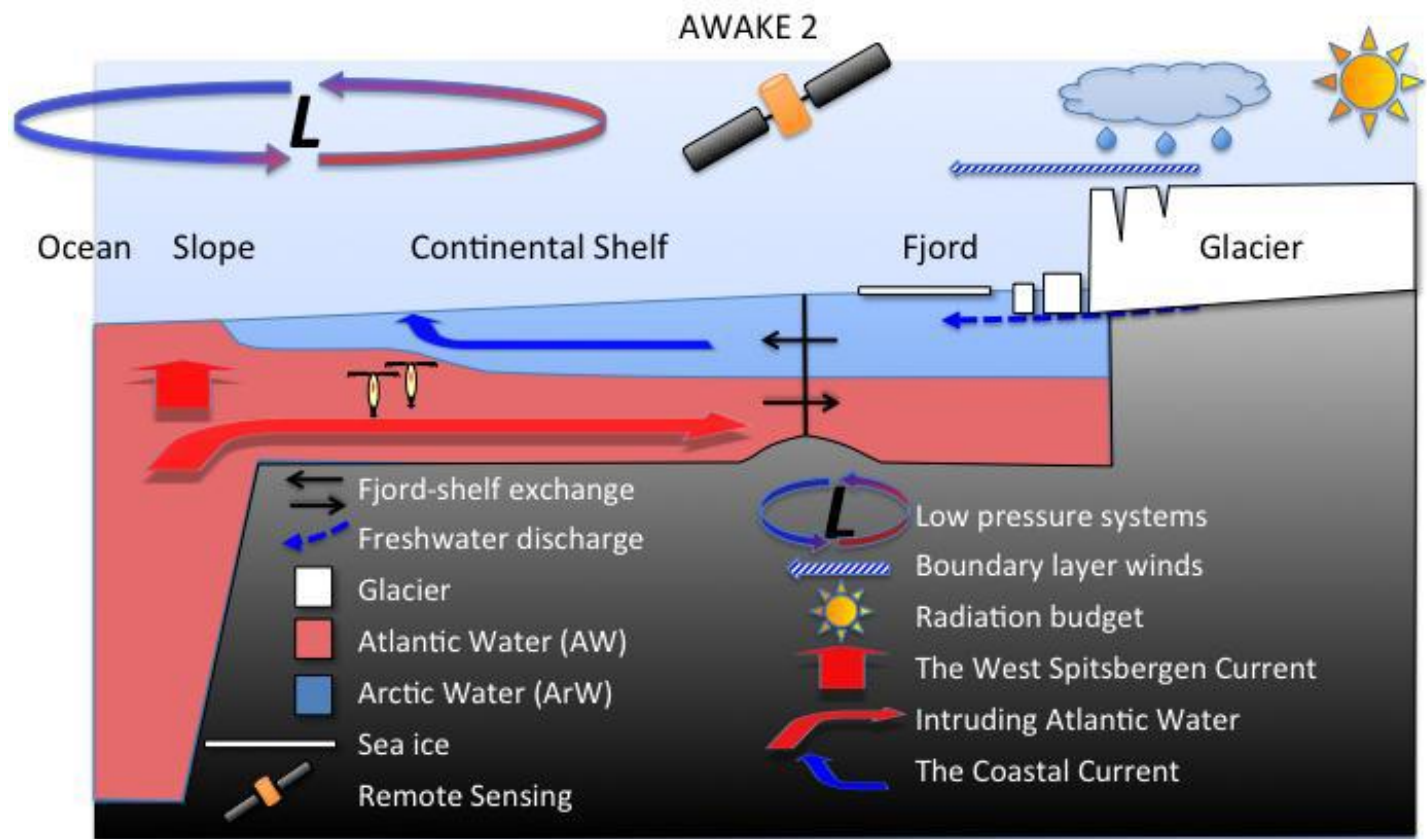
THE LEADING HYPOTHESIS

The leading hypothesis is that the acceleration and retreat of glaciers is a response to forcing in the maritime part of the glacier due to the variability of oceanic, atmospheric forcing, or both.

Mechanisms:

- The increase in the intensity of the underwater melting on the border of the ice-ocean.
- Reduction and weakening of the ice pack on the forehead of the glacier;
- Increasing the number of cracks, reduced structural integrity of glacier due to increased surface heating and melting.





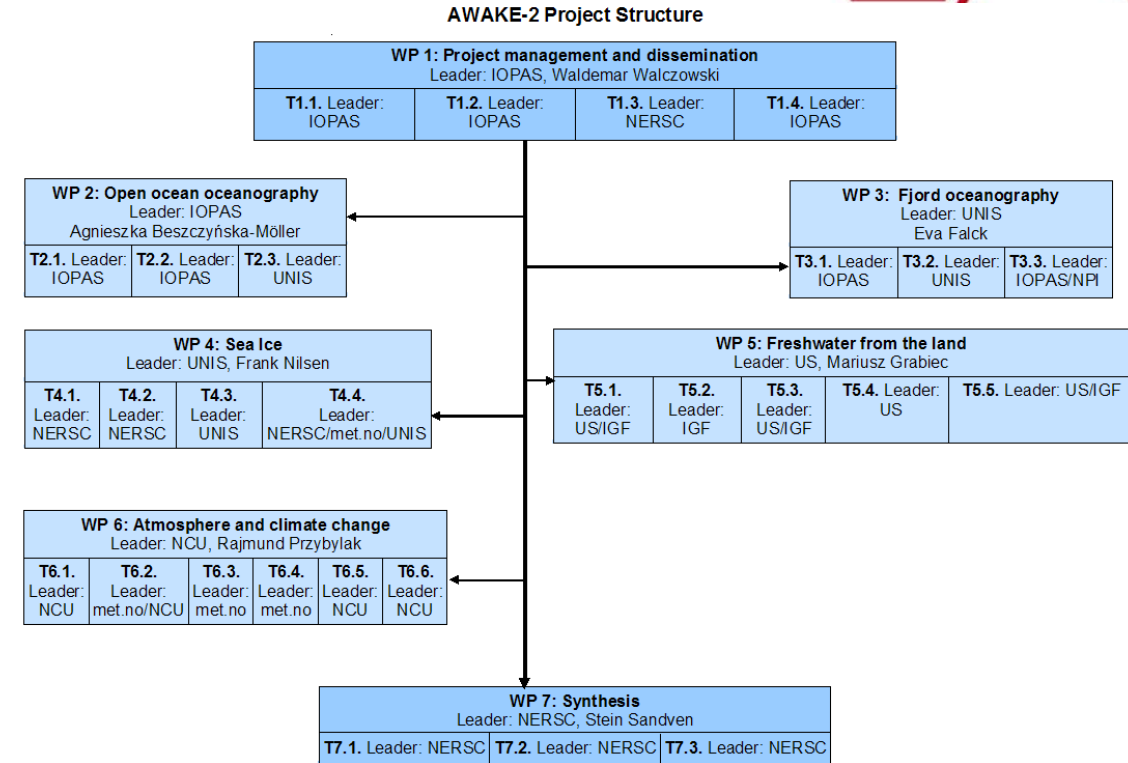
Open ocean (WP 2) Fjords (WP 3) Sea ice (WP 4) FW from land (WP 5) Atmosphere (WP 6)



PROJECT STRUCTURE

The project includes seven thematic work packages (WP1 -WP7):

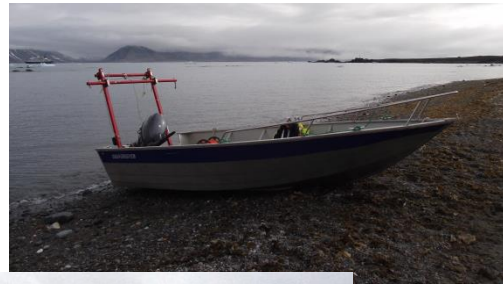
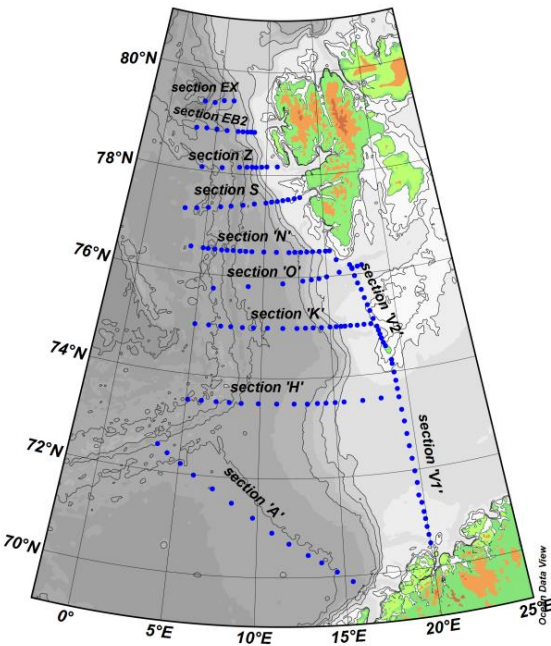
- WP 1: Project management and dissemination
- WP 2: Open ocean oceanography
- WP 3: Fjord oceanography
- WP 4: Sea Ice
- WP 5: Freshwater from the land
- WP 6: Atmosphere and climate change
- WP 7: Synthesis





MEASUREMENTS

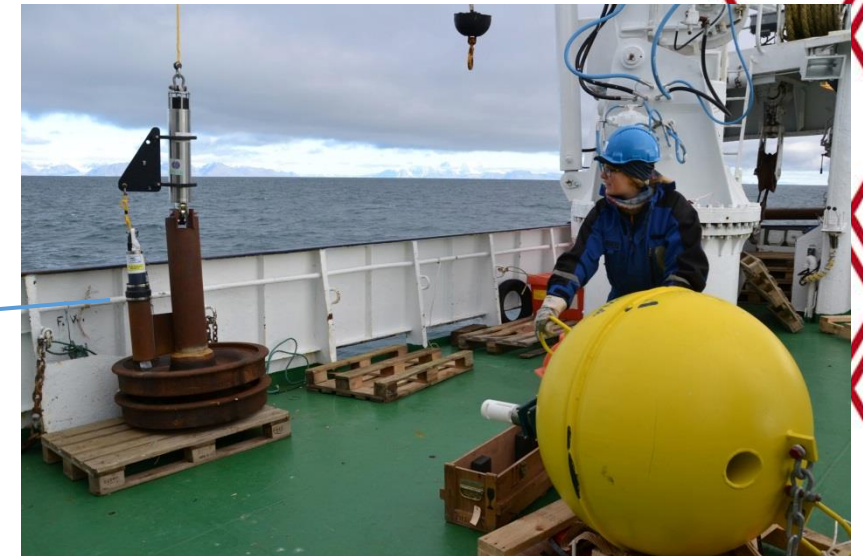
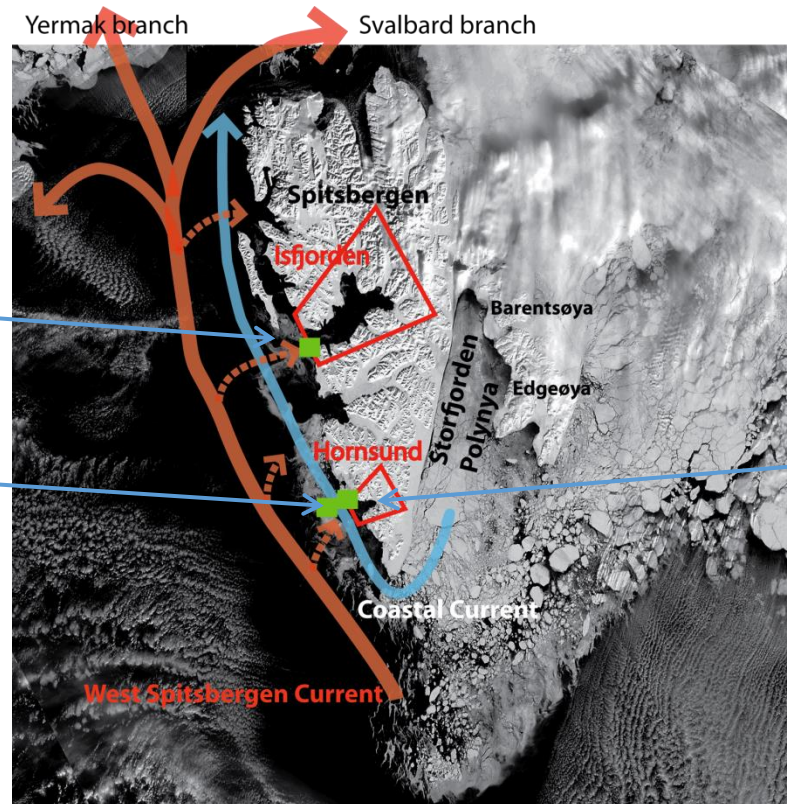
- The dedicated, multidisciplinary approach to achieve the project's aims is adopted by carrying out the coordinated meteorological, oceanographic, glaciological and geophysical observations in Hornsund and on the adjacent shelf and open sea.



Monitoring Atlantic and Arctic Water circulation



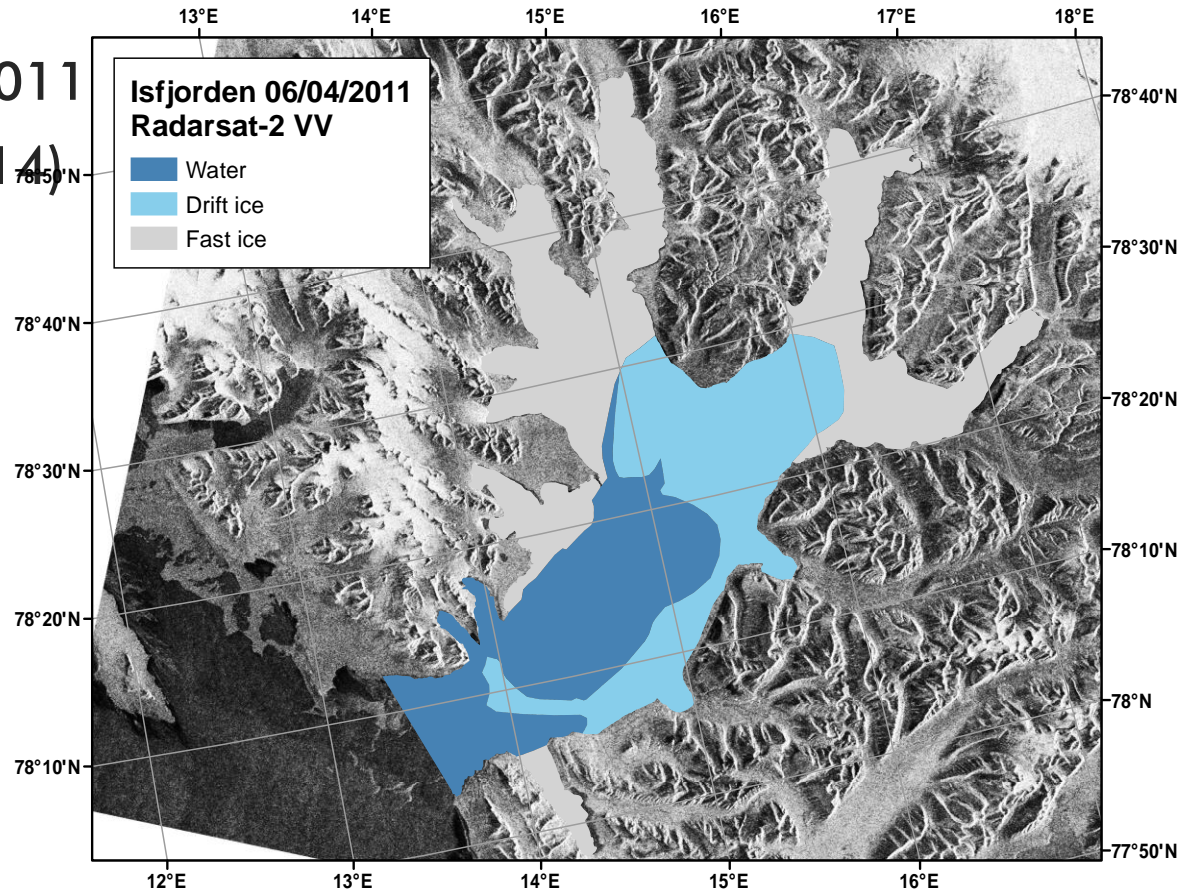
- Atlantic water inflow to Isfjorden
- Coastal Current and freshwater fluxes
- Sea ice monitoring of Isfjorden and Hornsund



Ocean bottom pressure moorings
(on R/V Håkon Mosby Sep 2014)

Sea ice cover in Isfjorden and Hornsund

- Radarsat-2 image April 6th 2011
- Sea ice time series (2000-2014) from remote sensing.
- Sea ice classification in Fast ice and Drift ice.



Muckenhuber et al. (2015), TCD

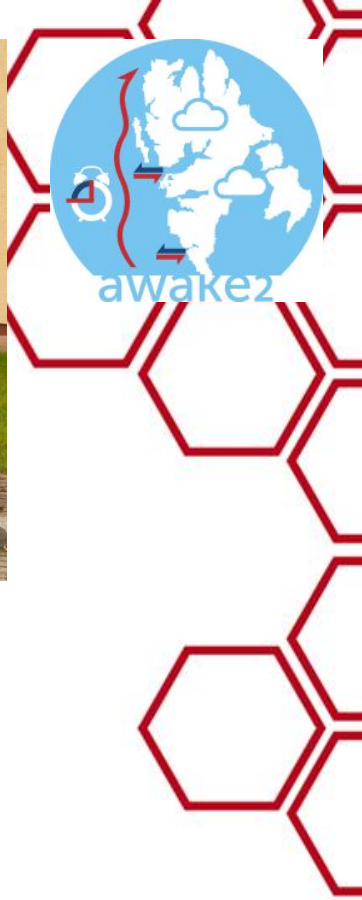


COLLABORATION

- Joint measurements;
- Logistic support;
- Project Meetings;
- Other meetings and conferences;
- PhD students exchange;
- Scientists visits;
- Data exchange;
- European Geosciences Union General Assembly 2016, Session OS1.10

„Atlantic water in the main gateways to the Arctic Ocean - impact on climate, sea ice, tidewater glaciers and ecosystem” organised together with the Polish – Norwegian Project PAVE.

<http://meetingorganizer.copernicus.org/EGU2016/session/20915>



COLLABORATION, RESULTS

- Hornsund. Retreat of glaciers

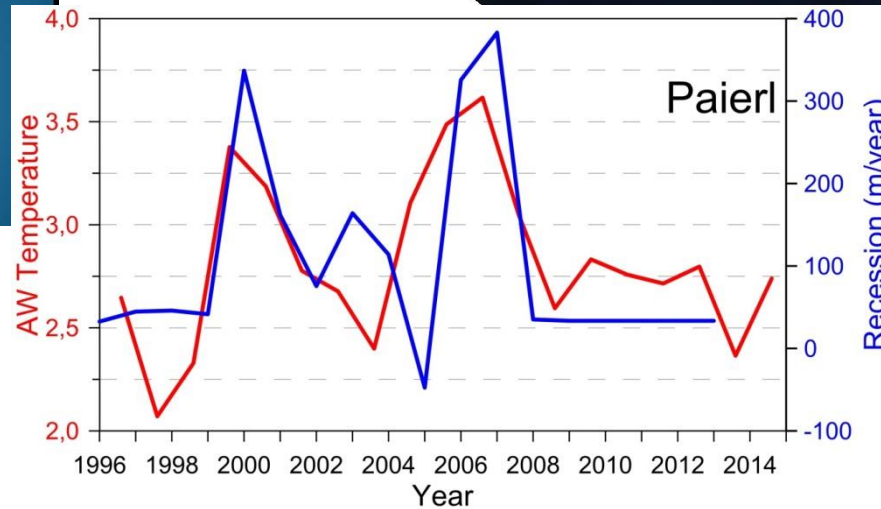
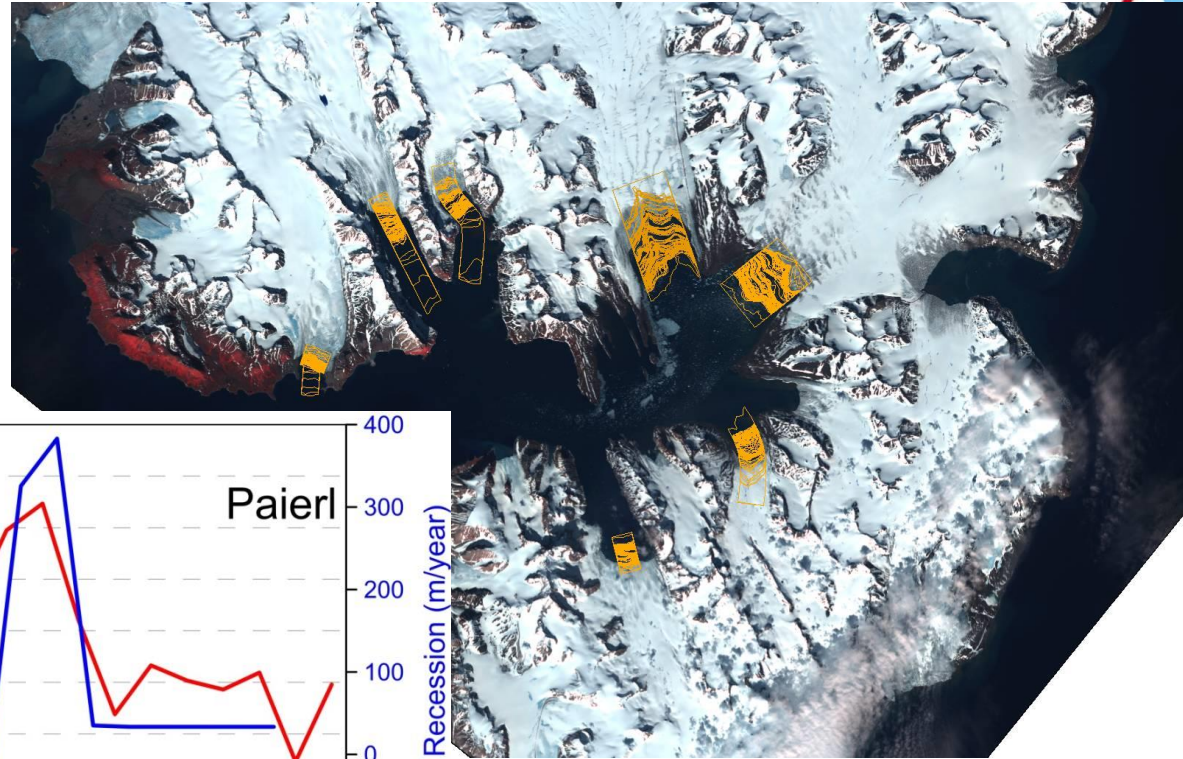




Quantity of the Arctic Marine Ecosystem

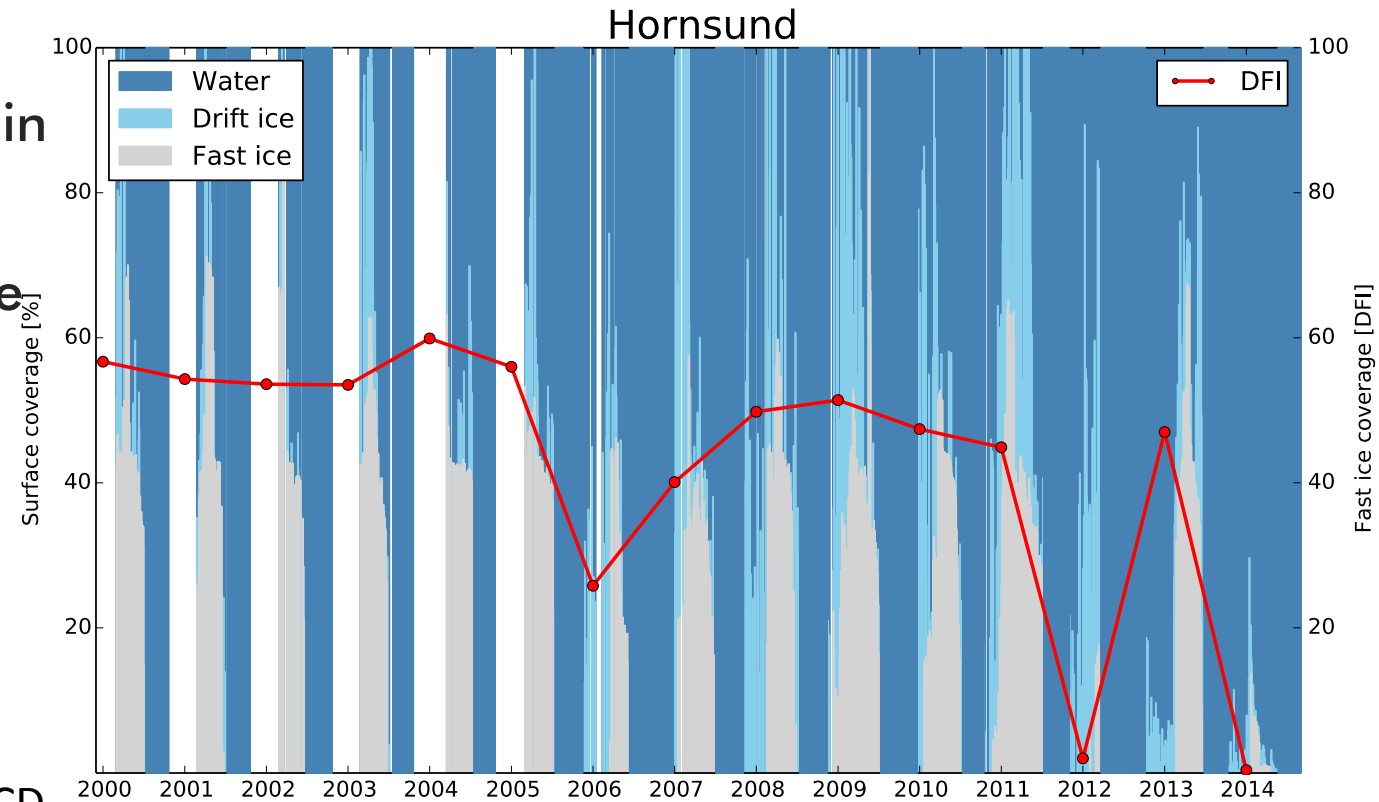
Ocean, sea ice and glaciers interactions in Svalbard area

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 Institute of Oceanology PAN
 Silesia University
 Institute of Geophysics PAN



Sea ice coverage of Hornsund 2000-2014

- DFI = Days of Fast Ice
- AW inflow to Hornsund in 2006, 2012 and 2014 strongly reducing sea ice cover.



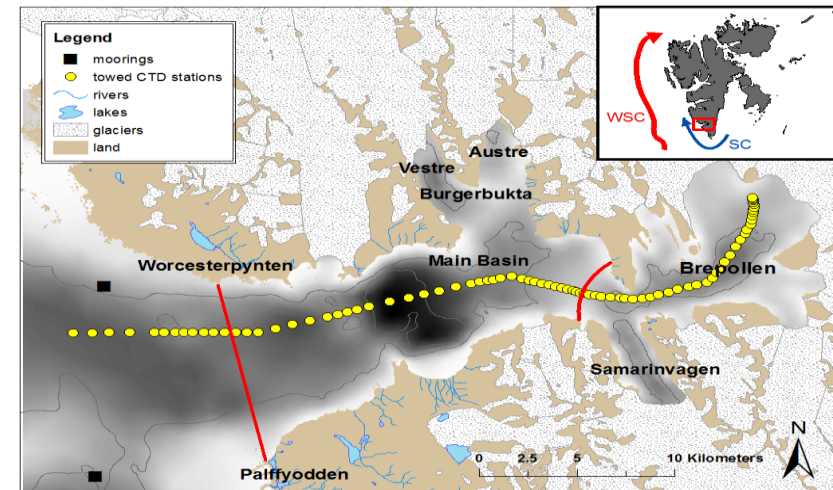
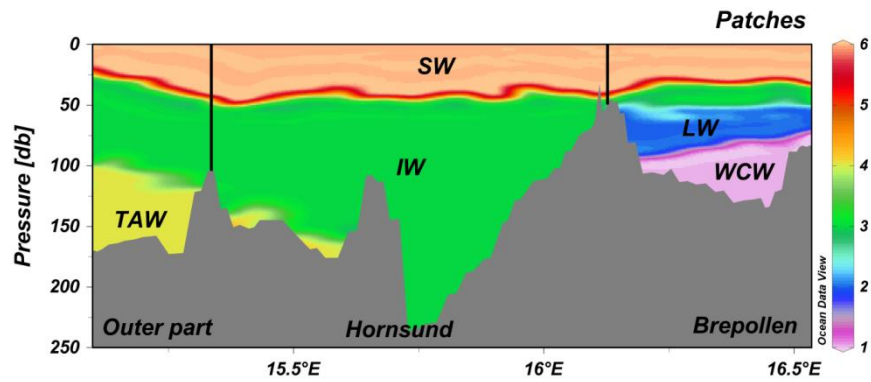
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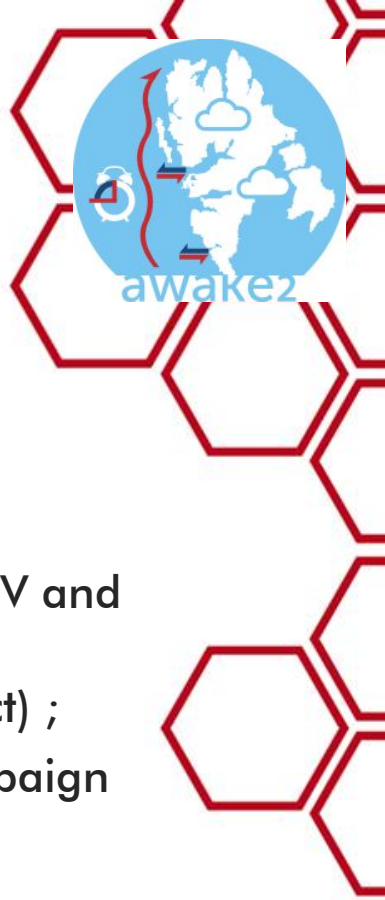
RESULTS

- Ocean influences Svalbard climate and ecosystem in various ways, mostly by heat fluxes (in winter up to 400 W/m²) and warm, salty water advection onto the shelf and into the fjords;
- Retreat rate of Hornsund glaciers reflects variability of AW;
- There are strong links between AW temperature, heat content and ice cover and glacial melt.



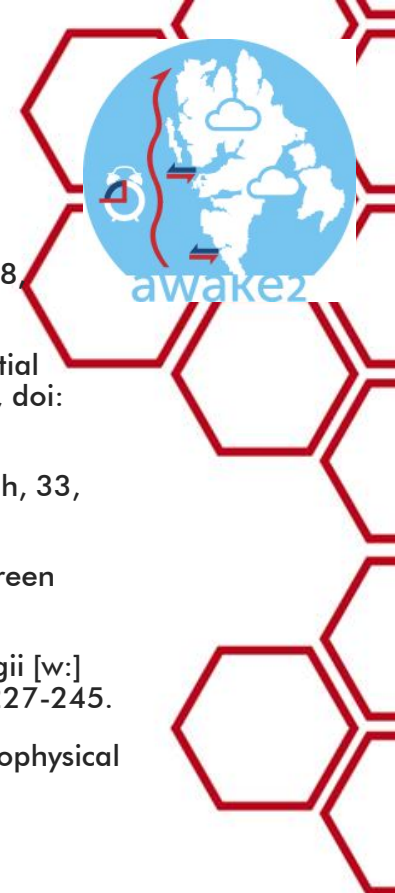
DISSEMINATION

- Webservice in English and Polish, presenting the main results of AWAKE-2 project;
- <http://water.iopan.gda.pl/projects/AWAKE2/index.html>
- Activities on social networks (during the whole project);
- Materials for project promotion: posters, brochures, popular science articles, contribution to TV and radio programs (during the whole project);
- Public outreach and media releases after major events in the project (during the whole project) ;
- Visit of a science journalist in Polish Polar Station in Hornsund during the AWAKE-2 field campaign (May 2014);
- Presentations and expositions during the annual Sopot Science Days in Poland organized and contributed to by IOPAN (every year in May);
- Participation in other Science Picnics;
- Promoting Arctic climate change problems to the general public (during the whole project).



PUBLICATIONS

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- Przybylak R., Arażny A., Rondli Ø., Finkelnburg R., Kejna M., Budzik T., Migąła K., Sikora S., Puczko D., Rymer K. and Rachlewicz G., 2014, Spatial distribution of air temperature on Svalbard during 1 year with campaign measurements, *International Journal of Climatology*, vol. 34, issue 14, doi: 10.1002/joc.3937.
- Wyszyński P., Przybylak R., 2014, Variability of humidity conditions in the Arctic during the first International Polar Year, 1882-83, *Polar Research*, 33, 23896, <http://dx.doi.org/10.3402/polar.v33.23896>.
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- Ignatiuk D., Błaszczuk M., Grabiec M., Majchrowska E., Pętlicki M., Piechota A., 2015, Nowoczesne metody pomiarowe i analityczne w glaciologii [w:] Absalon D., Matysik M., Ruman M. (red.) *Nowoczesne metody i rozwiązania w hydrologii i gospodarce wodnej*, ISBN 978-83-61695-26-4, ss. 227-245.
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- Przybylak R., Wyszyński P., Nordli Ø., Strzyżewski T., Air temperature changes in Svalbard and the surrounding seas from 1865 to 1920, *International Journal of Climatology*.
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Thank you

