



# Towards better tailored weather and marine forecasts in the Arctic to serve sustainable economic activities and infrastructure (TWASE)

Timo Vihma, Adriaan Perrels, Bin Cheng, Riina Haavisto, Atte Harjanne, Karoliina Hämäläinen, Sami Niemelä, Karoliina Pilli-Sihvola, Elena Shevnina, Irene Suomi

Finnish Meteorological Institute

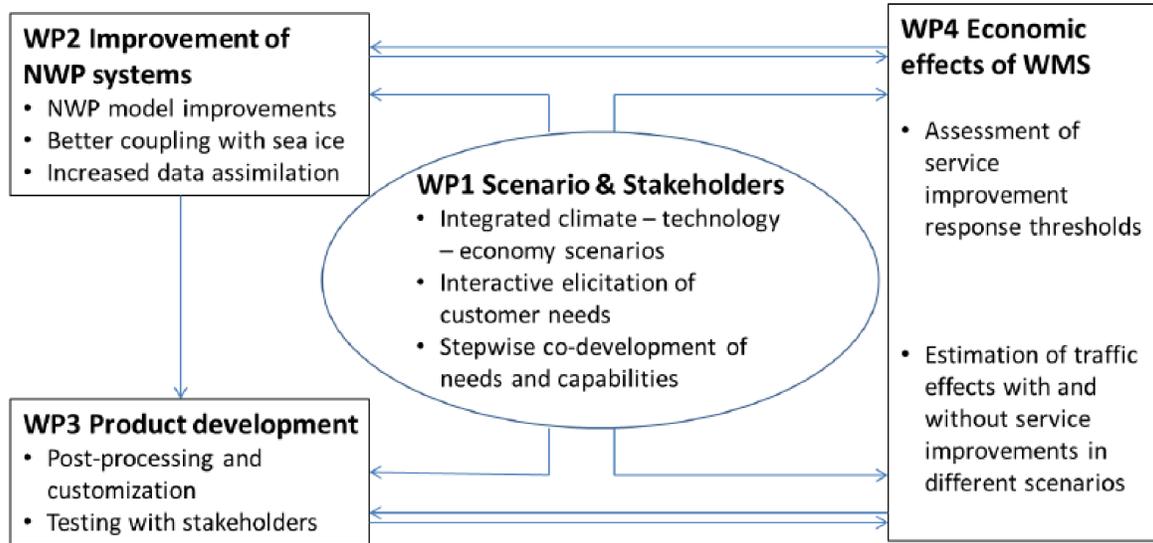
## Introduction

In the Arctic, economic activities, such as navigation, aviation, fisheries, energy production, manufacturing, and tourism, are extremely sensitive to weather. All these activities require accurate weather forecasts and accompanying marine forecasts, as well as long-term climate change projections to infer the future range of weather variability. The quality of Weather and Marine Services (WMS) in the Arctic evolves in conjunction with the unfolding of needs for such services. These need to be evaluated together with the service users.

## Objectives

1. Identify, classify, prioritise and conceptualise the needs of stakeholders based on an understanding of how the climatic, institutional and economic context will develop in the Arctic.
2. Improve the predictability of weather, marine and sea ice conditions in the Arctic
3. Improve preparedness for impacts of climate change by exploring likely shifts in weather and marine conditions in conjunction with the expanding range of aviation, maritime transport, infrastructure networks, and wind power production.
4. Evaluate and optimize the benefits of the new WMS products to enhance the development of sustainable economy and infra-structure in the Arctic.

## Work Packages



## WP1. Scenarios and Stakeholders

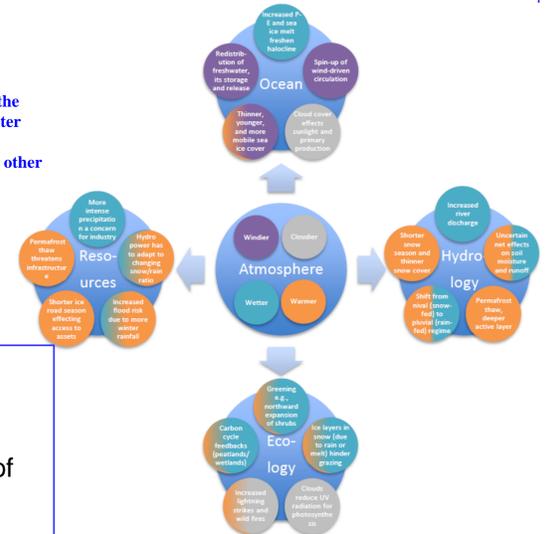
- Hydrological scenarios for northern Russia and their socio-economic impacts (Shevnina et al., 2017)
- General evaluation of the feedbacks and interactions in the land-atmosphere-ocean-society continuum in the Northern Eurasian region (Lappalainen et al., 2016)
- Effects of Arctic changes on mid-latitude weather (Overland et al., 2016), in particular on extreme weather (Vihma, 2017)
- Assessing uncertainties in Arctic socio-economic scenarios: [see poster by Riina Haavisto et al](#)
- Arctic Freshwater Synthesis: review on future scenarios of precipitation, evaporation, and moisture transport in the circumpolar Arctic, including estimation on the impacts of the expected changes (Vihma et al., 2016; Prowse et al., 2015)

## WP2. Improvement of NWP systems

- Work towards improved observations
  - remote sensing of air moisture (Boisvert et al., 2015)
  - better utilization of circumpolar IASOA observations in model validation and improvement (Vihma et al., 2016; Uttal et al., 2016)
- Satellite and radiosonde data assimilation
  - IASI temp. and humidity profiles over sea ice
  - Evaluation of the benefit from additional radiosonde soundings from the central Arctic
  - sea ice analyses based on combined use of satellite remote sensing data and thermodynamic modelling for the Bohai Sea (Karvonen et al., 2017) and Kara Sea
- Improvement of models
  - snow and sea ice thermodynamics



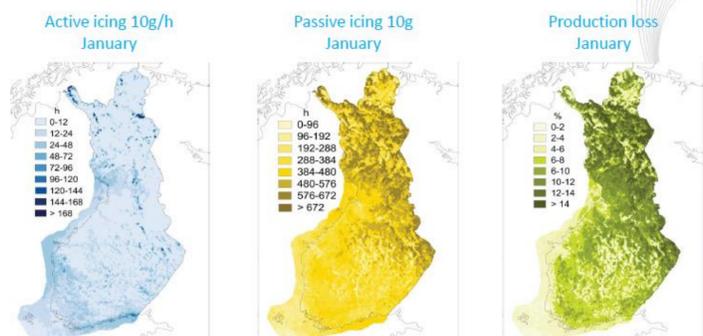
Scenarios for changes in the atmospheric component of the Arctic freshwater cycle, and its impacts on the other components



## WP3 Product development

- Wind gust parameterizations
  - Gust observations from research aircraft and testing of parameterizations (Suomi et al., 2016)
  - Lidar-based gust observations (Suomi et al., 2017)
- Probabilities for hydrological extremes: [see poster by Elena Shevnina et al.](#)
- Wind turbine icing (Karoliina's presentation)
  - Icing Atlas for wind mills (Hämäläinen and Niemelä, 2016)
  - Pre-operational icing forecasts

## Icing atlas for wind turbines



## WP4 Economic effects of WMS

[see poster by Riina Haavisto et al.](#)

Under work:  
Arctic shipping and Northern Sea Route development perspectives

