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Improved weather and climate services in support of economic activities in the Arctic - the TWASE project

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TWASE Objectives

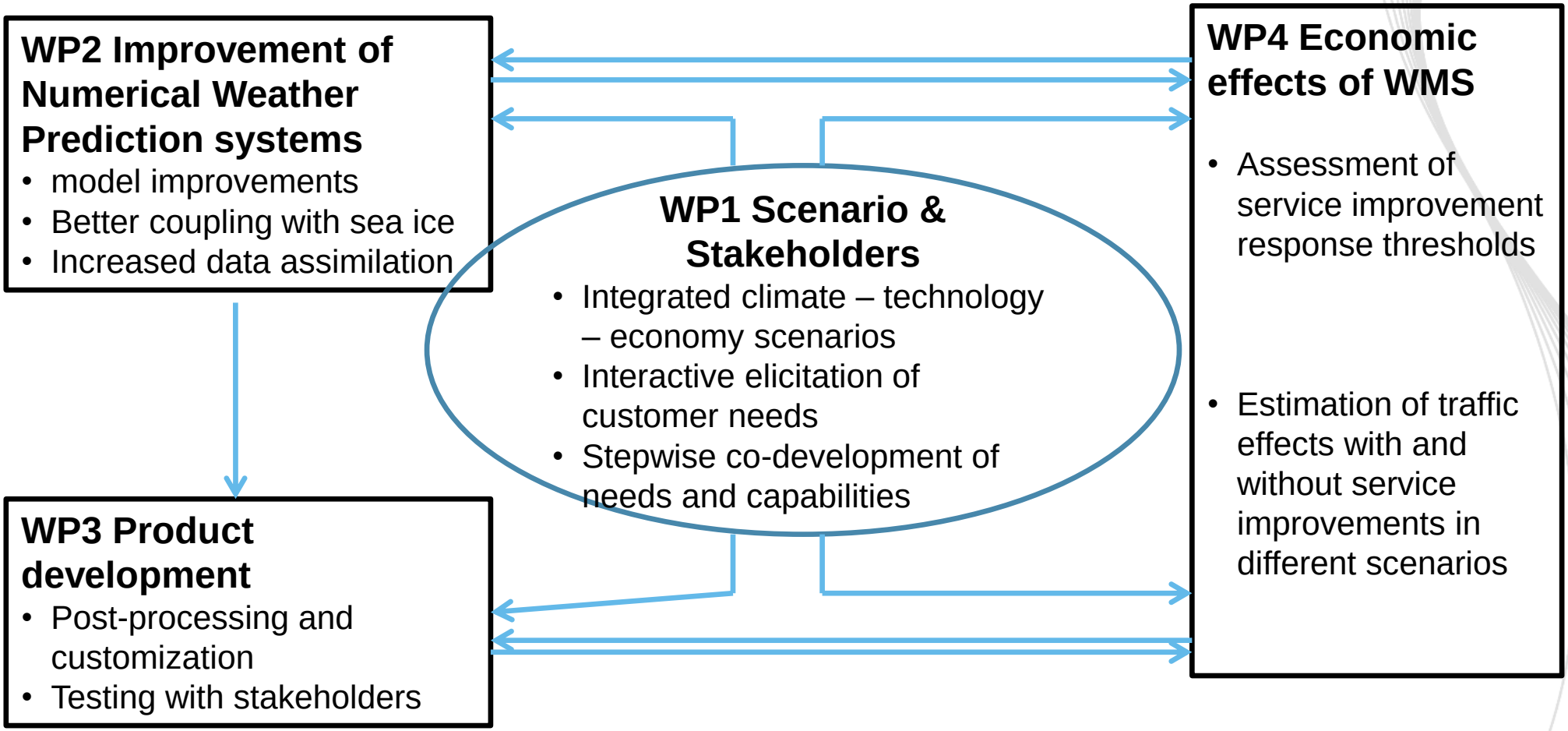
1. Identify, classify, prioritise and conceptualise the needs of stake-holders based on an understanding of how the climatic, institutional and economic context will develop in the Arctic.

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.

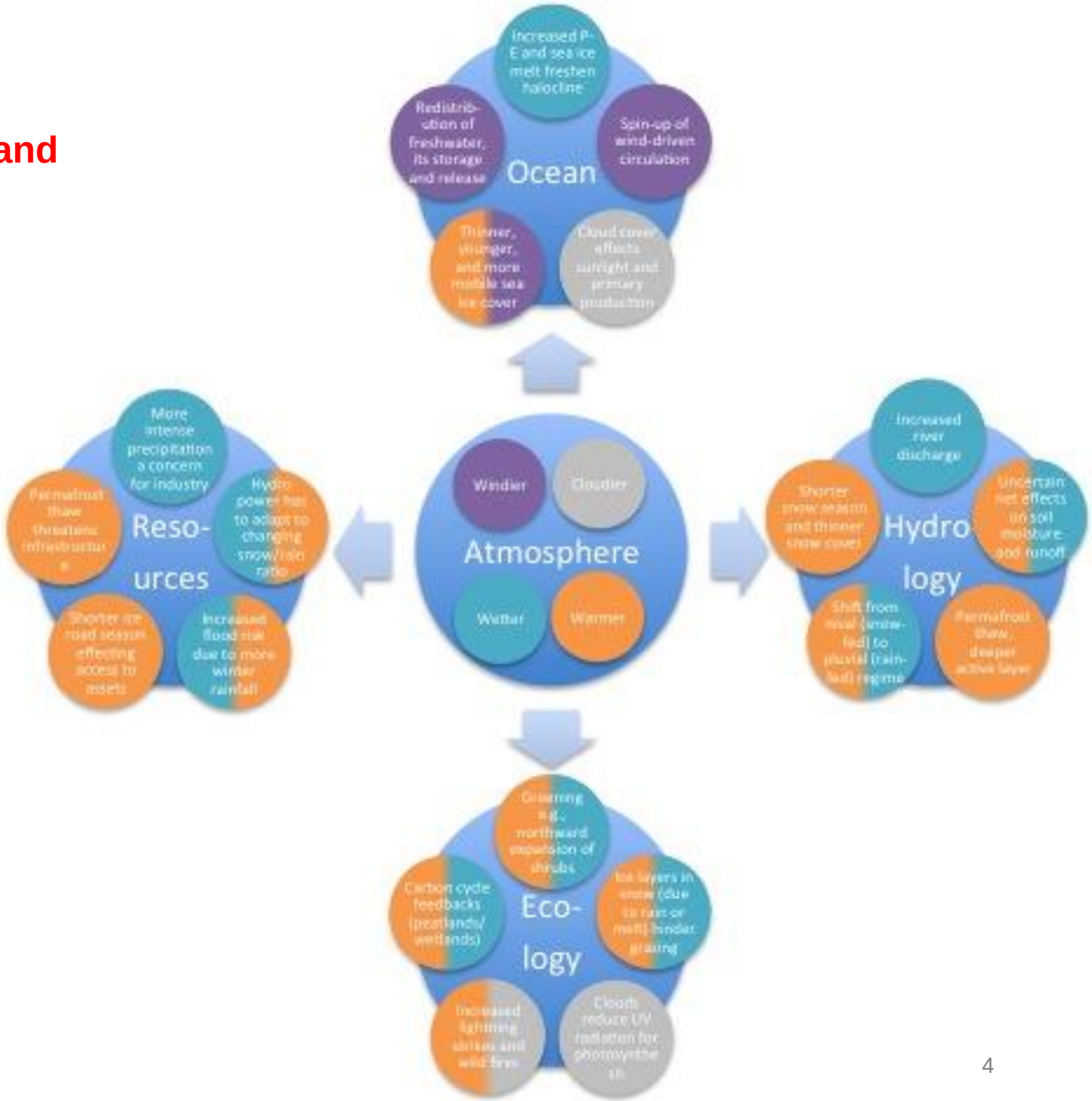
Work Packages



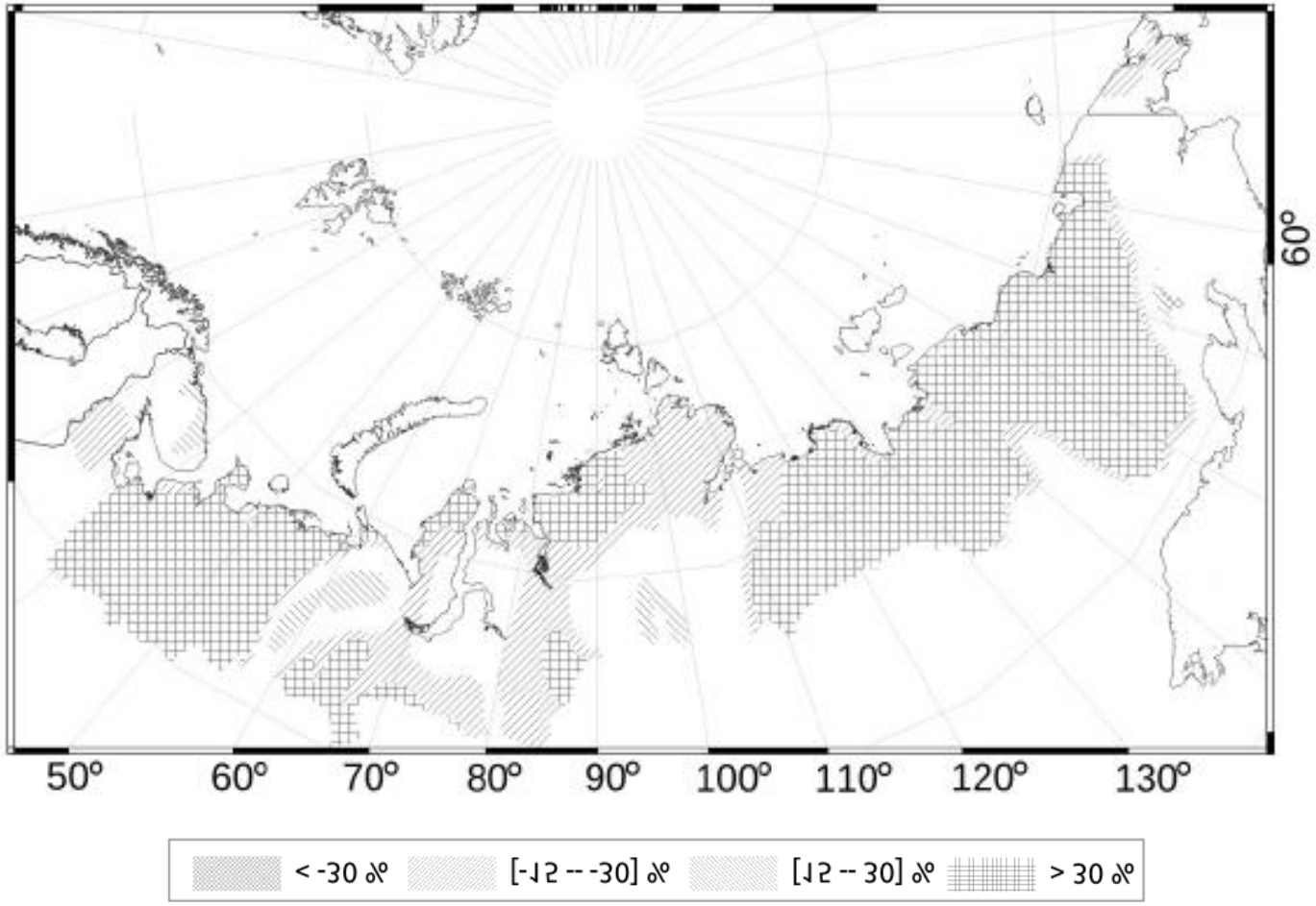
WP1. Climate scenarios and socio-economic impacts

Arctic Freshwater Synthesis under coordination of CliC, AMAP, and IASC.

Atmospheric component of the water cycle and impacts of its changes (Vihma et al., 2016)

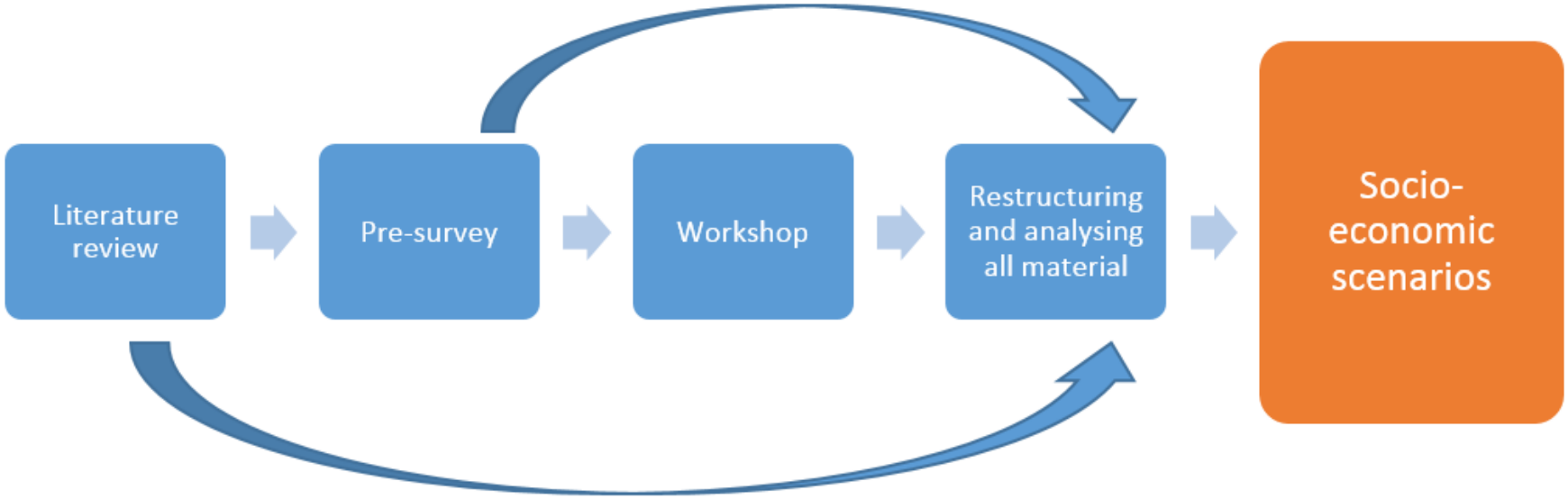


Assessment of extreme flood events in changing climate for a long-term planning of socio-economic infrastructure in the Russian Arctic



Regions with substantial changes in spring flood depth of runoff according to the Max Planck Institute ESM under scenario RCP2.6 (Shevnina et al., 2015)

WP1: Methodology for socio-economic scenario construction



NEXT STEPS (WP4): Evaluation of the economic value of improved WMS for different sectors in each scenario.

WP1: Socio-economic Scenarios for the Eurasian Arctic by 2040

INTERPRETATION OF THE NARRATIVES FOR THE WMS RELEVANT SECTORS

	"Wild West"	"Silicon Valley"	"Exploited Colony"	"Shangri La"	"Conflict Zone"	"Antarctic"
Framing uncertainties	Private – open - dirty	Private – open - clean	Public – open - dirty	Public– open -clean	Closed -dirty	Closed -clean
Resource extraction	Low hanging fruits	Efficient; Respects carrying capacity	Inefficient, old technology	Regulated, Sustainable technologies	Causes conflicts	None
Tourism	Popular destination	Responsible tourism	Difficult access	Responsible tourism	None	Exclusive
Shipping	Traffic jams	Traffic with minimum environmental impact	Supports resource extraction	Traffic regulated by international bodies	Military	Tourism and research

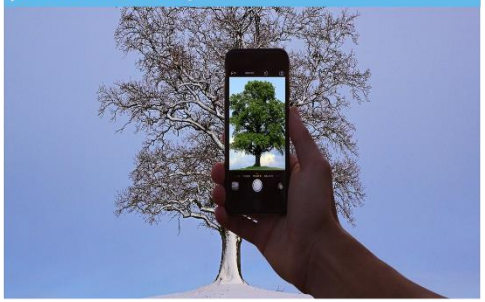
Private-Public–axis refers to who has the initiative and active role in the development of the Arctic.
Openness refers to the region being seen as open for new expansive actions. A **closed** Arctic refers to development where human activity is maintained at current levels at most or even reduced.
Dirty-clean-axis refers to the state of the environment as a result of human intentions.

WP1: What kind of weather and marine services are needed in the future?

IMPLICATIONS OF EACH SCENARIO FOR WEATHER AND MARINE SERVICES

WILD WEST - High demand for sector specific situational information (from oil, gas and tourism sectors, Search and Rescue operations)

SILICON VALLEY - High demand; Open data; competitive market (from green and clean entrepreneurs, scientific community, NGOs, private insurances)



EXPLOITED COLONY - Medium demand both for situational information and more general observations (from oil, gas, construction, other infrastructure, tourism)

SHANGRI LA - High demand; Tailored services (for shipping, clean technology, tourism)

CONFLICT ZONE - Low demand for commercial services, high demand for situational awareness and strategically important observations

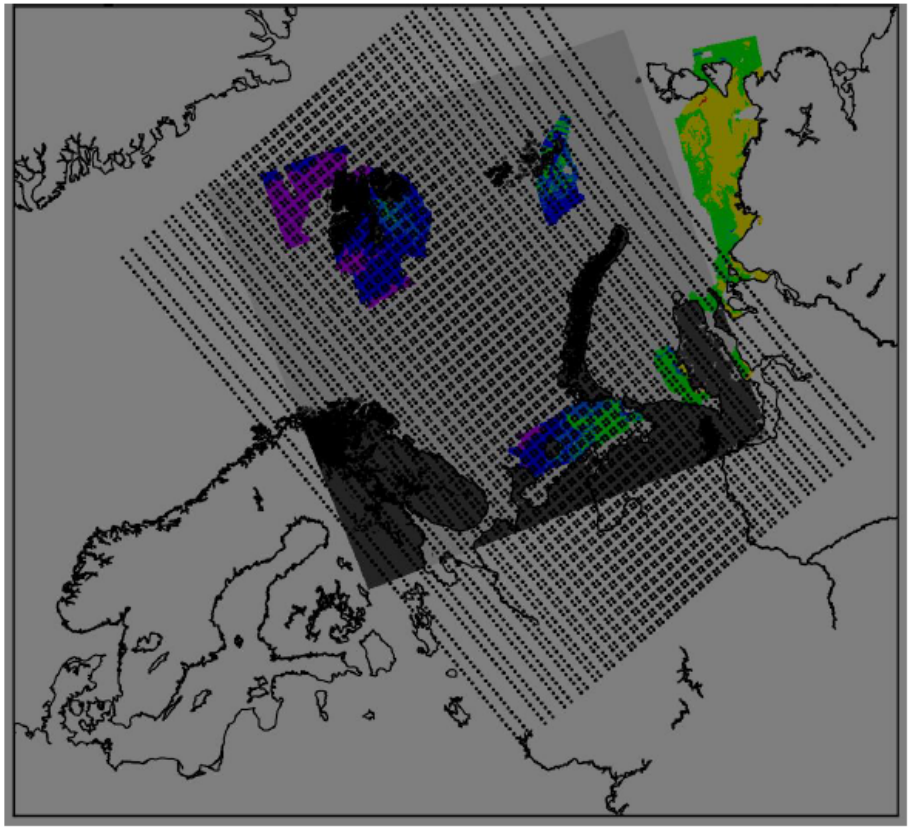
ANTARCTIC - Low demand in general, mainly for scientific purposes (for eco- and scientific tourism)

Report available at https://helda.helsinki.fi/handle/10138/160254

WP2 Improvement of weather forecasts

Satellite data assimilation over sea ice -> better initial conditions for weather models

IASI – a new generation hyperspectral satellite sounder - provides crucial information about atmospheric temperature and humidity in the Arctic, where only very few in-situ observations are available. By using co-located MODIS sea ice surface temperature product we can better assimilate IASI observations over sea ice into a numerical weather prediction system.



gray: Arctic AROME numerical weather prediction model domain, black dots: IASI observations, color: MODIS cloud-cleared sea ice surface temperature product

WP2 Improvement of weather forecasts

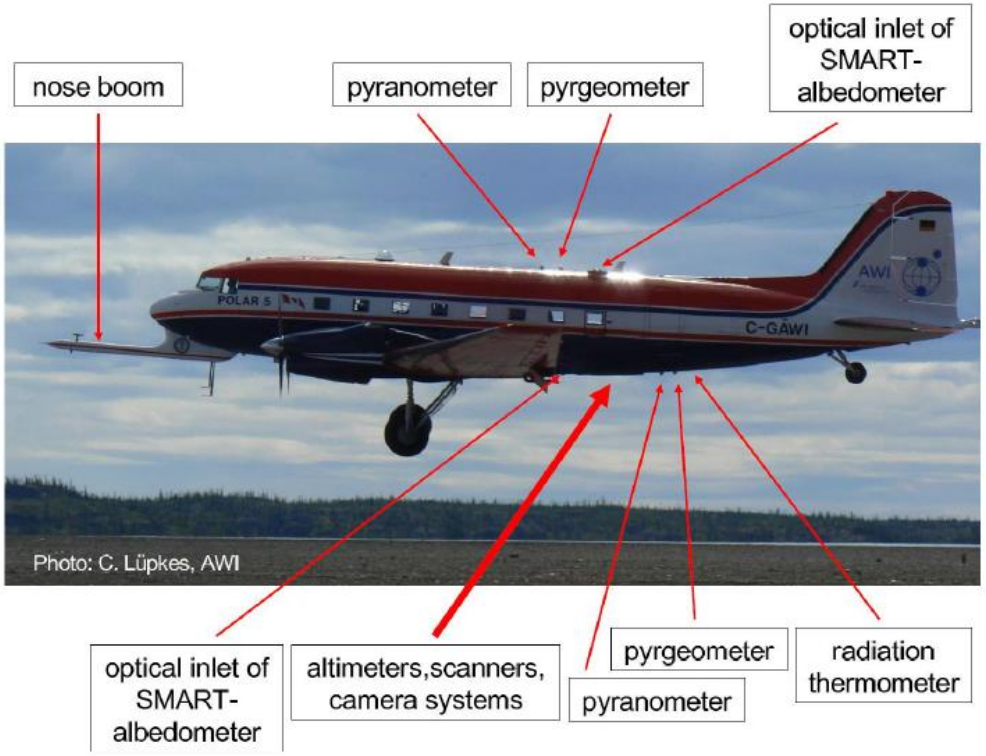
Better utilization of circum-Arctic observations in model evaluation and development of parameterizations

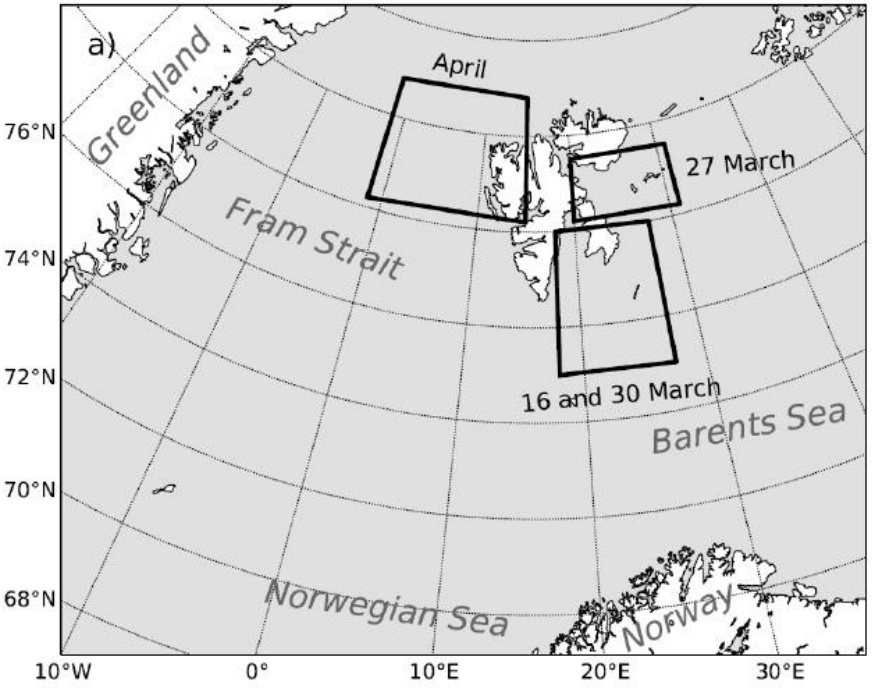
International Arctic Systems for Observing the Atmosphere (IASOA) Regional Processes Working Group (Vihma et al., 2016)

WP2 Improvement of weather forecasts

Wind gusts in the Arctic

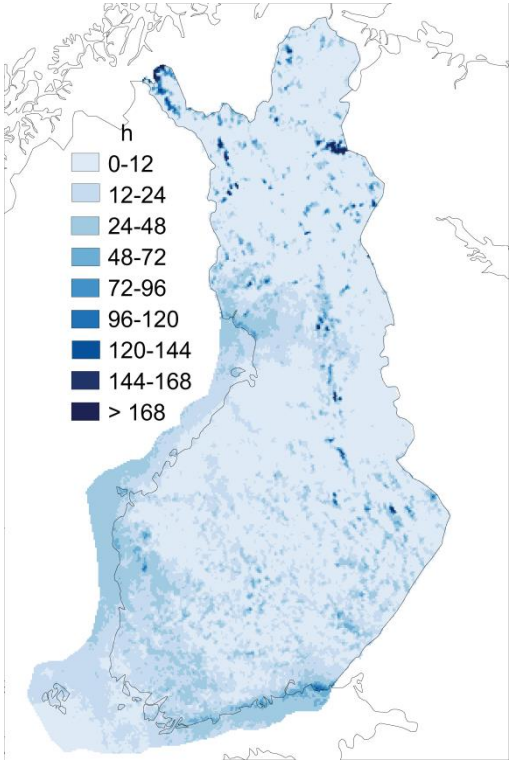
- important for aviation, navigation, and wind energy production
- so far information based solely on sparse point measurements.
- new method developed in TWASE to measure wind gusts from a research aircraft (Suomi et al., 2016) -> allows collection of data over large areas



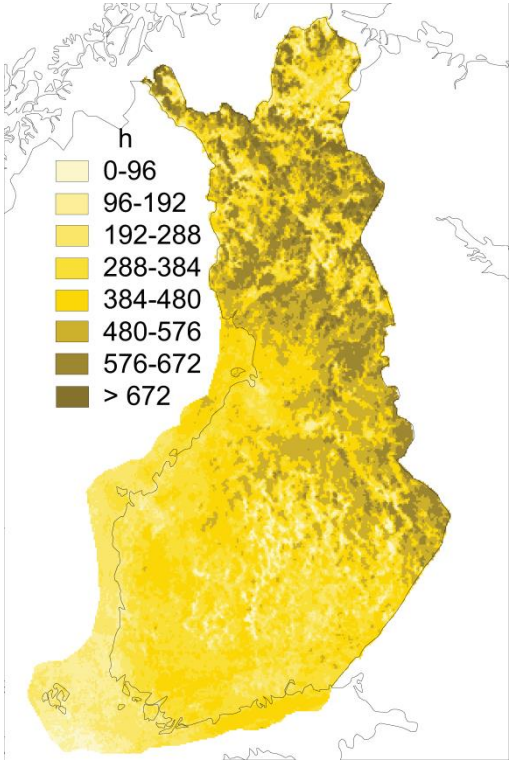


Icing Atlas for wind mills

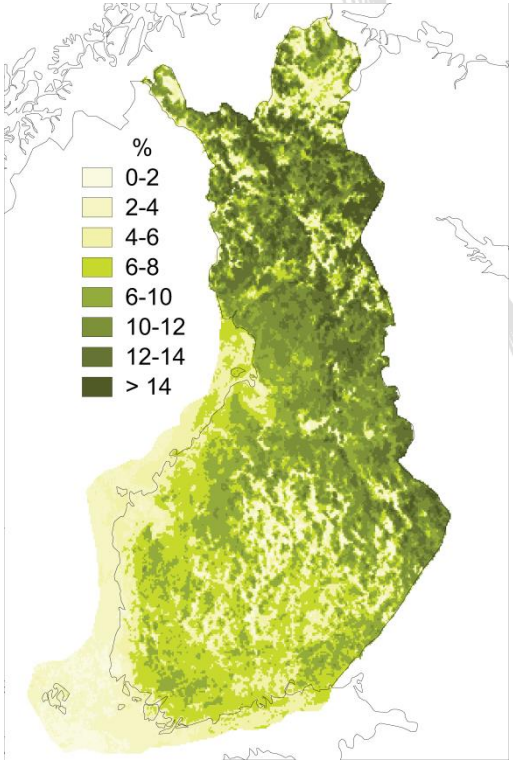
Active icing 10g/h January



Passive icing 10g January



Production loss January



Pre-operational Icing forecast (winter 2015 – 2016)

- HARMONIE weather forecasting model combined together with Icing-model, based on ISO STANDARD 12494.
- Web-interface for the customer
- Wind forecast presented with ”Trafic light” colouring, taking into account the risk of icing event.

Summary of expected results of TWASE

(a) improved WMS based on user needs

(b) improved and new post-processing methods of weather and marine forecasts for Arctic conditions adaptable to various socio-economic purposes

(c) structured information on the needs of economic actors, responsible authorities and practitioners as to their activities in the Arctic

(d) modelling tool to appraise economic effects of improved WMS based on various compound climate-socioeconomics-policy scenarios

(e) estimated response functions for critical thresholds in adverse weather and in weather-information levels.