FINNISH METEOROLOGICAL INSTITUTE

The known requirements for Arctic climate services

based on findings described in STT White paper 8/2015

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Regional drivers

- The Arctic region is home to almost four million people
- Economically, the region depends largely on natural resources (in particular oil, gas, metal ores, fish, reindeer and birds)
- Tourism is a strongly growing sector in many parts of the Arctic

→ ***settlements and industry have a strong need for information on e.g.***

- accurate hydrology, river and ice forecasts = flood vulnerability, freeze/thaw impacts
- ice edge and movements, freshwater discharge, sea currents, upwelling, ocean storms…

Climate change

While the provision of weather and oceanographic services is inherently challenging in the Polar Regions where observational data is sparse and the climate is particularly harsh, this work is further complicated by climate change, causing e.g.:

- Permafrost degradation
- Increasing winter runoff
- Coastal erosion
- Reduced sea ice thickness and extent
- Changes in water regimes

→ ***Local to global implications***

Existing services

“ National Meteorological and Hydrological Services observe weather, ice and water conditions around the world, providing a steady flow of data which are then transmitted worldwide for forecasts and planning purposes (WMO World Weather Watch).

Forecasts and warnings are generally provided for *surface, marine, and aviation weather interests*, with emphasis when possible on high-impact events such as extra-tropical storms and polar lows, storm surge and other coastal hazards, heavy precipitation, floods, droughts, volcanic ash, and space weather.

Services are delivered through a number of media from the Internet to high frequency (HF) radio broadcasts.”

Existing services

Services vary in terms of content, presentation, and time scales covered:

- ***General forecast services*** (land areas with permanent populations) are quite robust
- ***Coastal marine and offshore/high seas*****:** more detailed
- ***"Public" weather forecast information*** (temperatures, winds, and precipitation and warnings or alerts for extreme weather): available on an hourly to daily basis for 5-10 days in advance
- ***Marine forecasts*** are generally less detailed: forecasts of wind, sea, and weather conditions are generally provided for 24 hours up to 72 hours + general outlooks out through 5 days. Hazards such as strong winds, freezing spray (ice accretion), fog, and heavy seas are emphasized
- ***Sea ice services*****:** mainly near-real time products (satellite data + aerial/shipboard observations + in-situ sensors + models + expert analysis)

User needs

"*As more ships venture into the Arctic, the demand for ice information, as well as other ocean data, products and services, will continue to increase and the resources available to meet this increased demand will be stretched.*

The ice parameters needed in the future will not change significantly but will be required over larger geographic areas and longer periods of the year.

Operators will still need to know where the ice is and is not; where it is going to be, how closely packed it is and how thick and strong it is; generally, how difficult it will be to go around or, when necessary, go through.

These parameters will be needed on a variety of space and time scales - from the hemispheric to the local, from months and weeks to daily or even hourly - to support tactical and strategic route planning for ships, scientific study and the development of policy and regulations to ensure safe marine practices." (ref: AMSA report 2009)

User needs

- ***Seasonal predictions***, particularly the period of open water that defines an extended operations and shipping season, are increasingly in demand
- ***Multi-decadal sea ice projections*** for infrastructure planning, ecosystem stewardship, and projection of global climate impacts forced by changes first occurring in the Arctic
- ***Decadal predictions of sea ice loss*** needed but problematic (long-term modeling gives diverse model results + lack of good physical data regarding winds and clouds + current models are too slow in future projections of sea ice loss)
- ***Climate information*** generally needed in the Arctic
- ***Long time series for weather and ocean data*** needed for research

Examples of specific user needs in the Arctic

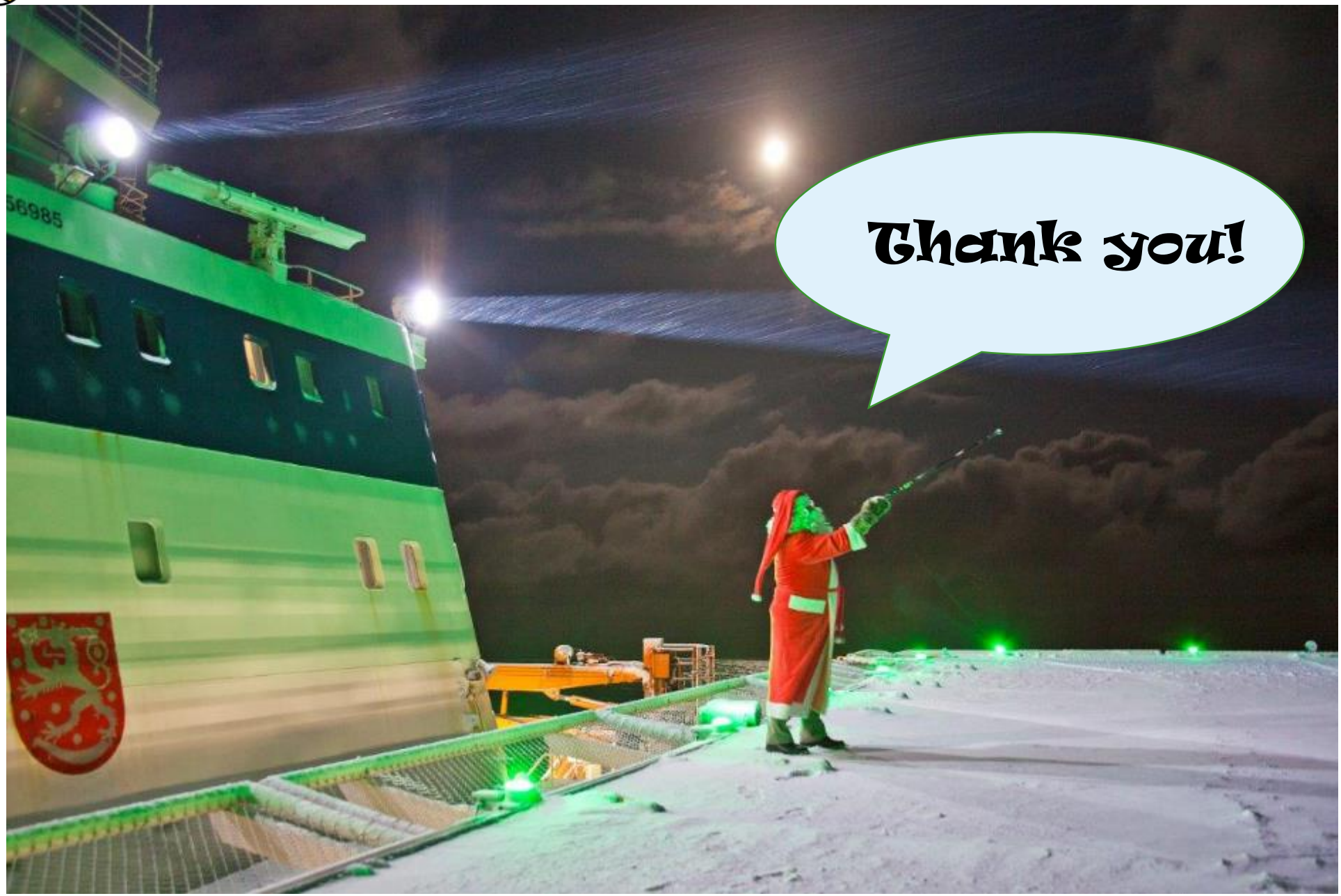
- ***Natural Resource Development*** (energy and mineral extraction and development): length of open water season, sea ice melting/freezing
- ***Transportation, SAR, oil spill combatting***: length of open water season, ice movements, sea ice melting/freezing, wave height, sea currents…
- ***Community Resilience and Adaptation Planning***: weekly – seasonal – long-time weather and climate looks needed for understanding, adapting and transforming to known and/or predicted changes
- ***Infrastructure Protection and Hazard Mitigation*** (information of e.g. erosion, flooding, permafrost thawing)
- ***Versatile Ecological Changes*** caused by changes in e.g. sea ice, higher sea-surface temperatures, warmer summers, reduced snow cover, etc.

Summary

“Improved sea ice and marine weather forecasting would assist the energy, maritime shipping and transportation industries, as well as infrastructure planning, economic development, and ecosystem stewardship.

An enhanced and integrated set of environmental observations is required to track changes to the Arctic across the land, in the atmosphere, and in the ocean, including physical indicators, biological responses, and social and economic impacts.

Rapid integration, interpretation, and dissemination of this information in near-real time are required to support decision-making.”


Thank you!