

# Services Requirements Paper

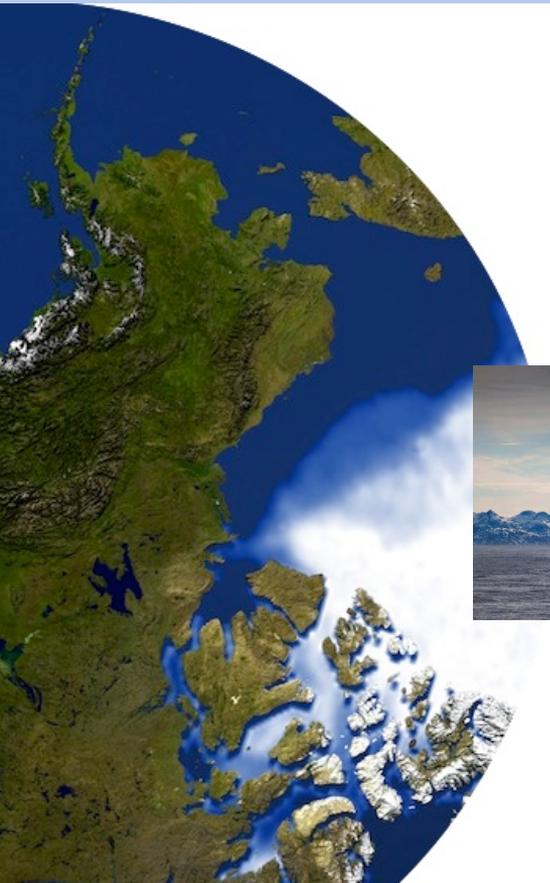
## Executive Council Panel of Experts on Polar & High Mountain Observations, Research, and Services

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# Overview

- Introduction to the “White Paper”
- Regional Drivers
- Existing Services
- Science/Service Needs
- Service Delivery Assessment
- Relationship to PRCC Concept

The first sunrise of the year in the High Arctic archipelago of Svalbard



Greenland

# Introduction to the White Paper

- 16<sup>th</sup> WMO Congress (June 2011) resolved to embark on a multi-year initiative to develop Global Integrated Polar Prediction System (GIPPS)
- GIPPS Objectives
  - Meet user requirements for high northern and southern latitudes, as well as for the “Third Pole”
  - Accurately predict the future state of the atmosphere; sea ice; (upper) ocean; and hydrosphere/cryosphere
  - Be supported by appropriate observational systems and enabling scientific research and development
- Purpose of the White Paper, as a continuation of EC-PORS/PHORS work on the GIPPS, was to define and validate the needs and opportunities for improving weather, ice, water, and climate services in the Polar Regions.



# Services White Paper

Igloolik, Nunavut, Canada

- EC PHORS 1 (2009): Service requirements must anchor the Panel's work
  - First milestone: Complete a high-level, standardized survey of products and services currently available in the polar regions -- provided at EC PHORS 2 (2010)
  - Second milestone: Collect requirements through members' interaction with user and customer groups -- focus on marine users
- EC PHORS 3 (2012): Version 1 of the Services White Paper presented
  - Results of marine surveys conducted across Arctic with information from several international, intergovernmental reports to supplement
- EC PHORS 5 (2014): Version 2 of the Services White Paper presented
  - Greater elaboration about service outcomes in key thematic areas
  - Explicit mapping to geographic areas: Arctic, Antarctic, Third Pole
  - Context from National Strategies released by most Arctic countries
  - New information from Third Pole; Southern Pole incomplete

# Services White Paper



A Nenets reindeer herders' camp near Salemal, Yamal

- EC PHORS 6 (2015): Version 3 of the Services White Paper presented
  - White Paper significantly revised to bring organization and focus to the spectrum of service requirements and gaps by framing them around specific user groups
  - Regional drivers for Antarctica separated from Arctic; existing services for the southern polar region better articulated
  - Use of WMO Service Delivery Progress Model as a framework to identify common gaps across the NMHSs and consider recommendations (workshop to follow)
  - Included a section on Research to Operations (R2O) Considerations
    - Observations, modeling and prediction, and information dissemination to users should be tightly linked

# Regional Drivers



Holman Island, NWT, Canada

## ➤ Arctic

- Populations/communities commonly distributed along or dependent on coastal waterways and river systems for access and subsistence
- Economic drivers: natural resources, tourism, transportation
- Ecosystem changes: permafrost degradation, increasing runoff, coastal erosion, reduced ice thickness
- “National Strategies” – priorities placed upon stewardship, responsible resource development, international collaboration

# Regional Drivers



Antarctica

- Antarctic
  - Several permanent research stations (29 nations, 40 stations)
  - Fishing and tourism
  - Antarctic Treaty System
  
- Third Pole (Tibetan Plateau)
  - Critical source for water availability; most populated region of the world
  - Cryospheric changes have broad impacts downstream



# Existing Services

## ARCTIC/ANTARCTIC

Lapland, Finland

### “Public” weather forecast information

- Available on an hourly to daily basis for five to ten days in advance
- Warnings for hazardous or extreme events such as high winds, floods, blizzards

### Marine forecasts

- Generally less detailed, provided for broad areas
- Do not extend far into the future -- 24 hours up to 72 hours in some locations with more general outlooks through five days
- Hazards such as strong winds, freezing spray, fog, and heavy seas emphasized

### Sea ice services

- Provision of ice charts and basic forecasts is a governmental responsibility for safety at sea
- Focus is on the production of near-real-time analyses
- Information required by a variety of marine and coastal interests

# Existing Services

## ARCTIC/ANTARCTIC



### Climate Services:

- Statistical information based upon historical records
- Predictions based upon general circulation models
- Consensus-driven outlooks developed through RCOFs
- Many climate analyses and forecasts are being produced by various centers

### Antarctic programs :

- NMHSs or oceanographic agencies provide tailor-made advice to their respective Antarctic programs
- Weather services built from small dedicated groups operating at the periphery of their homeland National Weather Service
- With exception of McMurdo summer forecast office, all other Antarctic briefing offices insufficiently staffed to provide continuous 24x7 service



Tibetan Plateau and surrounding mountains

# Existing Services

## THIRD POLE / HIGH MOUNTAINS

- Weather/precipitation is forecast by most regional and national weather service for the Tibetan Plateau and Himalayas
- Long-term prediction of water availability from changes in glacier meltwater is operational
- Monitoring networks of permafrost exist along Tibetan highways and railways with some initial predictions of permafrost thawing and preventive measures being made
- For ecology protection and pasture maintenance, some basic research is carried out in the headwaters of rivers such as the Yello, Yangdz, and Meikong, including in-situ measurements of ecology and hydrology

# Science/Service Needs

## ARCTIC



Swedish ship, Oden

| User/Decision-maker                          | Science/Service Requirement  |
|--|--|
| Natural Resource Development                 | <ul style="list-style-type: none"> <li>- Weather and ice hazards (specific, accurate)</li> <li>- Seasonal scale melt-out and freeze-up outlooks, length of open water season</li> <li>- Storminess outlooks</li> </ul>   |
| Transportation                               |  |
| Infrastructure and Hazard Mitigation         | <ul style="list-style-type: none"> <li>- Storm surge forecasts and impacts</li> <li>- Understanding of permafrost melting, coastal erosion rates</li> <li>- Multi-decadal climate and sea ice projections</li> <li>- Tools to help understand relationships between and among changing conditions</li> </ul> |
| Community Resilience and Adaptation Planning |  |
| Ecological Changes                           | <ul style="list-style-type: none"> <li>- Long term observations, integrated information</li> <li>- Improved scientific understanding</li> </ul>  |

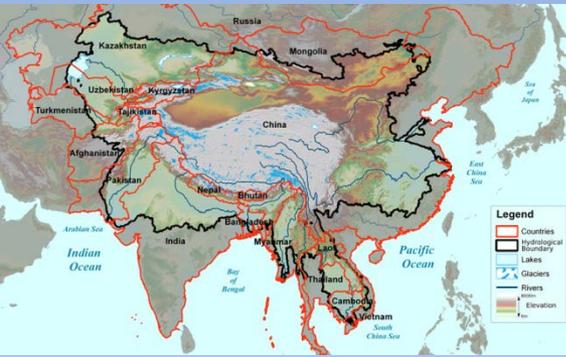
# Science/Service Needs

## ANTARCTICA



Southern Ocean Seas

| User/Decision-maker                        | Science/Service Requirement   |
|--|---|
| Operational Community:<br>Tourism, Fishing | <ul style="list-style-type: none"><li>- Weather and ice hazards (specific, accurate)</li><li>- Iceberg details, ice edge analysis</li><li>- Consistency across services</li><li>- Longer range hazardous weather outlooks</li></ul> |
| Research Community                         | <ul style="list-style-type: none"><li>- Robust, uninterrupted observation programs</li></ul>  |



# Science/Service Needs

## THIRD POLE

The Earth's Third Pole represents the largest and highest collection of mountain ranges in the world.

| User/Decision-maker                        | Science/Service Requirement   |
|--|---|
| Water Resource Management                  | <ul style="list-style-type: none"> <li>- Seasonal scale and longer term climate prediction and meltwater projections</li> <li>- Coupling of hydrologic models</li> </ul>  |
| Hazard Prevention                          | <ul style="list-style-type: none"> <li>- Longer lead time for hazardous weather (blizzards)</li> <li>- Improved seasonal scale predictions related to spring flooding conditions</li> <li>- Improved monitoring for glacier lake outburst flood risk</li> </ul> |
| Infrastructure Protection                  | <ul style="list-style-type: none"> <li>- Understanding of permafrost melting, ground settling</li> </ul>  |
| Ecology Protection and Pasture Maintenance | <ul style="list-style-type: none"> <li>- Long term observations, integrated information</li> <li>- Improved scientific understanding</li> </ul>   |



# Service Delivery Assessment



NASA-sponsored ICESCAPE expedition

- WMO defines a strategy for service delivery to enable a continuous, cyclical process to strengthen services across the world.
  - User engagement and partnerships, service design and development, service delivery, evaluation and improvement
- EC-PHORS Services Task Team used the WMO Service Delivery Progress Model to identify potential best practices and actions to improve service delivery among the NMHSs
  - Arctic Region can be considered developed or advanced for weather services. Sea ice services and climate services are less so, but under development.
  - Antarctic Region is considered to be at an intermediate level. Forecast operations and dissemination match the international state of the art, though verification and user engagement are not well developed.



# Relationship to PRCC Concept

Aurora borealis over the Arctic National Wildlife Refuge, Alaska, U.S.A

- RCC concept identified as a best practice
- Polar or Pan-Arctic RCC would represent an advancement in service delivery for this region
- This workshop is an opportunity to design this Polar RCC framework to meet user needs, align with the WMO Strategic Plan, and advance on the holistic vision of the GIPPS.



Researcher in Canadian Arctic

# Time for Discussion