WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Current status of the

Pan-Arctic Regional Climate Outlook Forum (PARCOF)

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WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

WMO International Workshop on Global Review of Regional Climate Outlook Forums, Ecuador, 5 – 7 September 2017

PARCOF - Background

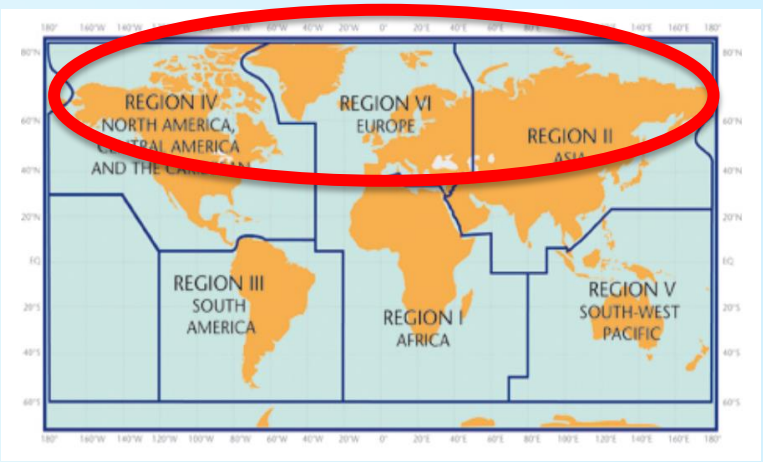
- WMO EC-69 (May 2017) endorsed the organization of PARCOFs.
- The <u>first</u> **PARCOF** is planned for Spring 2018 and will be lead by **Canada**
- Will coincide with the launch of the Polar RCC (**PRCC**) demonstration phase and will be *highly dependent* on the **PRCC** products and services

<u>Note on the **PRCC**:</u>

EC-69 also endorsed the PRCC hybrid network structure involving three WMO RAs:

<u>Role by geograhical areas of responsibility:</u>

- **Canada** will lead the **North American Node** (with Canada and the USA as members of the consortium)
- **Norway** will lead the **Northern Europe and Greenland Node** (with Denmark, Finland, Iceland, Norway, Sweden and possibly other interested European countries as members of the consortium)
- **Russian Federation** will lead the **Eurasian Node**

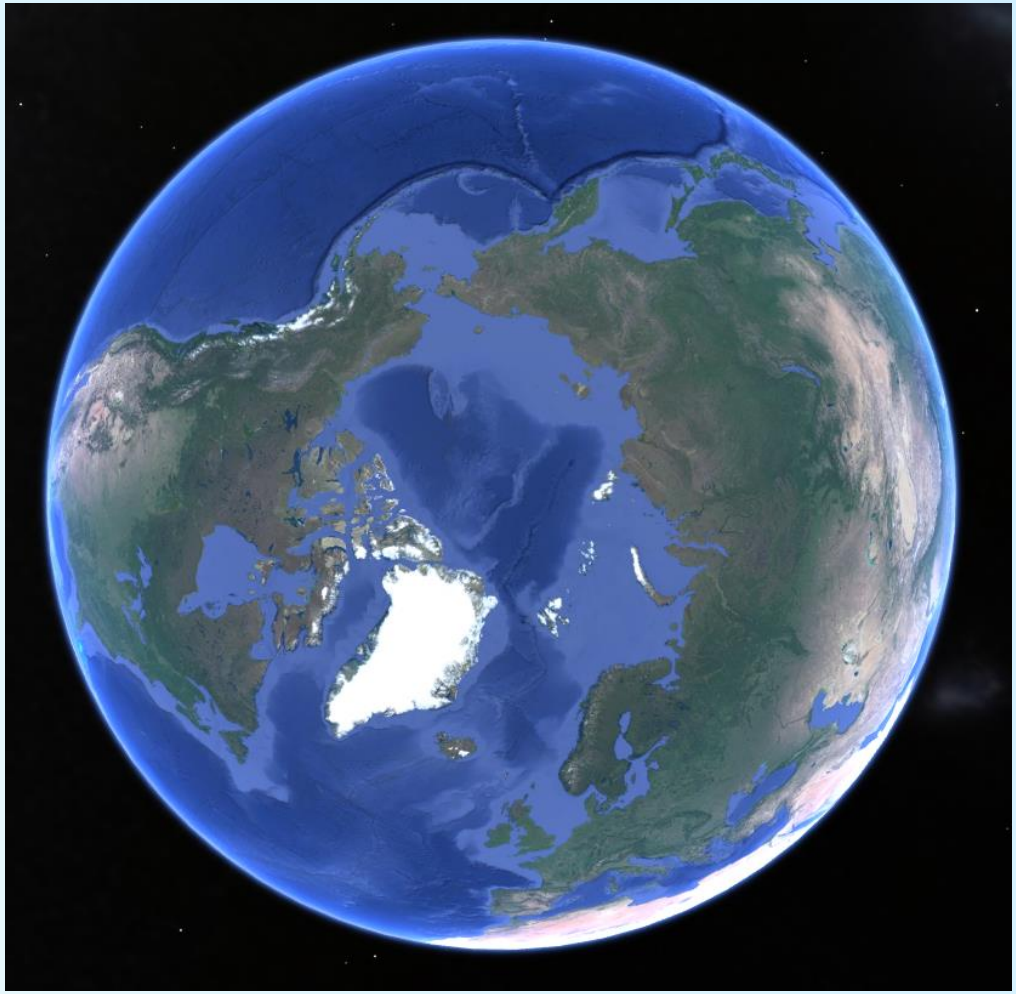


<u>Role by functional cross-node responsibility:</u>

- **Canada** will lead development of **Long-Range Forecasts (LRF)**
- **Norway** will lead **Operational Data Services**
- **Russian Federation** will lead the **Climate Monitoring**

PARCOF - Geographic domain

- Very large area
- 24 time zones !!
- Involves 8 countries (Arctic Council Member States)



- **Canada**
- **Finland**
- **Iceland**
- **Kingdom of Denmark**
- **Norway**
- **Russian Federation**
- **Sweden**
- **United States of America**

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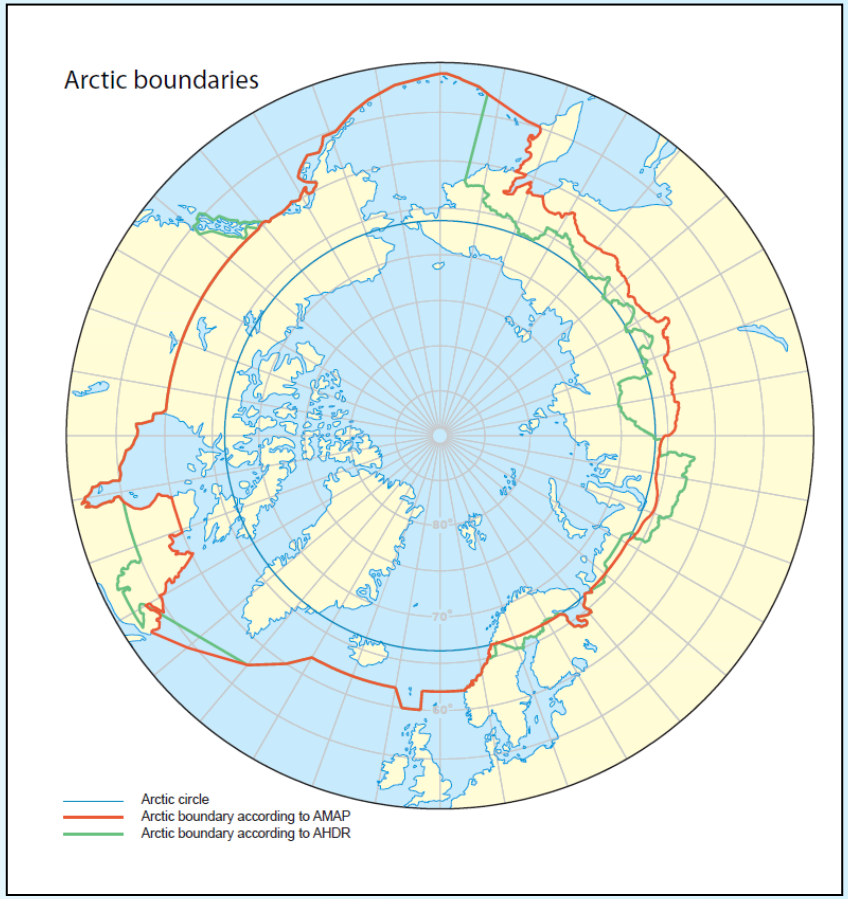
PARCOF - Geographic domain

- Many definitions of the Arctic boundaries exist!
- For PRCC/PARCOF, generally from 60°N to North Pole (90°N) with important exceptions
- Exact southern boundary depends on stakeholder interests
- PARCOF needs to be flexible



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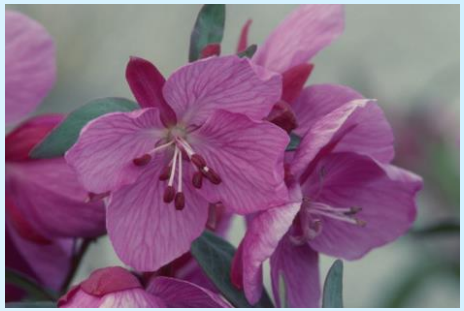
- **Russian Federation**
- **Sweden**
- **United States of America**

AMAP: Arctic Monitoring and Assesment Program
AHDR : Arctic Human Development Report

PARCOF – Arctic specificities

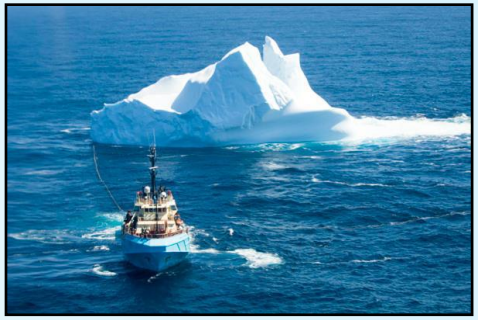
- Arctic is a unique place:
  - Vast territory, with complex terrain where **sea ice** plays a key role in influencing climate conditions and socio-economical activities
  - Harsh weather and **extreme cold climate conditions**
  - **Fragile ecosystem**
  - **Expensive** cost of living and industrial operations due the remoteness and cold climate
  - **Indigenous people** represents a important part of the populations



The Arctic is experiencing Climate Changes more rapidly and more severely than most parts of the world

PARCOF: needs for risk management

- Climate change impacts are having important effects such as increased marine transportation; increasing tourism and increased natural resources exploitation, all of which would benefit from improved and harmonized seasonal climate outlooks to reduce and manage risks.



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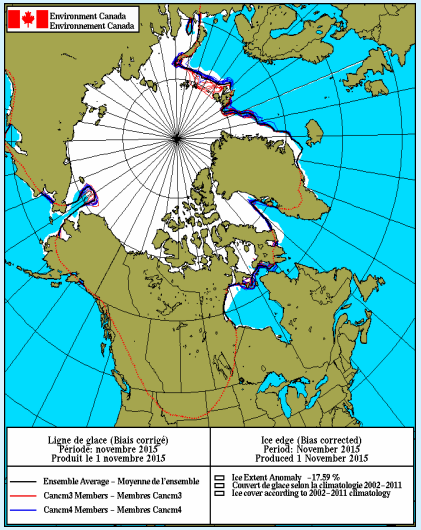
PARCOF – Domains of application and needs

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

Note: Not a final list, other domain of applications and related product and services may exist.

PARCOF – Objectives

- To review the recent Arctic climate conditions and their possible impacts on the coming season



- To asses and interpret monthly and seasonal forecast products for the region (**temperature**, **precipitation** ***as well as various operational and experimental sea ice products***) and develop outlook statements in plain language to communicate the information as well as communicating risks

- To **engage with key users**, **decision makers and indigenous knowledge holders** in a dialogue to better understand their needs and for them to explore how they can integrate the information

- To **discuss with the polar scientific community**, especially those involved in the PPP and YOPP, how advances in knowledge will translate into improvements in regional-scale services delivered through the PRCC.

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PARCOF – Key participants

- **PRCC-Network members (8 countries) :**
  - **Geographic area node representatives** (North America, Northern Europe and Greenland, Eurasia)
  - **Functional cross-node** representatives (Long-Range Forecasts (LRF), Operational Data Services, Climate Monitoring)
- **WMO secretariat**
- **Indigenous representatives**
- **Potentially other organisations (TBC):**
- Global Cryosphere Watch (**GCW**)
- International Ice Charting Working Group (**IICWG**)
- Year of Polar Prediction (**YOPP**), **MEOPAR**
- Arctic Council - Arctic Monitoring and Assessment Program (**AMAP**)
- Some UN bodies (**WHO**, **UNEP** and **UNESCO-IOC**)
- other pan-arctic organizations such as the Sustaining Arctic Observing Networks (SAON)
- International Arctic Science Committee (**IASC**)
- International Arctic Social Sciences Association (**IASSA**) and the International Association of Cryospheric Sciences (**IACS**) may be interested to attend.

GCW Global Cryosphere Watch

INTERNATIONAL ICE CHARTING WORKING GROUP

YOPP YEAR OF POLAR PREDICTION

ARCTIC COUNCIL

AMAP

Polar Climate Predictability Initiative

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PARCOF – Frequency and dates

- **Sea ice seasonality is the driver**

  The presence or absence of ice regulates many activities in the Arctic such as transportation, fishing and hunting, tourism, resource extraction.

  – Whereas the onset and end of the rainfall/dry seasons drive the dates of RCOFs in tropical and sub-tropical regions, in the Arctic it is the break-up/freeze up of sea ice that is the driver.

  – **Two main seasons**: a very long winter (9 months) and a short and cool summer (3 months)

  – **Freezing and thawing periods** on the fringes of these two seasons are the most important considerations for many sectors

- **Two PARCOFs per year**

  <u>First:</u> Face-to-face meeting in Spring (April or May)

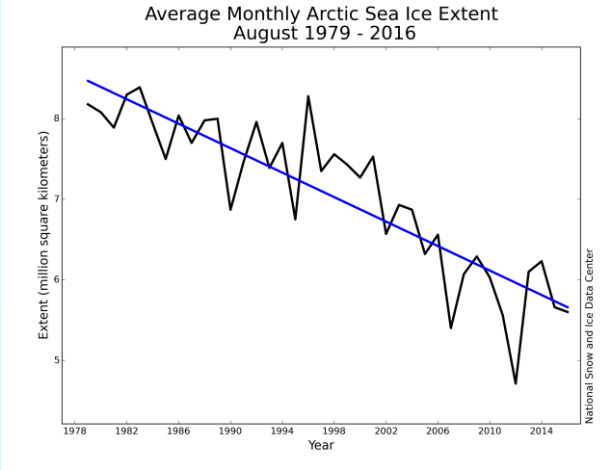
  - A 2-3 day meeting a few weeks before the summer ice break up and melting
  - Predicting well the **break-up date** for various Arctic locations is highly important for many users and have a high impact on the socio-economical activities
  - Appearance of **open water waters** have a large impact on the precipitation and surface temperature

  <u>Second:</u> Virtual meeting in Fall (Septembre)

  - Before the freeze-up
  - Users need to know how much time they will have for some of their activities that require ice-free open waters, noting that other activities require solid ice (ex: ice fishing, fret transportation on thick enough ice, ..)

PARCOF – Source of predictability

- **Sea ice** concentration and volume
  - A reduction in sea ice decreases the Arctic's albedo while increasing the absorption of solar radiation ultimately leading to a warmer sea surface and near-surface air temperature
  - Anomalous open water provides more moisture for precipitation and contribute to precipitation predictability
  - Long-term trend of decreasing sea ice is a source of predictability. Year-to-year variability exists but the return to sea ice extent values of decades ago is impossible in the short term.



- Persistence of **Sea Surface Temperature**
  - Warm SSTA delays sea ice formation. Anomalous open water areas keep the surface air temperature warmer than normal compared to when the area is covered by sea ice.

- **Arctic Oscillation** (and **North Atlantic Oscillation**)
  - Winter time Arctic temperatures and sea ice motion are strongly influenced by the AO. This influence can persist for months.
  - Numerical climate predictions have fairly good skills in predicting the AO and NAO in the seasonal time scale

PARCOF – Methodology (TBC)

- **Sources of Long-range Forecasts for the Pan-Arctic region**

Temperature and precipitation:

The main PARCOF products will include long-range forecasts of **temperature and precipitation** covering the whole Pan-Arctic region. It must be noted that these forecasts are at this moment **the only WMO mandatory forecast products** that the PRCC have to make available to the PARCOF. These forecasts will be based on the **WMO Multi-Model Ensemble Long Range Forecasts** and therefore **produced objectively** from a combination of Global Climate Models from the WMO Global Producing Centers (GPCs-LRF). These forecasts are meant to be representative of the large scale climate features. Sub-regional forecasts might be produced and put forward by the regional nodes.

Sea ice conditions:

Not yet a mandatory PRCC forecast product, but available experimental and operational outlook products would be use. The same multi-model ensemble approach using global climate models is planned to be used experimentally. A Canadian project called **FRAMS** (Forecasting Regional Arctic Sea Ice from a Month to Seasons) has been recently undertaken and should provide the PARCOF with one of the best source of long-range Pan-Arctic sea ice predictions. FRAMS is funded by MEOPAR and endorsed by YOPP. It is expected that statistical downscaling techniques would be applied to the sub-regional and local areas by some of the countries involved in the PARCOF. The Sea Ice Prediction Network (**SPIN**) initiative is also a excellent source of sea prediction and discussion.

Other products:

Eventually other outlook products from various sources might be introduced in the PARCOF bulletin (ex: snow water equivalent, SSTA, permafrost, etc..).

PARCOF – Methodology (TBC)

- **Communication of Expected Skill and Forecast Confidence**

  To the possible extent, **calibrated probabilistic forecasts** would be used. The probabilistic approach allows for the communication of forecast confidence, and when they are calibrated, unskillful probabilistic forecast regions are reduced to equal chances, expressing an expected low forecast skill. Furthermore, since the goal is to produce and communicate objectively made (no human subjectivity involved) forecasts, **historical skill measures from model hindcasts could be communicated as expected skill maps (correlation, RMSE or Brier Scores, ROC scores) accompanying forecast maps**. The use of **masks applied on forecast maps** where the skill is estimated too low could be done too.

- **Evaluation of the previous Seasonal Outlook**

  Review of the previous season (winter or summer) will be done at the beginning of the PARCOF. Diverse PRCC verification products would be used. The forecast verification will use standard metrics on grids as well as at station locations. Sea ice forecast verification is a relatively new scientific domain and will require special attention. Verification of sea ice freeze-up and break-up/melting dates would be of great interest.

PARCOF – Methodology (TBC)

- **Capacity Development Activities**

  We plan to hold a one or two-day capacity-building workshop preceding the PARCOF program. Such workshops are already planned within the FRAMS project, **to engage, co-develop and to train users** of new experimental long-range sea ice forecast products. **Workshops on the use of Indigenous Knowledge** and climate information **communication** with Indigenous People might as well be organized.

- **User Involvement**

  In addition to the user involvement activities and capacity development workshops during PARCOFs, **it would be of interest to define a clear feedback mechanism between the PARCOFs event**. It could be through an **internet forum, on-line chat**, **email distribution list**, **social networks**, etc. NMHSs have already their own network that would most likely need to be formalized, strengthen and vet (that would be the case in Canada). To be sure that the PARCOF products are used and useful, we may have to **perform surveys** as well as **visiting the users at their work place** when possible to better understand their decision-making environment.

- **Downstream Use of the PARCOF Information at the National Level**

  It is expected that the PARCOF Bulletin will be further refined at the National levels, for example by the **applications of some downscaling methods**, and/or be considering additional observations not available in time to be considered in the PARCOF process.

PARCOF – Summary of expected outcome

- Communicating risks and opportunities via **an integrated bulletin**;
- Exploring the use of Indigenous Knowledge;
- Improving understanding of users' needs;
- Understanding Science Plans to improve predictions

PARCOF – Way Forward

- Came here to ear about your lessons learned and best practises!
- First PARCOF ever : spring 2018
- Planning the first PARCOF has just started
- Thanks in advance for your recommendations!

Arctic fox jumping ahead on its prey Source: elainebp3.weebly.com

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¡Gracias!
Thank you!
Merci!

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