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# Prospective WMO Polar Regional Climate Centre/MME for sea ice prediction

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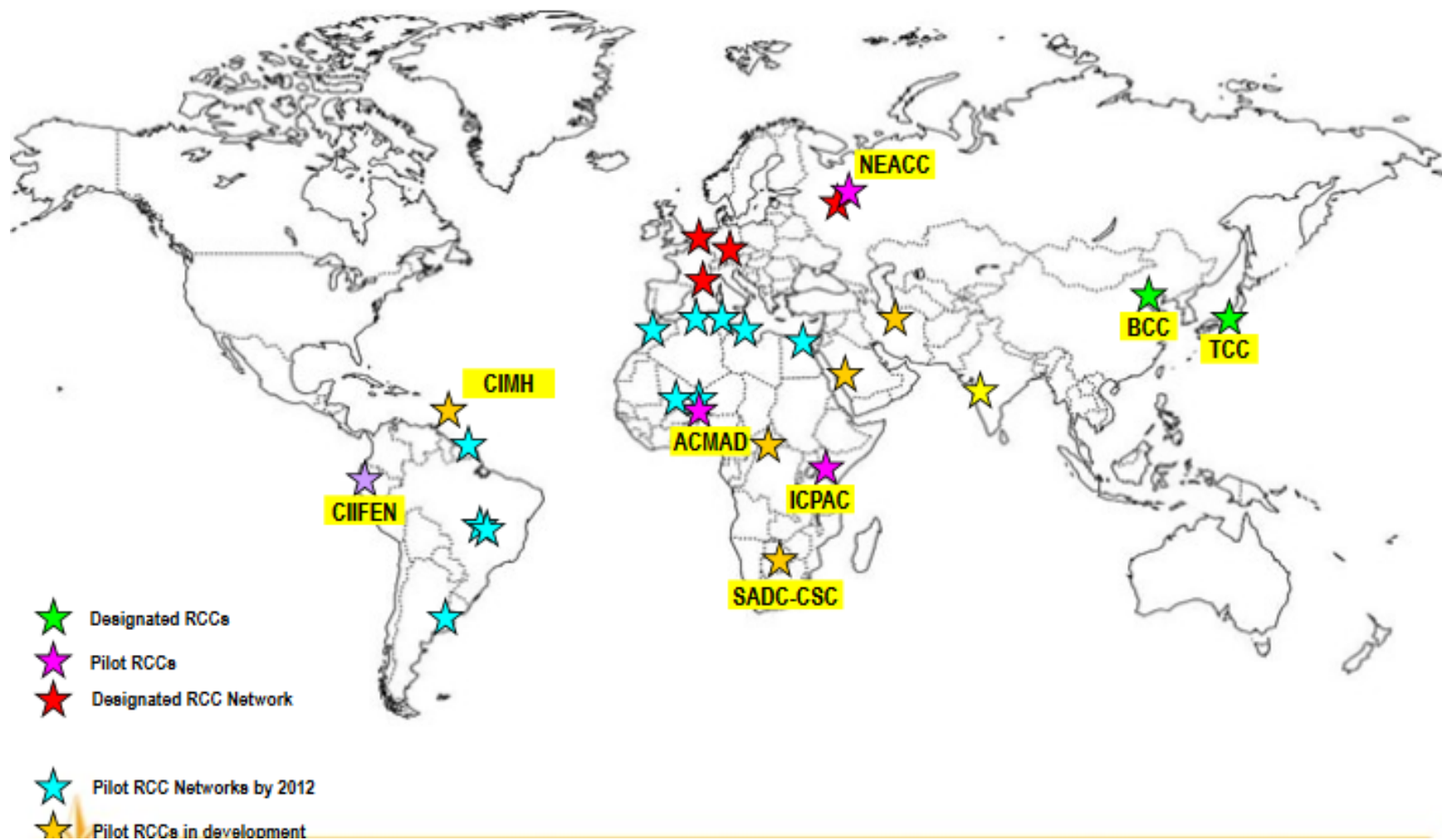
# Context - What is a RCC?

- WMO RCC services span a set of **mandatory** and additional **highly recommended** functions
- Mandatory functions must be fulfilled in order to obtain WMO's designation as WMO RCC.
- General procedures described in the Manual on the Global Data-processing and Forecasting Systems (WMO-No. 485, edition 2014)

<b>Mandatory functions</b>	<b>Highly recommended functions</b>
I. Operational Activities for Long Range Forecasts (LRF) (Temperature and Precipitation)	V. Climate prediction and climate projection
II. Operational Activities for Climate Monitoring	VI. Non-operational data services
III. Operational Data Services, to support operational LRF and Climate monitoring	VII. Coordinating functions
IV. Training in the use of operational RCC products and services	VIII. Training and capacity-building
	IX. Research and development

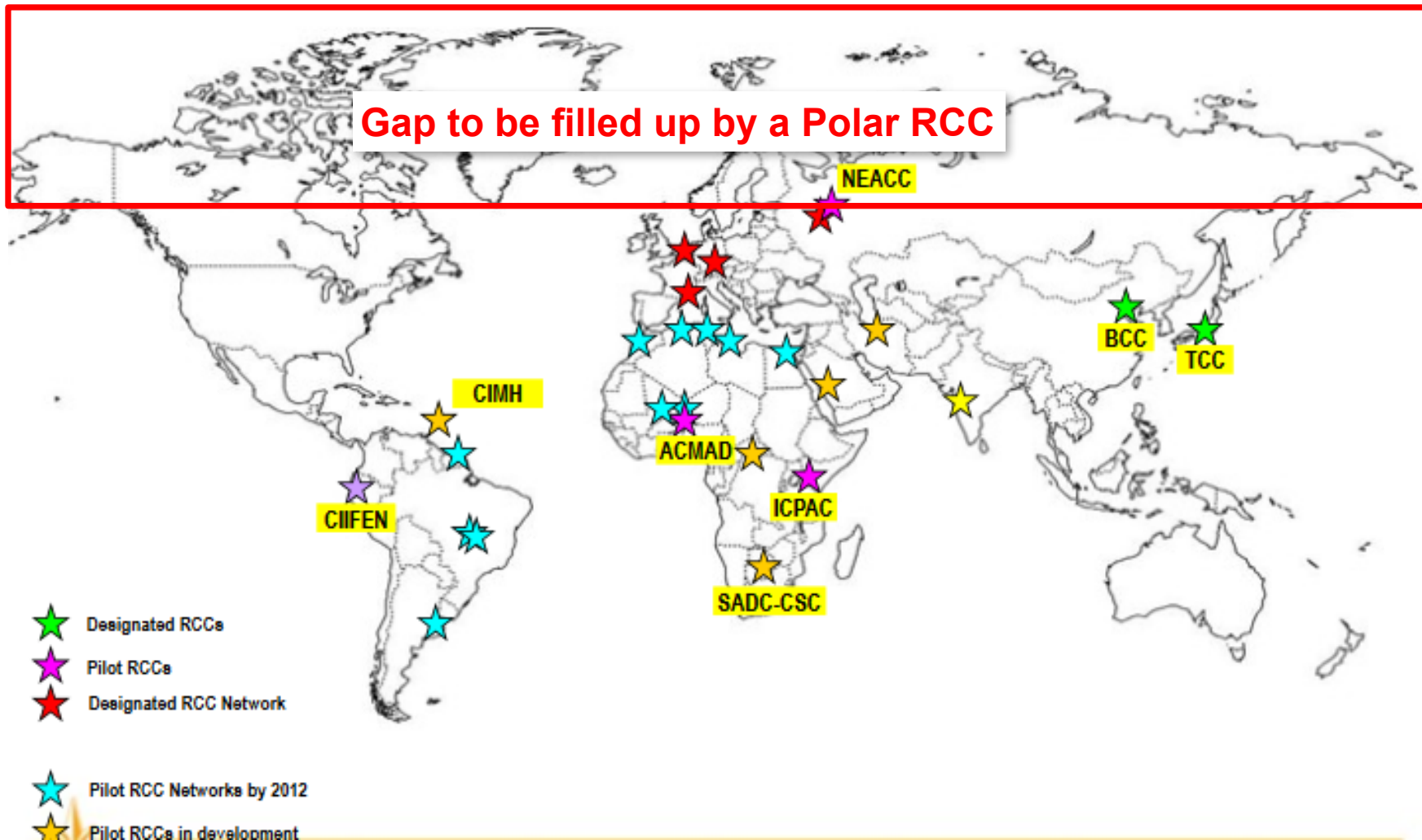
# WMO RCC Status Worldwide

Caribbean (CIMH) – in demonstration phase.



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# Implementing a RCC in the Arctic

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- **2008**, WMO-WCRP IPY Workshop on CLIPS in Polar Regions (St. Petersburg)
- **2013**, Resolution to develop Polar RCCs - WMO Executive Council – 65<sup>th</sup> session – Arctic a priority region to better serve at regional level endorsed by:
  - EC-Panel of Experts on Polar and High Mountain Observations, Research and Services (EC-PHORS)
  - Global Cryosphere Watch
  - Commission for Climatology and Commission for Basic Systems
  - Concerned Regional Associations
- **March 2015**, WMO's Survey of Members on needs and capacities for Polar RCC services (identifying priority functions).
- **Nov. 2015**, Scoping Workshop on Climate Services for Polar Regions: Towards Implementing an Arctic PRCC-Network. (WMO, Geneva)
- **Jan 2016**, **WMO's survey** on national contributions to the envisaged Arctic
- **Jun 2016**, **WMO EC-68** agreed to implement PRCC as **APRCC-network**
- **Nov. 2016**, Implementation Planning Meeting for Arctic Polar RCC-Network. (WMO, Geneva) – [Implementation Plan & 1<sup>st</sup> PCOF for 2017](#)

# Understanding Users' Needs

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- User Needs

Decision-makers in Polar Regions are known to need information on:

- i. Temperature
- ii. Precipitation, both liquid and frozen
- iii. Circulation (pressure, wind)
- iv. Snow cover
- v. Sea ice (extent, concentration, thickness, etc)
- vi. Metocean (sea water temperature, salinity, level, waves)
- vii. Freeze/Thaw periods and conditions

- Source (CLIPS in Polar regions, Russia 2008)
- Response from the NMHS in the WMO 2016 survey on PRCC



# RCC Models and proposed network

- **Organizational models**
- 2 existing structures :
  - a) One **single** (multifunctional) **centre** delivers all the RCC functions,
  - b) A **Network** of centres (RCC nodes) tackle the RCC functions.
    - Network can be Geographically based or Activity based
    - **WMO EC-68 in June 2016** agreed to implement Arctic PRCC as **APRCC-network**

Arctic RCC-Network	
Proposed Network nodes	Countries
Northern Europe and Greenland	Denmark, Finland, France, Germany, Iceland, the Netherlands, Norway, Sweden and UK
Eurasia	Russian Federation
North America	Canada and USA

# Seasonal Prediction of Sea Ice

## Toward multi-centre operational forecasts

- WMO has developed concept for distributed Polar Regional Climate Centre (RCC), to provide consolidated seasonal forecasts to national meteorological centres and other clients
- Decision to implement expected in late 2016
- ECCC's Canadian Centre for Meteorological and Environmental Prediction (CCMEP) in Dorval has expressed interest in hosting Polar RCC node focused on multi-centre seasonal forecasting of sea ice
- Enhanced R&D capacity will be needed to develop user-relevant multi-centre sea ice forecast products and to establish dialogs with spectrum of end users



### RCC implementation in the Polar Regions

The World Meteorological Organization (WMO) Executive Council through its Panel of Experts on Polar and High Mountain Observations, Research and Services ([EC-PHORS](#)) (renamed from EC-PORS to EC-PHORS by EC-67) is developing a concept for the establishment of Regional Climate Centres (RCCs) for the Polar Regions.

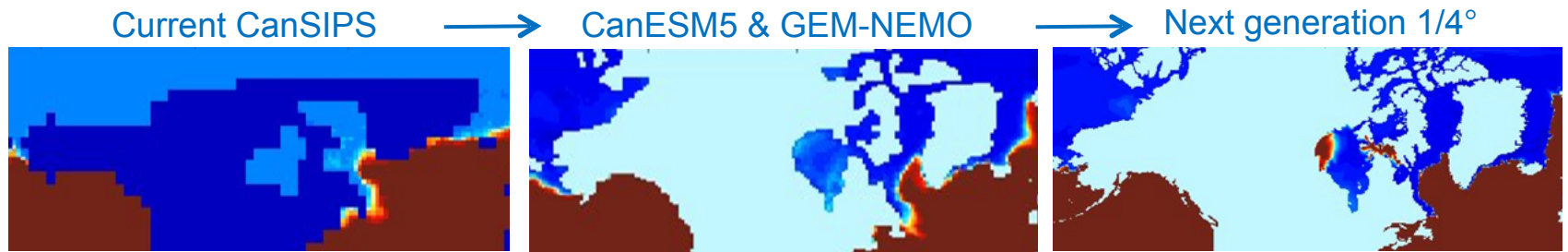


# Seasonal Prediction of Sea Ice

## Model and initialization R&D

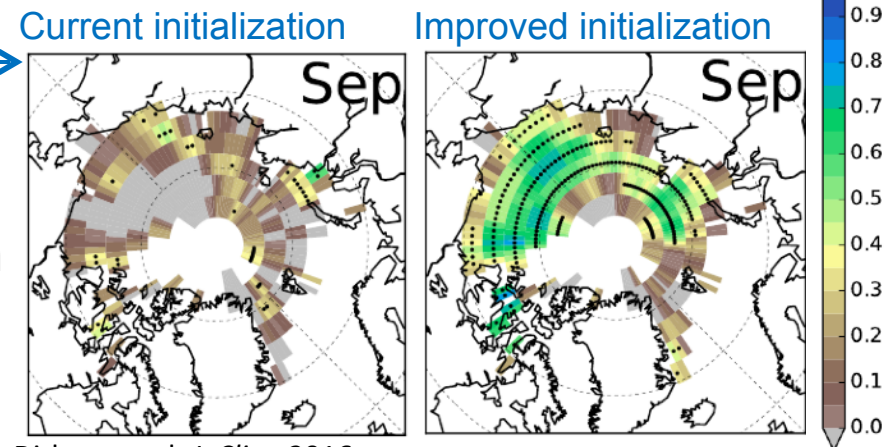
- Seasonal sea ice prediction young and emerging field, ECCC among earliest
- Model development at CCCma/RPN is improving sea ice resolution & physics:

Sea ice grid - coastlines in Canadian Arctic



- Accurate initialization of sea ice, particularly thickness which is sparsely observed, is critical for good forecasts
- Best practices for initialization still a major research question
- Coordinated seasonal sea ice prediction experiments planned under YOPP, ECCC well positioned to participate

CanSIPS skill for predicting September sea ice concentration from start of May



Dirkson et al. *J. Clim.*, 2016

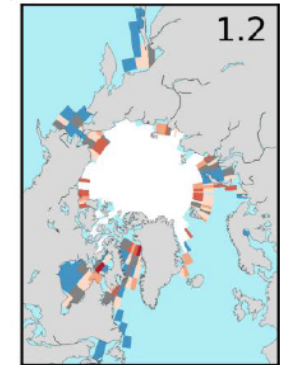
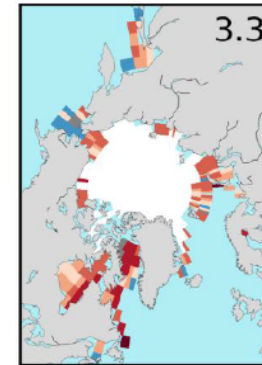
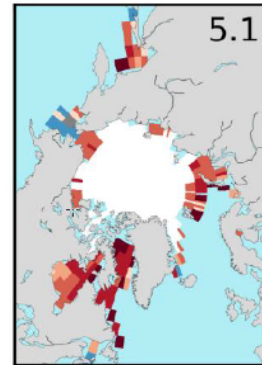
# Seasonal Prediction of Sea Ice

## Product development

- Major push needed to develop user-relevant products + ties to end users
- Examples of product R&D to build on: CanSIPS w/ trend CanSIPS detrended persist. detrended

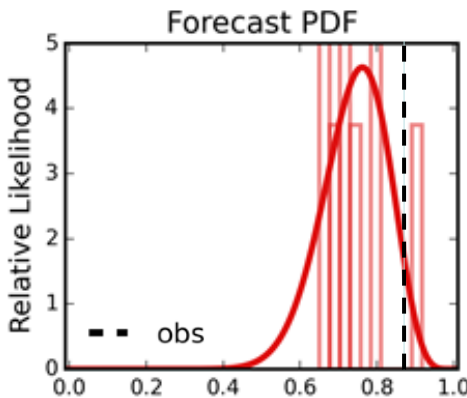
Skill of existing CanSIPS system for predicting sea ice freeze dates →

Calibrated probabilistic forecasts of sea ice presence for arbitrary concentration thresholds ↓

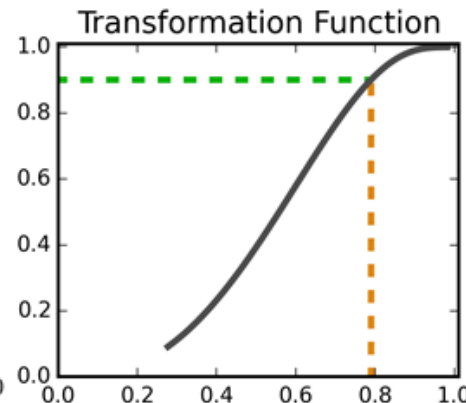


Sigmond et al. *GRL*, submitted

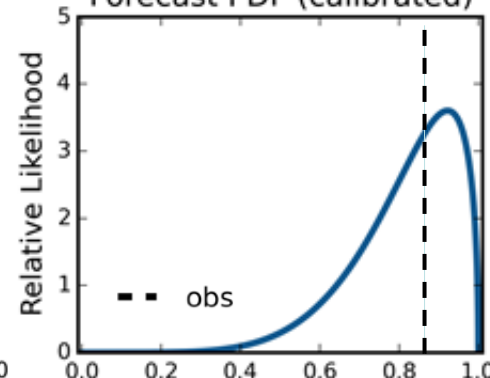
Beta distribution fit to raw forecast values



Quantile mapping based on hindcasts



Improved probabilistic skill



Dirkson et al. *in preparation*

- Probabilistic forecasts of open shipping routes