



Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

ECCC seasonal forecasting R&D aimed at meeting user needs

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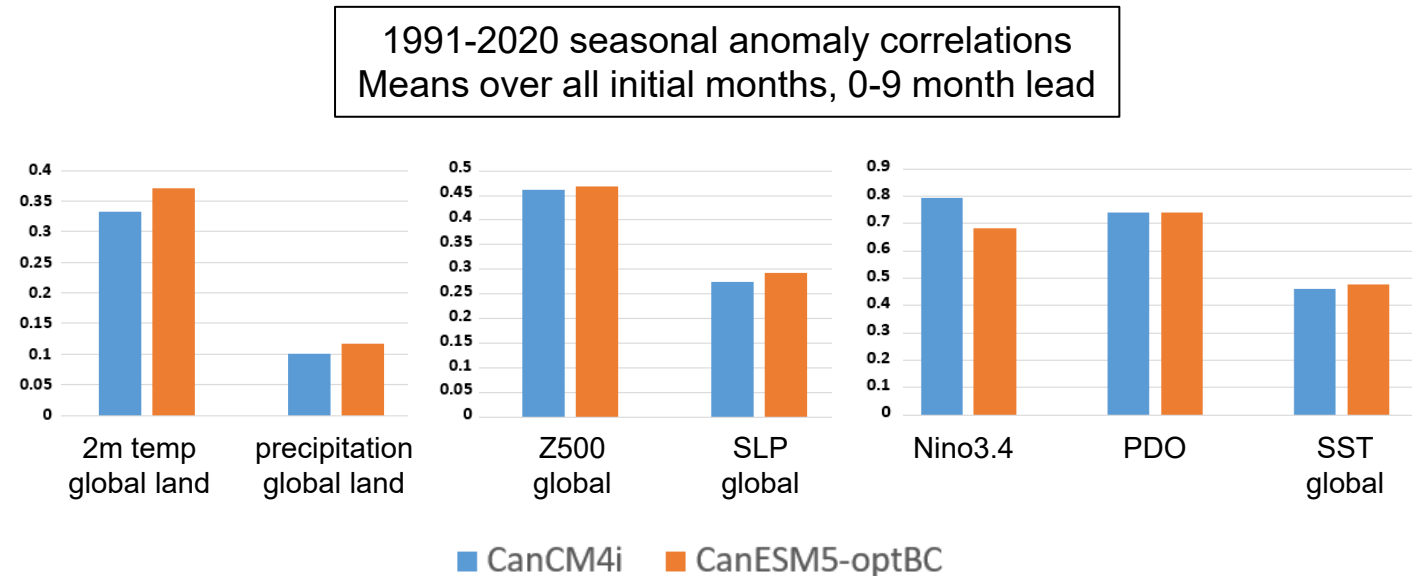
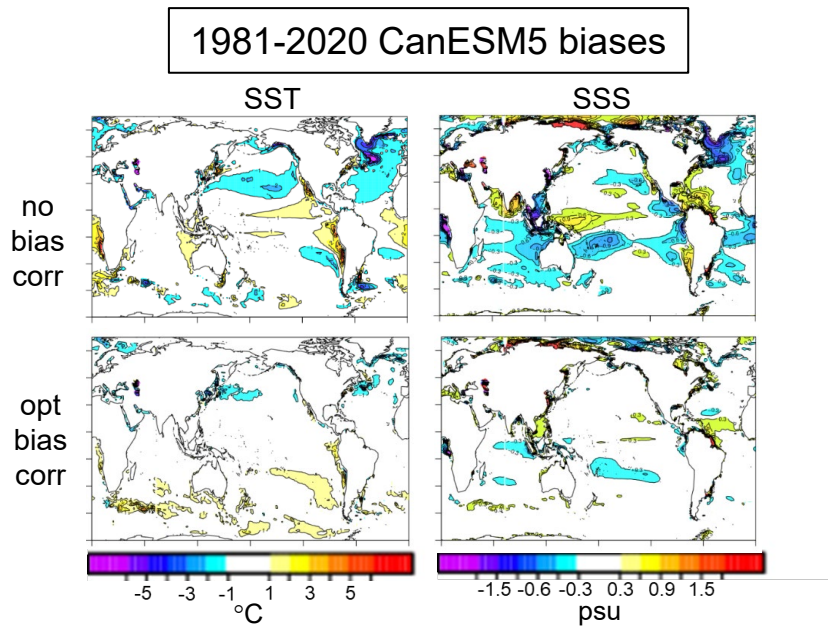


Canada 

Development of ECCC seasonal forecasting system

- ECCC's seasonal forecasts have always employed its own **multi-model ensemble**
 - 2 tier (atmosphere + specified SST) 1997-2011
 - 1 tier (coupled) 2011-present:

System	Debut	Climate models	NWP models	Ensemble	Coupled?	Range
CanSIPsv1	2011	CanCM3, CanCM4	-	2×10	Y	12 mon
CanSIPsv2	2019	CanCM4i	GEM-NEMO	2×10	Y	12 mon
CanSIPsv2.1	2021 Dec	CanCM4i	GEM5-NEMO	2×10	Y	12 mon
CanSIPsv3	Mid-2024	CanESM5.1-optBC	GEM5.2-NEMO	2×20	Y	12 mon



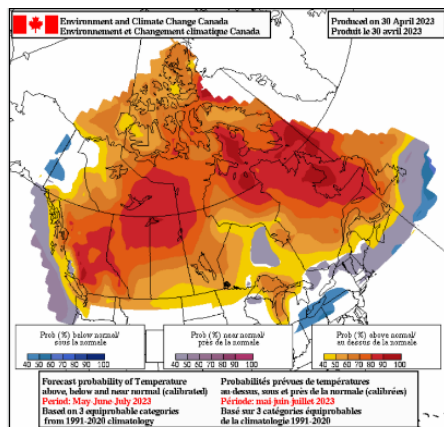
Enhancement of products and dissemination

Current modest steps forward

Weather site

- Temperature & precip
- Static maps
- Canada only

Temperature and Precipitation Probabilistic Forecasts



https://weather.gc.ca/saisons/prob_e.html

Climate site

- 5 additional variables
- Interactive maps
- Canada and global

Seasonal forecasts for Canada

Current forecasts

Select variable:

Temperature

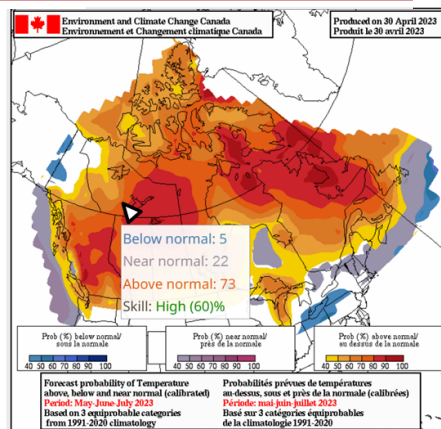
Select period:

May-Jun-Jul ==> 1-3 month

Output options

- Forecast map
- Skill map
- Reliability

Download data



<https://climate-scenarios.canada.ca/?page=seasonal-forecasts>

Global seasonal forecasts

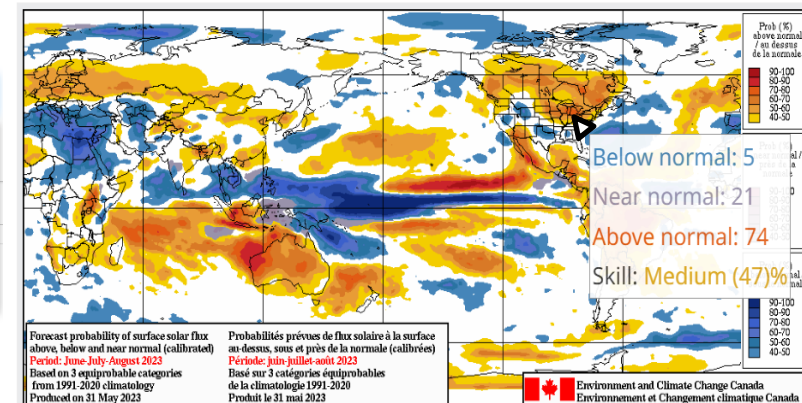
Current forecasts

Select variable:

Surface solar radiation

- Temperature
- Precipitation
- Sea surface temperature
- Snow water equivalent
- Surface solar radiation
- Cloud fraction
- Specific humidity

- Forecast map
- Skill map
- Reliability



Products under development

- ECCC produces a wide range of daily and sub-daily variables for Copernicus:

Variable ?

At least one selection must be made

- | | |
|---|--|
| <input type="checkbox"/> 10m u-component of wind | <input type="checkbox"/> 10m v-component of wind |
| <input type="checkbox"/> 10m wind gust since previous post-processing | <input type="checkbox"/> 2m dewpoint temperature |
| <input type="checkbox"/> 2m temperature | <input type="checkbox"/> Eastward turbulent surface stress |
| <input type="checkbox"/> Evaporation | <input type="checkbox"/> Land-sea mask |
| <input type="checkbox"/> Maximum 2m temperature in the last 24 hours | <input type="checkbox"/> Mean sea level pressure |
| <input type="checkbox"/> Minimum 2m temperature in the last 24 hours | <input type="checkbox"/> Northward turbulent surface stress |
| <input type="checkbox"/> Orography | <input type="checkbox"/> Runoff |
| <input type="checkbox"/> Sea surface temperature | <input type="checkbox"/> Sea-ice cover |
| <input type="checkbox"/> Snow density | <input type="checkbox"/> Snow depth |
| <input type="checkbox"/> Snowfall | <input type="checkbox"/> Soil temperature level 1 |
| <input type="checkbox"/> Sub-surface runoff | <input type="checkbox"/> Surface latent heat flux |
| <input type="checkbox"/> Surface net solar radiation | <input type="checkbox"/> Surface net thermal radiation |
| <input type="checkbox"/> Surface runoff | <input type="checkbox"/> Surface sensible heat flux |
| <input type="checkbox"/> Surface solar radiation downwards | <input type="checkbox"/> Surface thermal radiation downwards |
| <input type="checkbox"/> TOA incident solar radiation | <input type="checkbox"/> Top net solar radiation |
| <input type="checkbox"/> Top net thermal radiation | <input type="checkbox"/> Total cloud cover |
| <input type="checkbox"/> Total column cloud ice water | <input type="checkbox"/> Total column cloud liquid water |
| <input type="checkbox"/> Total column water vapour | <input type="checkbox"/> Total precipitation |

Variable ?

At least one selection must be made

- | | |
|--|--|
| <input type="checkbox"/> Geopotential | <input type="checkbox"/> Specific humidity |
| <input type="checkbox"/> Temperature | <input type="checkbox"/> U-component of wind |
| <input type="checkbox"/> V-component of wind | |

Pressure level

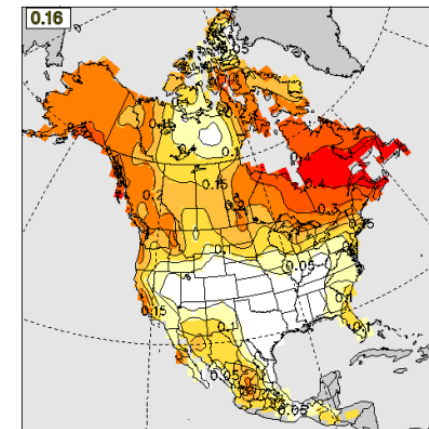
At least one selection must be made

- | | | | |
|----------------------------------|----------------------------------|----------------------------------|-----------------------------------|
| <input type="checkbox"/> 10 hPa | <input type="checkbox"/> 30 hPa | <input type="checkbox"/> 50 hPa | <input type="checkbox"/> 100 hPa |
| <input type="checkbox"/> 200 hPa | <input type="checkbox"/> 300 hPa | <input type="checkbox"/> 400 hPa | <input type="checkbox"/> 500 hPa |
| <input type="checkbox"/> 700 hPa | <input type="checkbox"/> 850 hPa | <input type="checkbox"/> 925 hPa | <input type="checkbox"/> 1000 hPa |

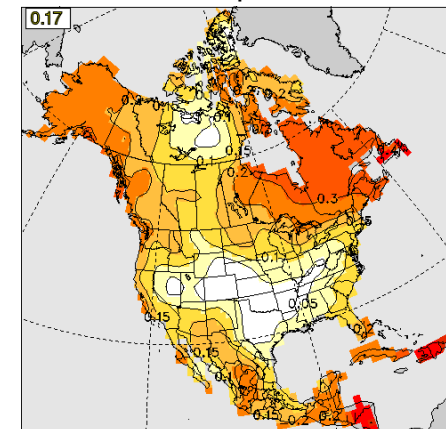
- Developing from this data sector-relevant climate indices such as
 - Heating, cooling, growing degree days
 - Wet days exceeding specified rainfall amount
 - Many additional possibilities relating to hot and cold extremes, etc
- Potential to drive application (e.g. crop) models

CanSIPsv2.1 1991-2020 CRPS DJF 0 month lead

Heating degree days



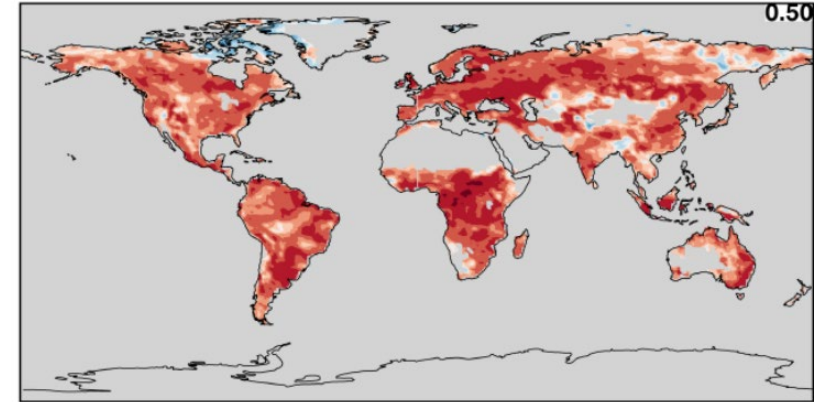
2m temperature



Products under development (2)

- Sea surface height (already produced, hindcasts available soon)
- Drought-relevant variables including soil moisture →
- User interfaces under development:

GEM5-NEMO 1991-2020 ACC vs ERA5 Sep 1 month lead



-1 -0.9 -0.7 -0.5 -0.3 -0.1 0 0.1 0.3 0.5 0.7 0.9 1
Sospedra-Alfonso et al., *J. Hydromet.*, under review

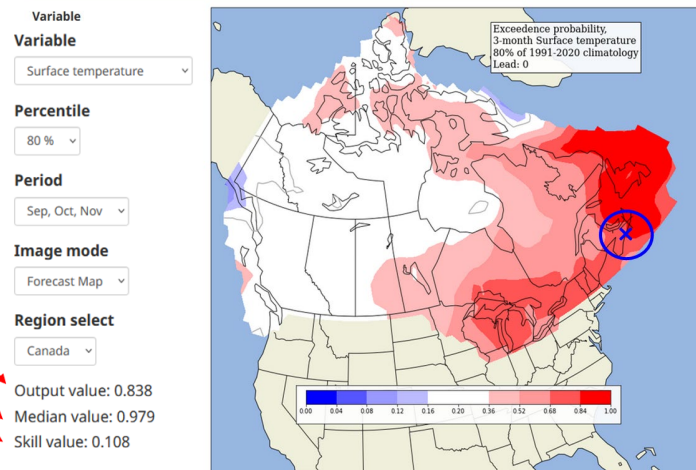
Probabilities of exceeding user-selected values via a flexible interface (somewhat like IRI site)

Probability of exceeding 80th percentile (vs 20% climatologically)

Probability of exceeding median = 50th percentile (vs 50% climatologically)

Skill values (> ~0.05 are statistically significant)

Probabilities of exceedance prototype



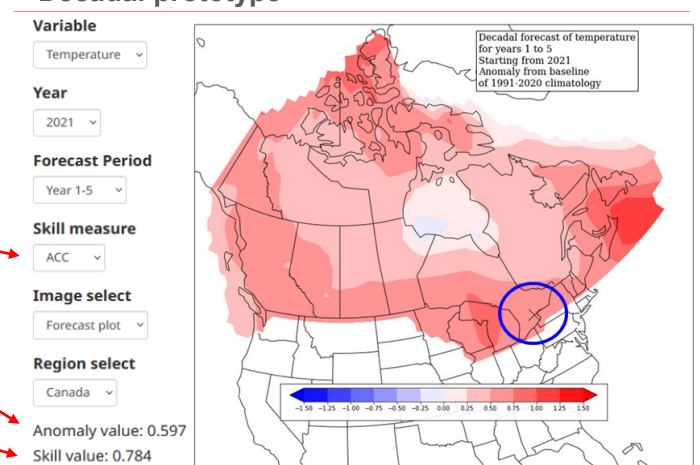
Interactive interface for ECCC decadal predictions

Decadal prototype

ACC, RMSE, ...

Local anomaly vs 1991-2020 clim

Local skill value



Longer term ambitions

- Versatile interface that provides local probabilities of **user-selected events** (e.g. 3 consecutive days above 35°C)
- High-resolution predictions for **coastal oceans** including biogeochemistry
- **Overall strategy** is to provide user-relevant, location-specific information
- **User consultation is needed** to ensure relevance and value of these products.
Otherwise...

