Wildfire Season Forecast 2023

Richard Carr, Wildland Fire Research Analyst,
Natural Resources Canada, Canadian Forest Service
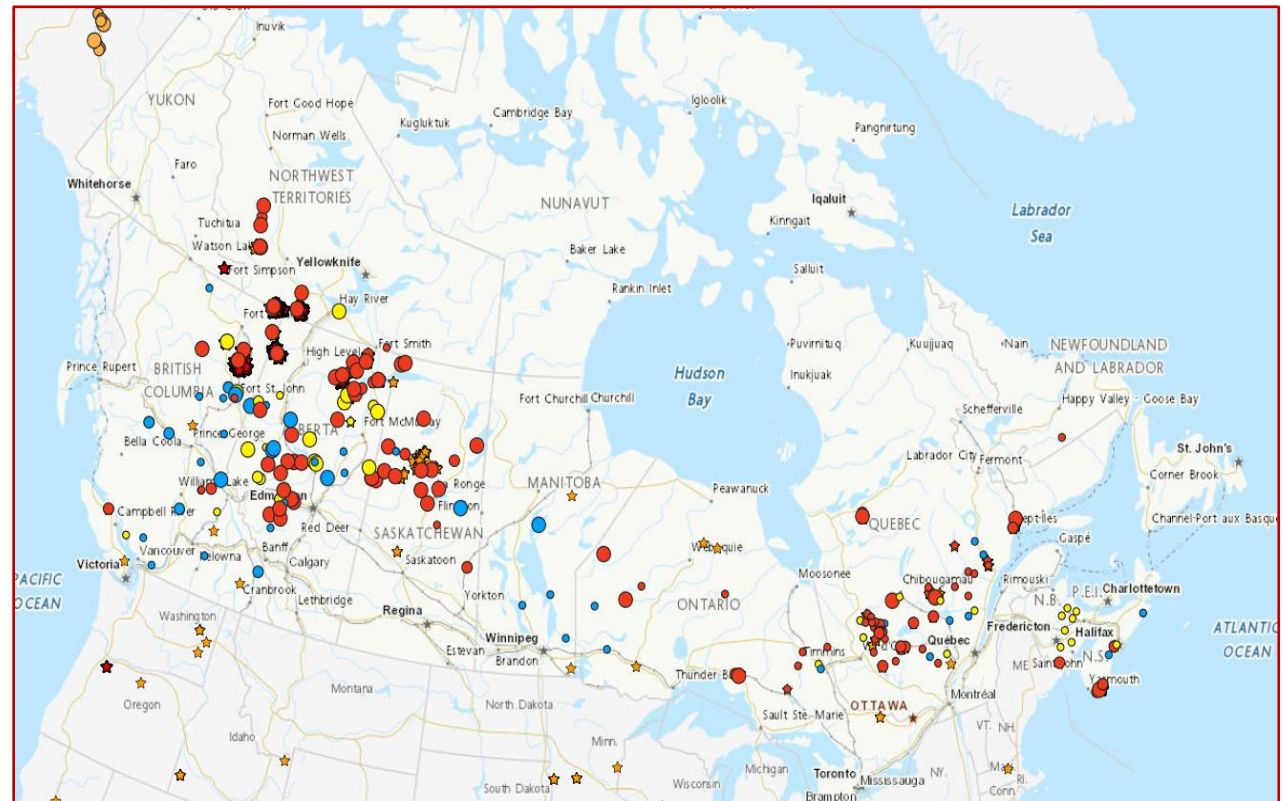
I C L R

Forecast 2023

June 6, 2023

Whoa! What's going on this year?!!

CWFIS interactive map, June 2, 2023

- **Already at/above mean area burned for an entire year**

Statistics to date

- *"I don't want to comment on that since the numbers are changing so fast they are quickly outdated."*

- Numbers from the June 5, 2023 CIFFC Situation Report:

  - Fires: 2266
  - Area burned: 3,571,727 ha
  - 10-year averages for early June: (~1700 fires, 270,000 ha)

- CIFFC National Preparedness Level (NPL) at 5 since May 11 (earliest on record)   **1   2   3   4   5**
  - International crews in from USA, AUS, NZ, ZA,
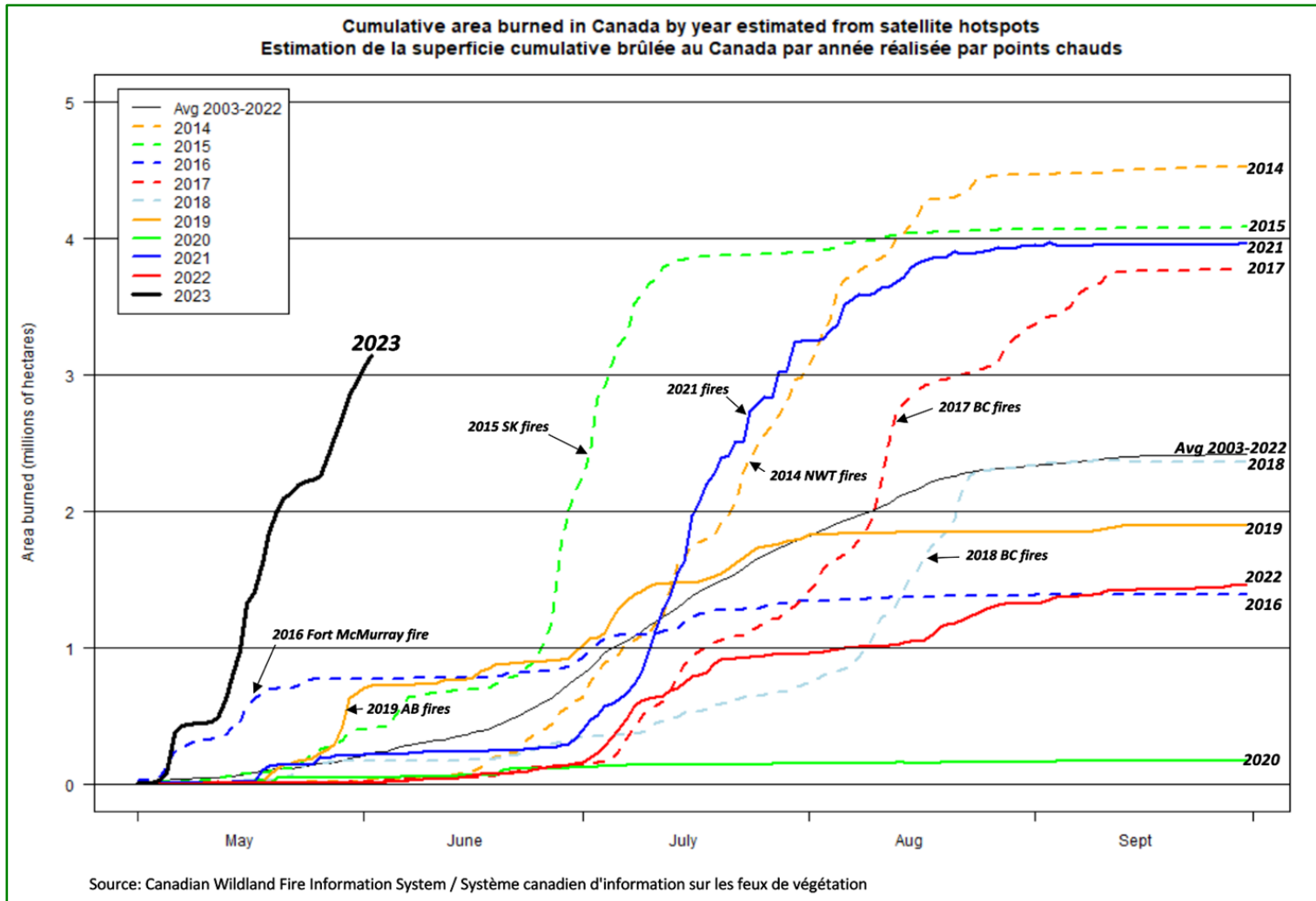 - CIFFC situation report web page has been reworked

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1989 vs 2023

- **1989 featured most area burned in our modern records**
  - **~7.5 million hectares burned; about 43% in Manitoba**

- **Were 1989 weather patterns similar to 2023?**
  - **Both years featured fading La Nina; 1989 persisted later**
  - **1989-early 1991 had long extended ENSO-neutral period**
  - **Drought prevalent**

- **Add 30 years of climate warming**

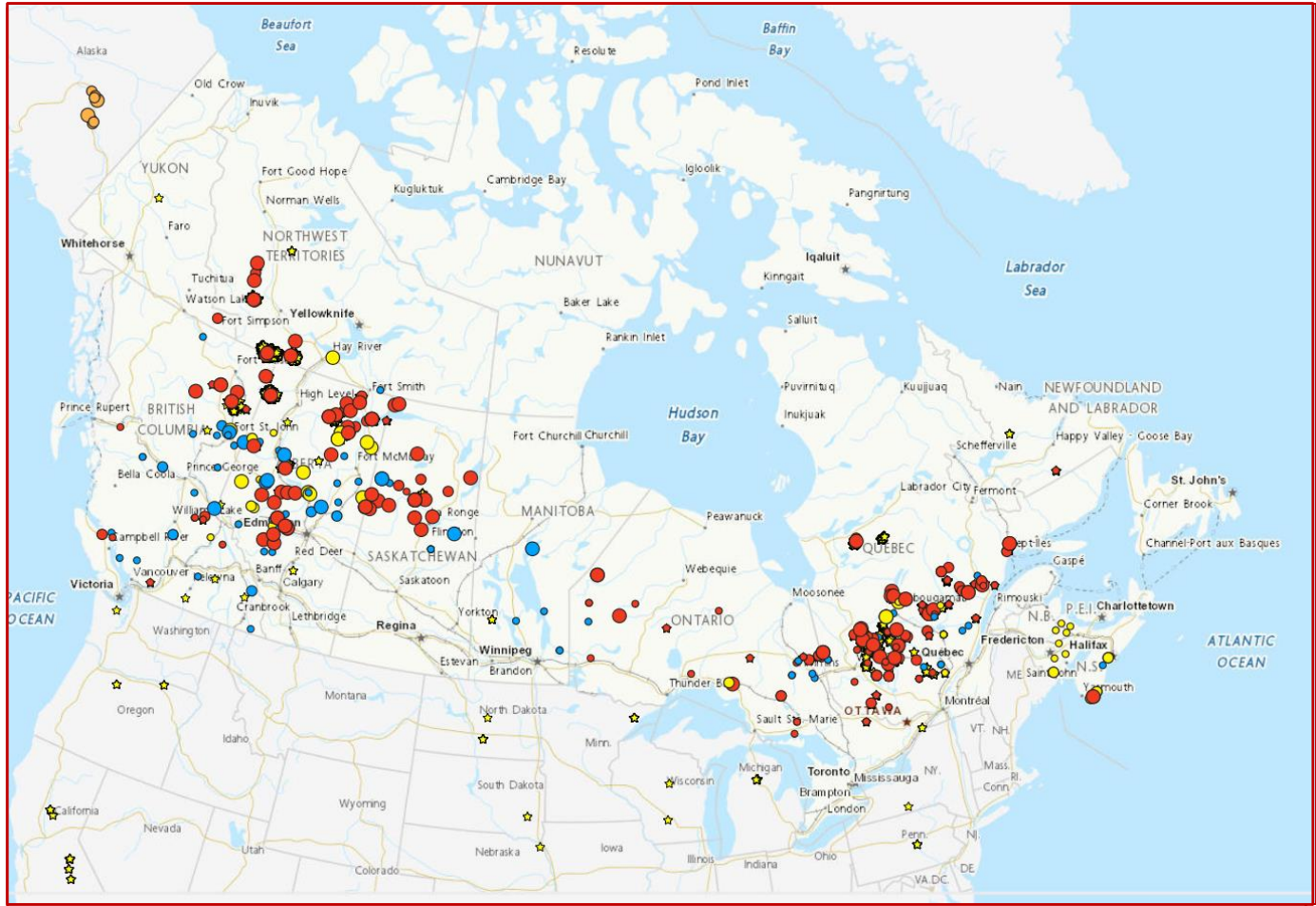- **Better detection and suppression methods in 2023**

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Unprecedented area burned increase

Cumulative area burned in Canada by year estimated from satellite hotspots
Estimation de la superficie cumulative brûlée au Canada par année réalisée par points chauds

Source: Canadian Wildland Fire Information System / Système canadien d'information sur les feux de végétation

# Hotspot and Fire Progression

June 3, 2023

Why might this have happened?

Facts and Anecdotes

- **Transition speeds of ocean/atmosphere indexes may be more important than phase maxima/minima**

- **Warmest May on record in Washington state**

- **Similar in western Canada? Numbers not assessed yet**

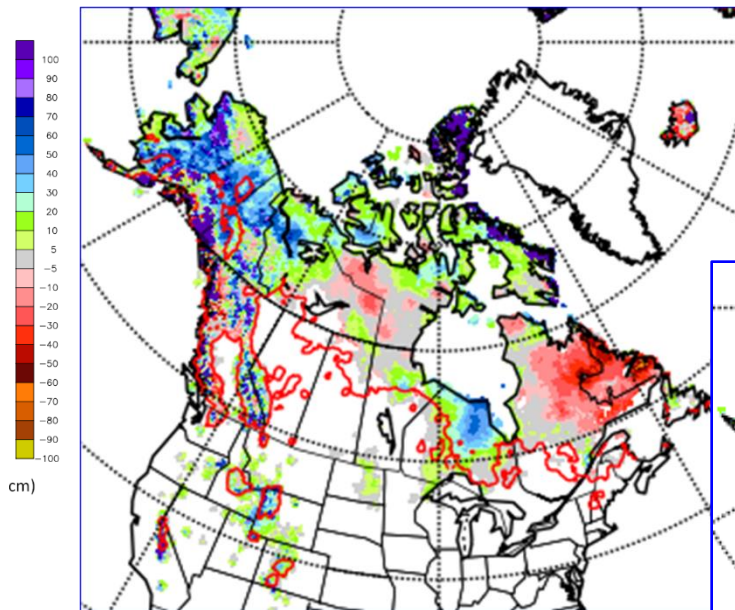Natural Resources Canada   Ressources naturelles Canada

Drought Progression

- **Drought intensified in late 2022; few areas of improvement**
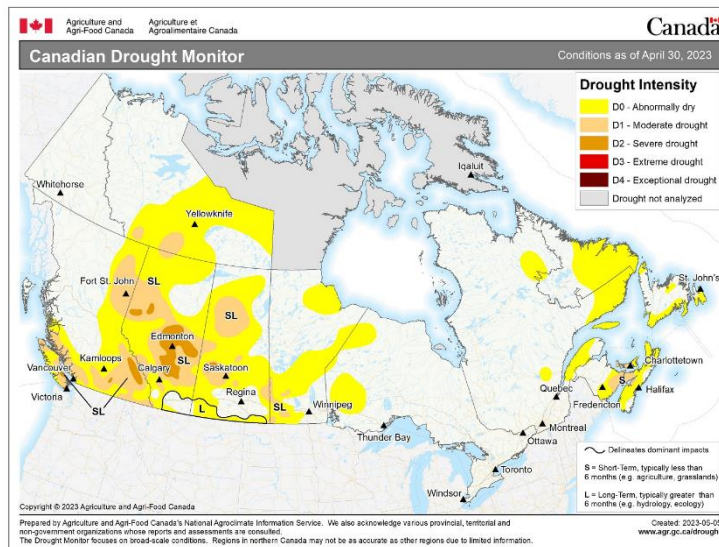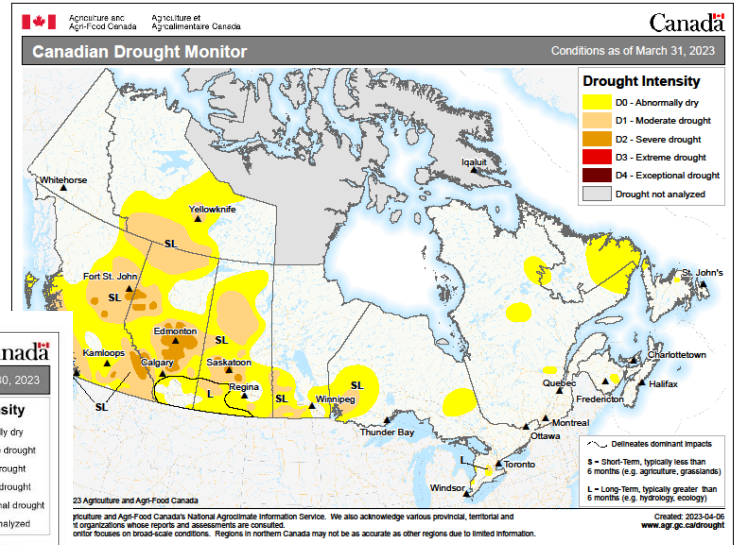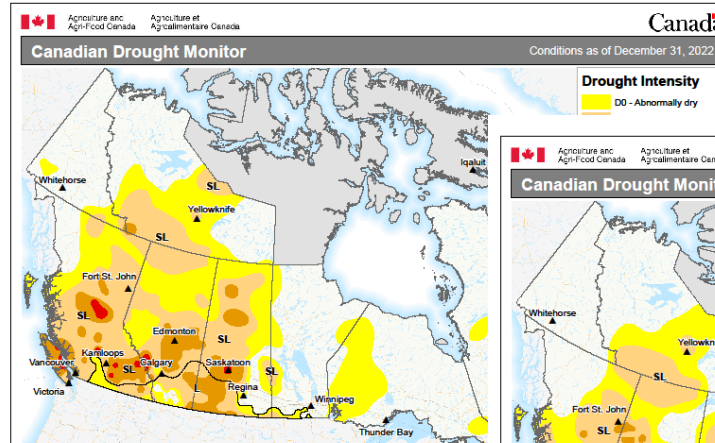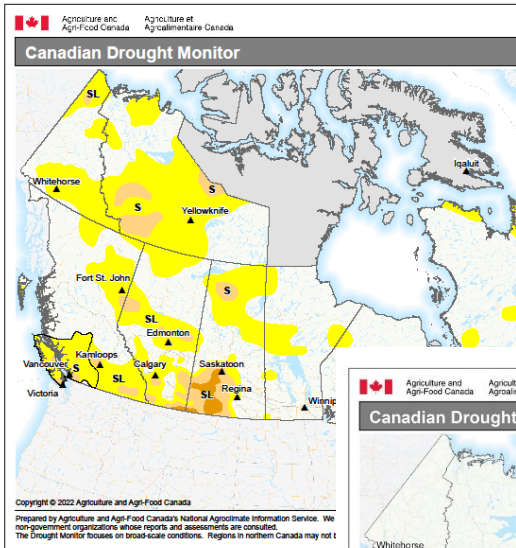
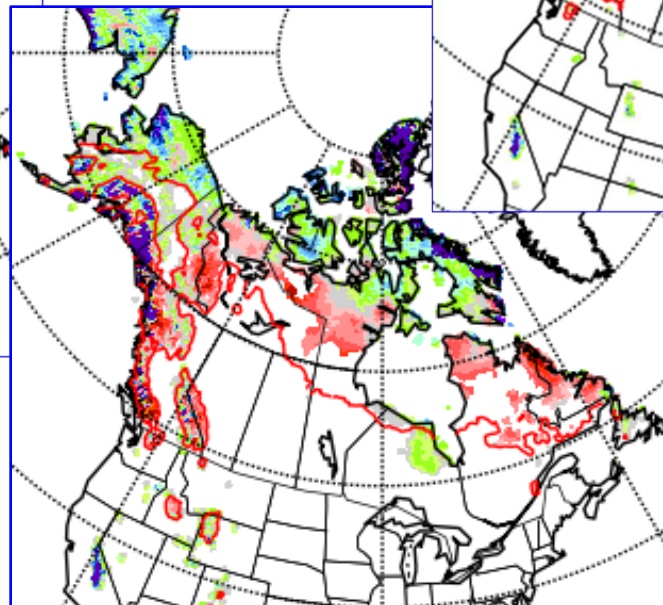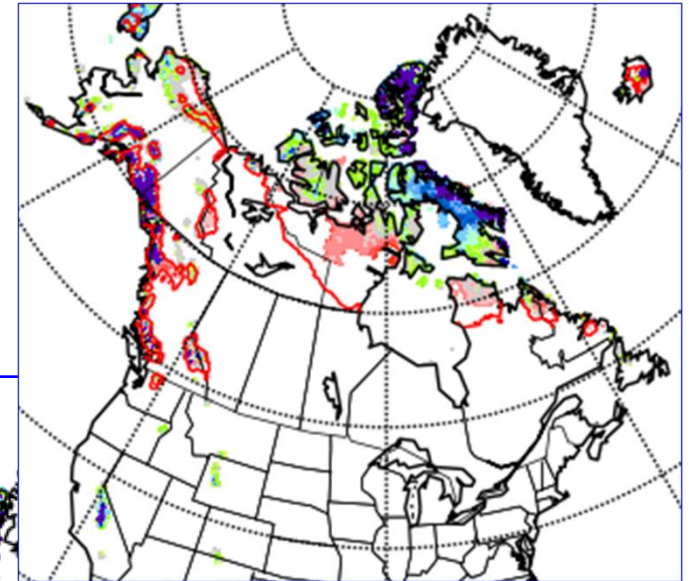# 2022 Spring start-up conditions

Snow depths

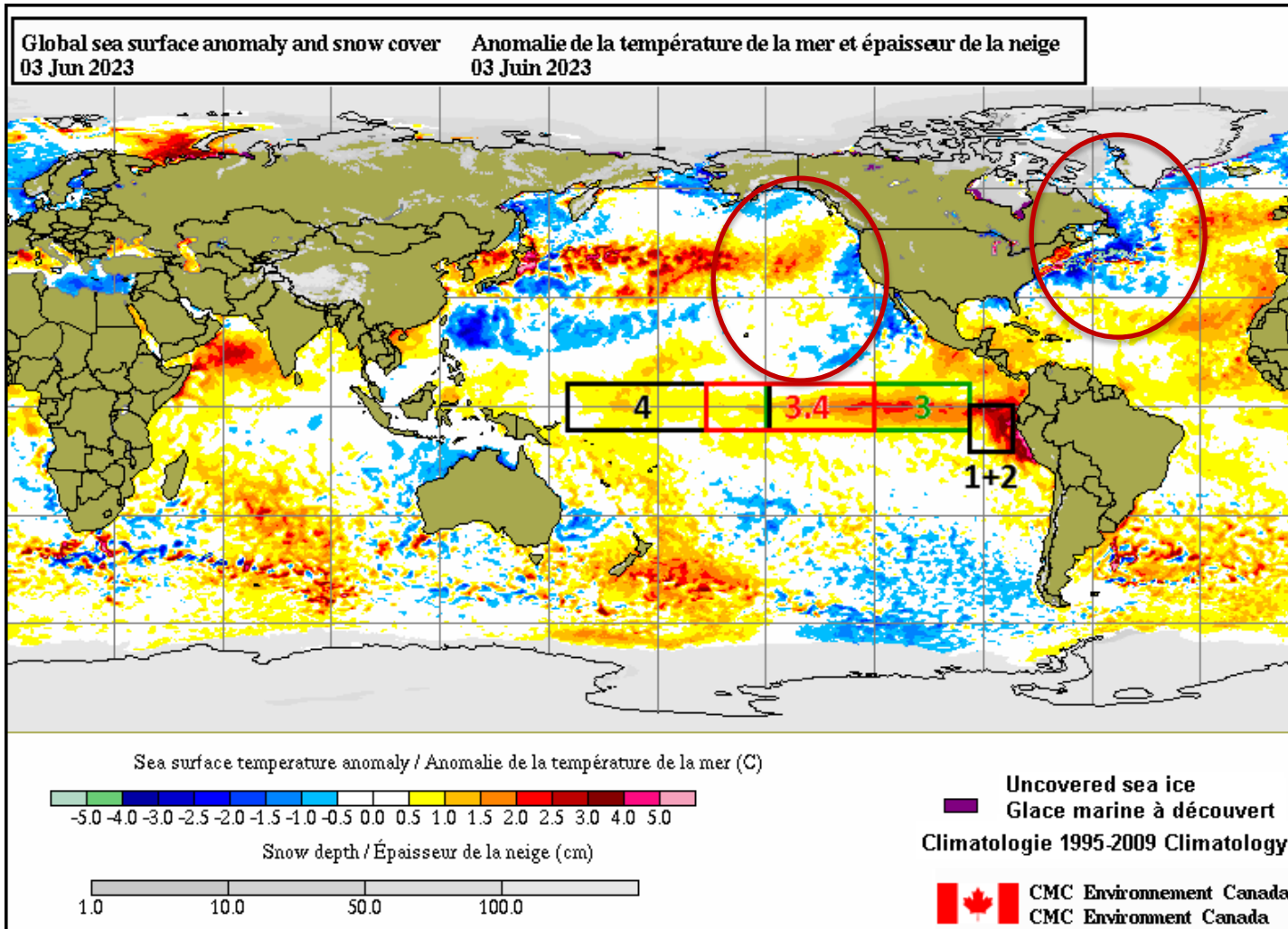- **Affects spring more than summer**

April 26, 2023

May 10, 2023

May 17, 2023

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ENSO, PDO – Current SST

Global sea surface anomaly and snow cover
03 Jun 2023

Anomalie de la température de la mer et épaisseur de la neige
03 Juin 2023

Sea surface temperature anomaly / Anomalie de la température de la mer (C)

-5.0 -4.0 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0

Snow depth / Épaisseur de la neige (cm)

1.0   10.0   50.0   100.0

Uncovered sea ice
Glace marine à découvert
Climatologie 1995-2009 Climatology

CMC Environment Canada
CMC Environnement Canada

La Nina faded

El Nino developing

Are we getting the "worst" of each???

Cold north Atlantic favoring high pressure in east?

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Fire problems in ENSO Springs

El Niño:
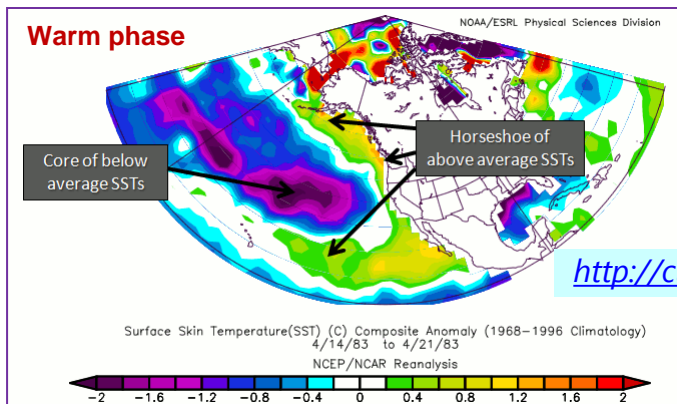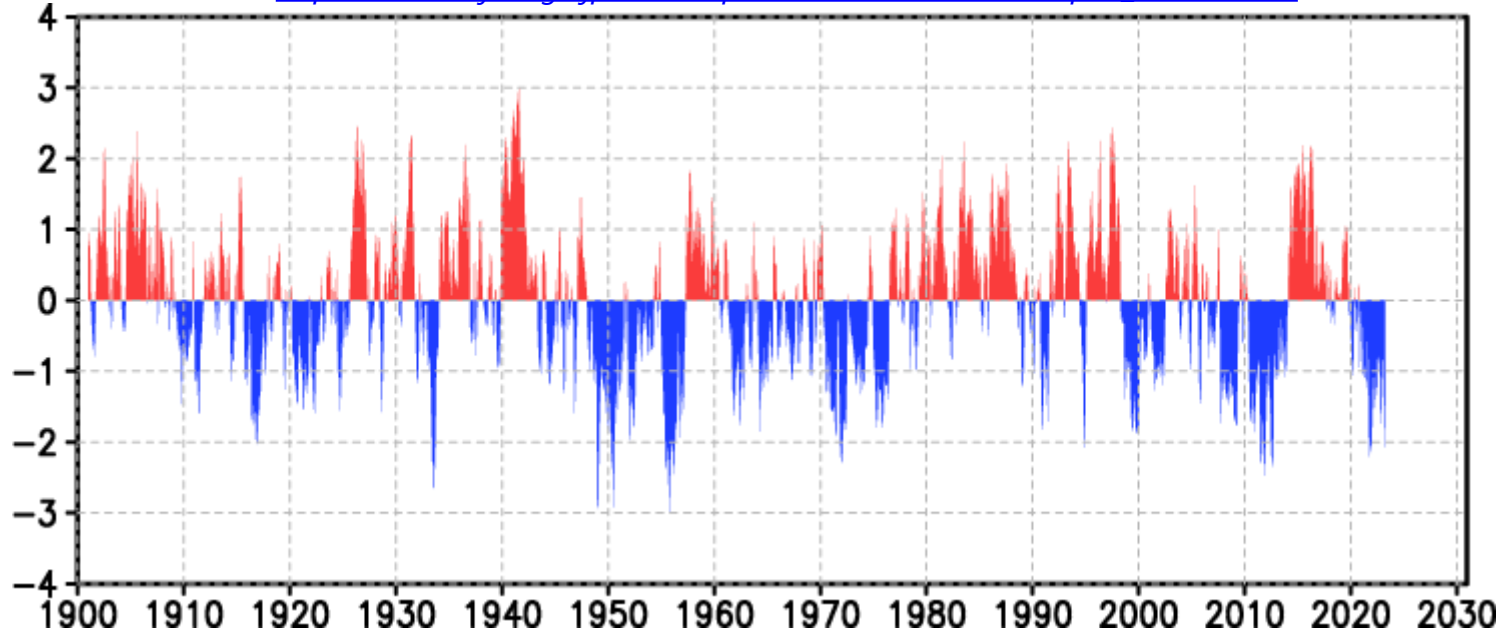- **Warm, windy, dry in western Canada**

La Niña:
- **Arctic surface highs bring dry air, strong wind around edges**
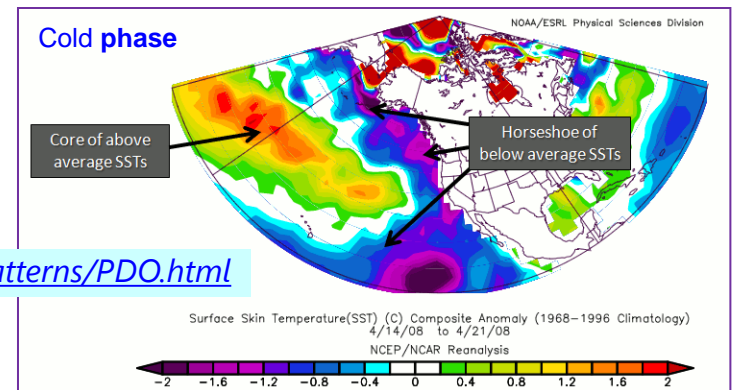- **Temperature *may* be cool**

Summer fire problems may depend on other influences

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1995	1.0	0.7	0.5	0.3	0.1	0.0	-0.2	-0.5	-0.8	-1.0	-1.0	-1.0
1996	-0.9	-0.8	-0.6	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5
1997	-0.5	-0.4	-0.1	0.3	0.8	1.2	1.6	1.9	2.1	2.3	2.4	2.4
1998	2.2	1.9	1.4	1.0	0.5	-0.1	-0.8	-1.1	-1.3	-1.4	-1.5	-1.6
1999	-1.5	-1.3	-1.1	-1.0	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.5	-1.7
2000	-1.7	-1.4	-1.1	-0.8	-0.7	-0.6	-0.6	-0.5	-0.5	-0.6	-0.7	-0.7
2001	-0.7	-0.5	-0.4	-0.3	-0.3	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3
2002	-0.1	0.0	0.1	0.2	0.4	0.7	0.8	0.9	1.0	1.2	1.3	1.1
2003	0.9	0.6	0.4	0.0	-0.3	-0.2	0.1	0.2	0.3	0.3	0.4	0.4
2004	0.4	0.3	0.2	0.2	0.2	0.3	0.5	0.6	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.4	0.4	0.3	0.1	-0.1	-0.1	-0.1	-0.3	-0.6	-0.8
2006	-0.8	-0.7	-0.5	-0.3	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.8
2019	0.7	0.7	0.7	0.7	0.5	0.5	0.3	0.1	0.2	0.3	0.5	0.5
2020	0.5	0.5	0.4	0.2	-0.1	-0.3	-0.4	-0.6	-0.9	-1.2	-1.3	-1.2
2021	-1.0	-0.9	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.7	-0.8	-1.0	-1.0
2022	-1.0	-0.9	-1.0	-1.1	-1.0	-0.9	-0.8	-0.9	-1.0	-1.0	-0.9	-0.8
2023	-0.7	-0.4	-0.1	0.1								

Large area burned →
Virginia Hills, AB →
Chisholm, AB →
Kelowna, BC →
Slave Lake, AB →
PDO positive phase →
Fort McMurray, AB →
Big years in BC →
Western half →

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Pacific Decadal Oscillation

Warm phase

Cold **phase**

http://climate.ncsu.edu/climate/patterns/PDO.html
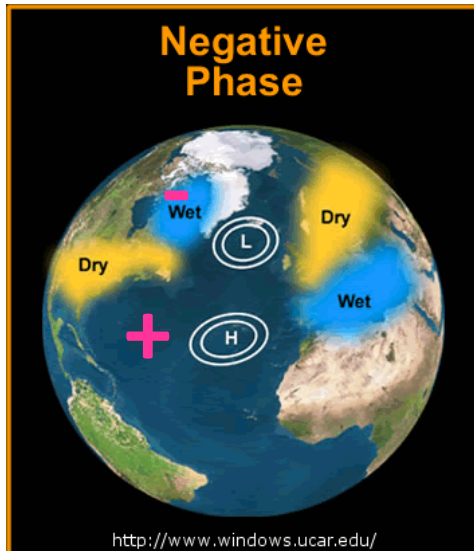
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North Atlantic Oscillation
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/pna/nao.timeseries.gif

Positive Phase
http://www.windows.ucar.edu/

Negative Phase
http://www.windows.ucar.edu/
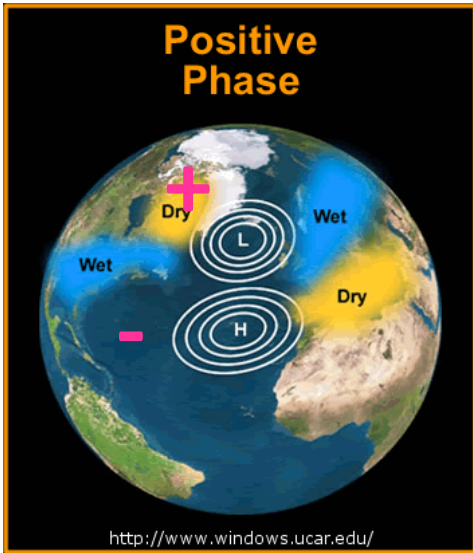
Quebec Area Burned (NFDB, ha*1000)

Year	Area Burned
2020	69
2019	10
2018	86
2017	38
2016	33
2015	5
2014	64
2013	1900
2012	64
2011	12
2010	315
2009	94
2008	1
2007	343
2006	136
2005	800
2004	3
2003	88
2002	1000
2001	33
2000	39

Standardized 3-Month Running Mean NAO Index Through January 2023

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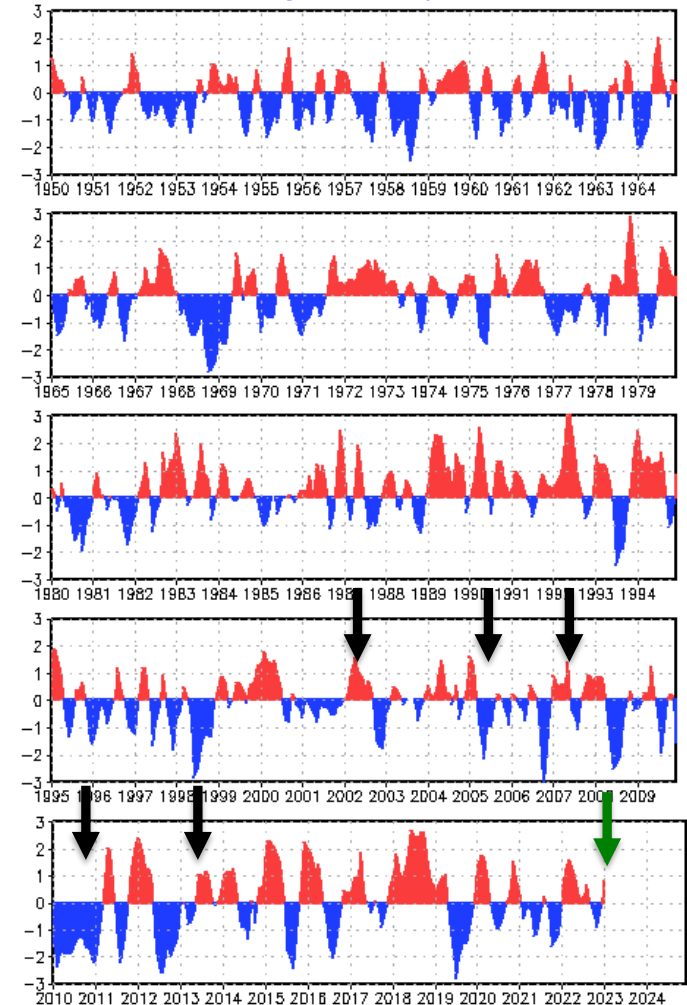
NRCan-CFS Prediction: April run, for May and June

This is not the most recent forecast
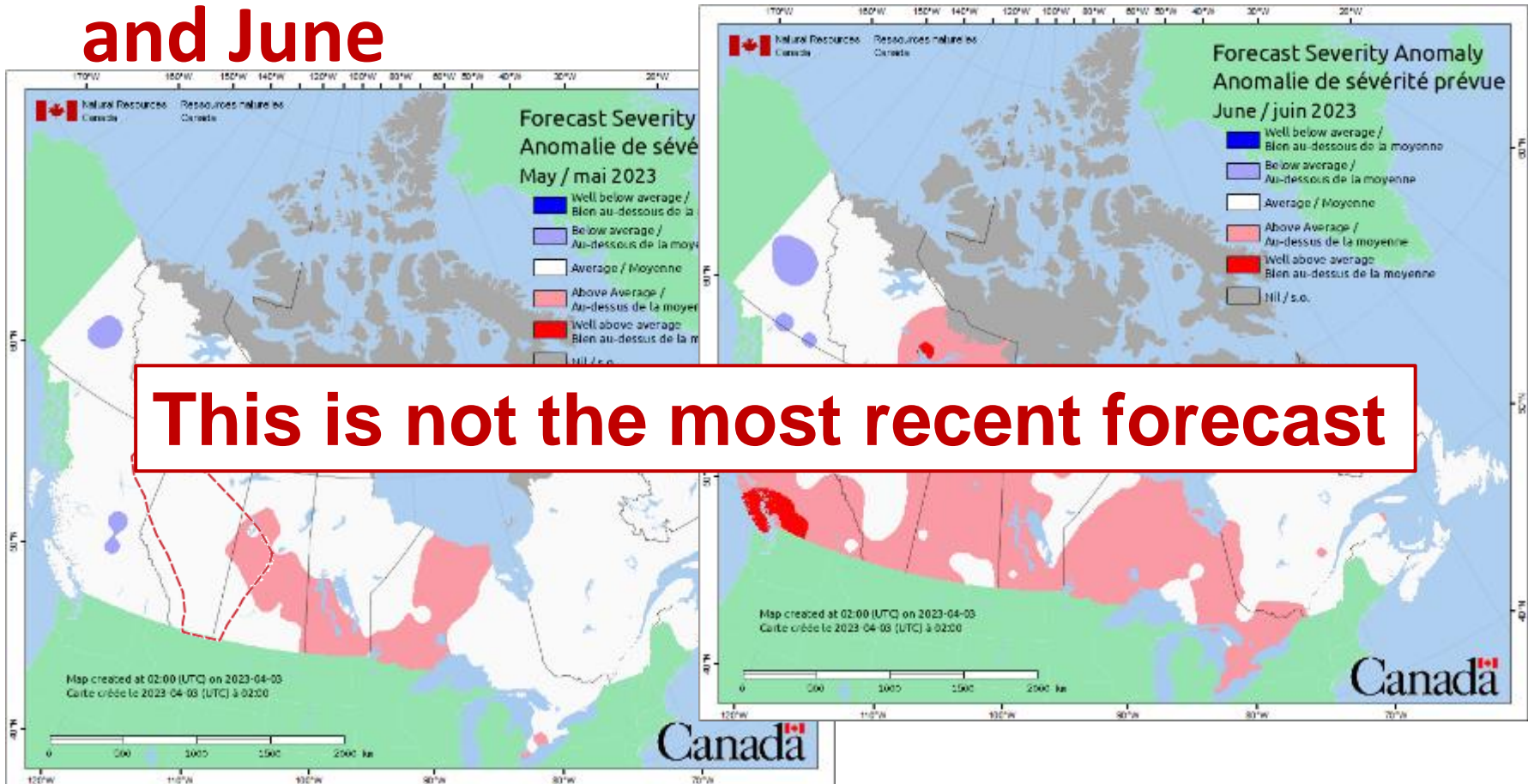
Anomaly
Predicted values normalized against average weather

NRCan-CFS Prediction: May run, for May and June
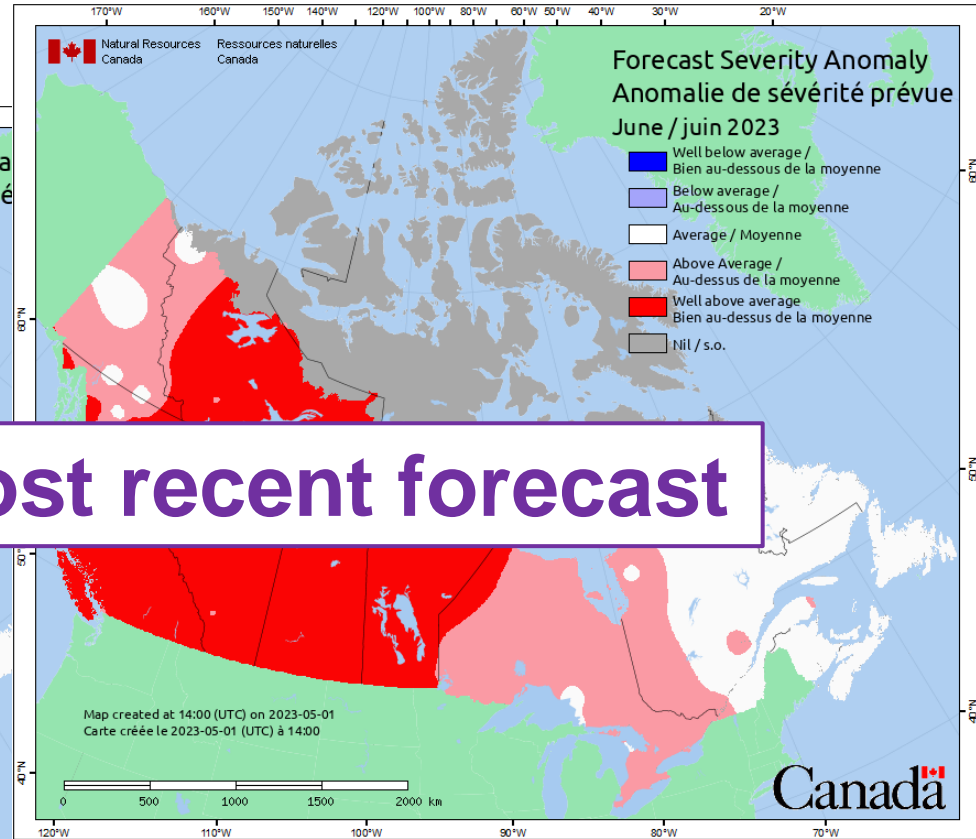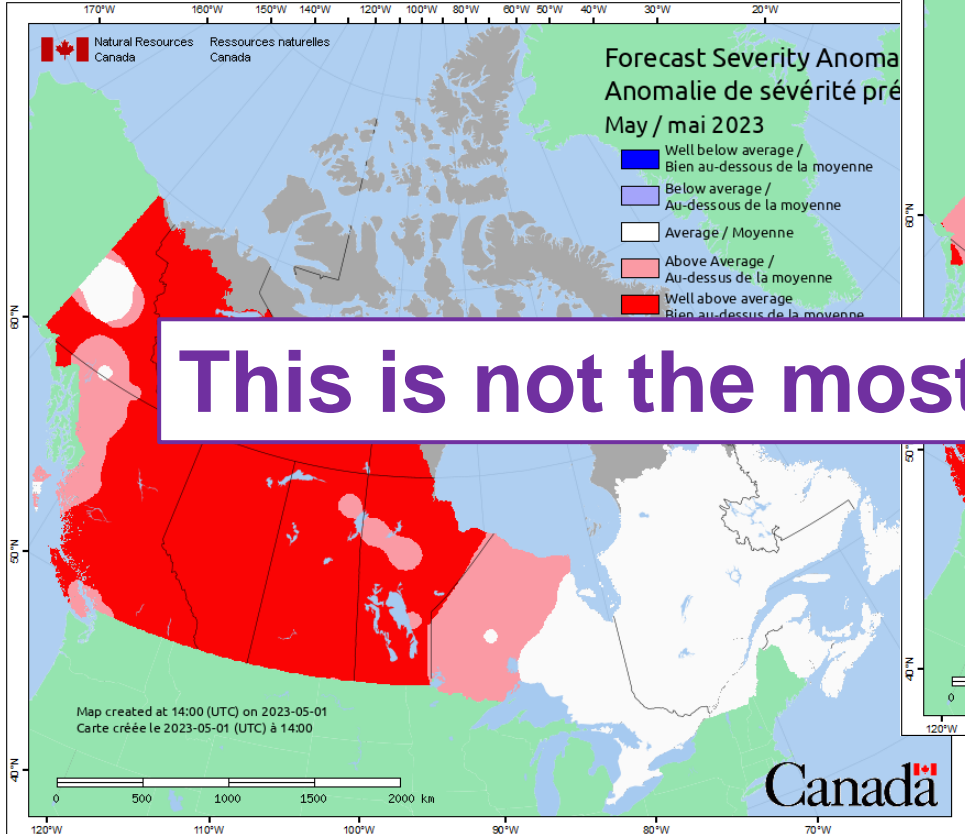
This is not the most recent forecast

Anomaly

Predicted values normalized against average weather

Why did April and May Forecasts Differ?
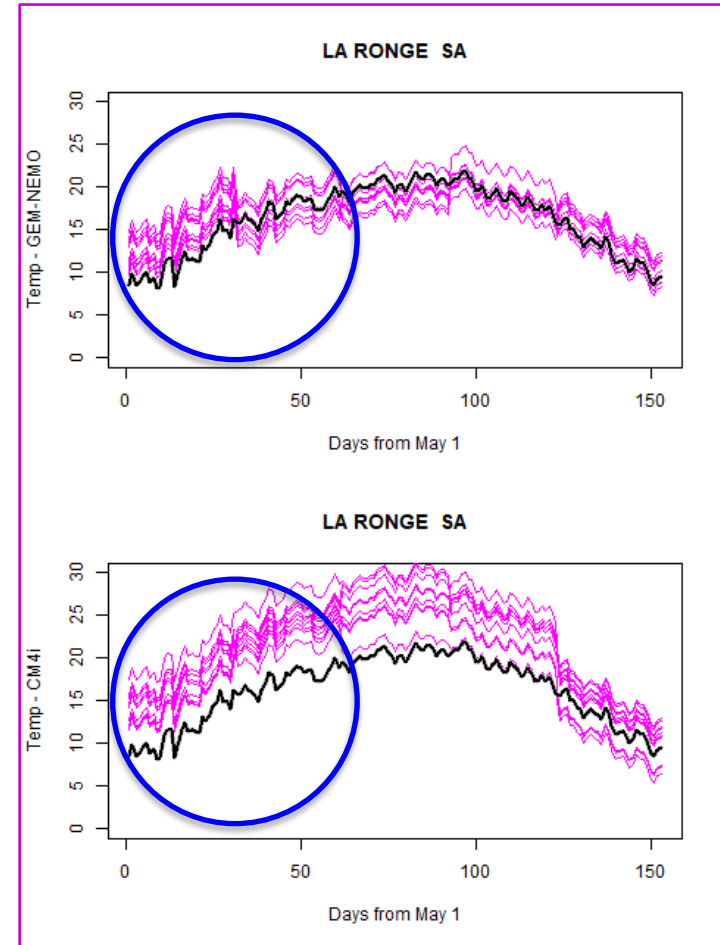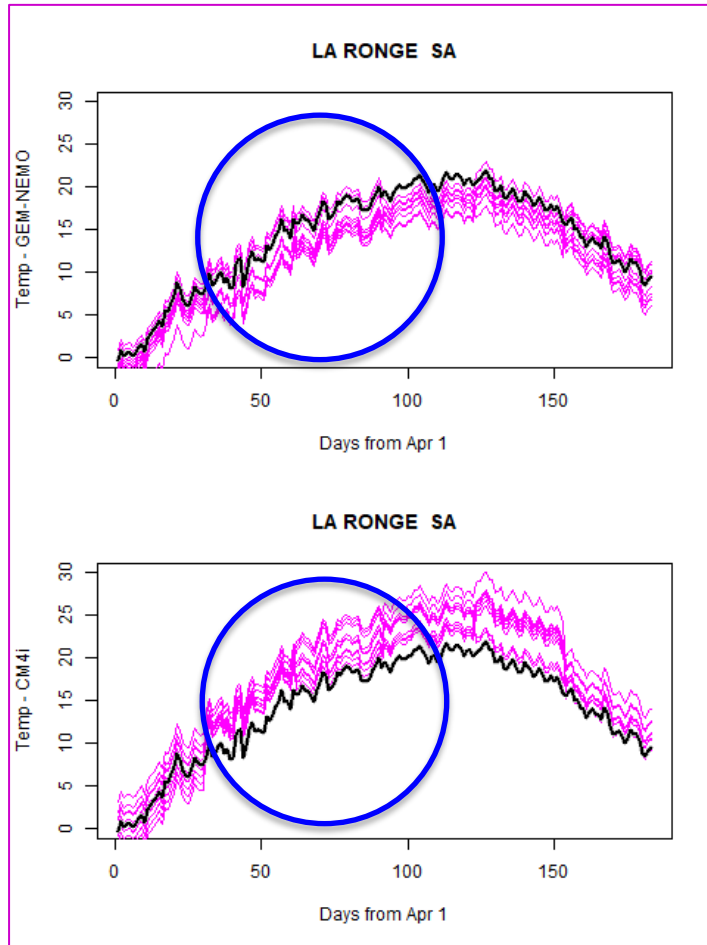
Canadian Seasonal to Interannual Prediction System:
- CanCM4i + GEM5-NEMO

Climate Ensemble Data: CanSIPS

- **Models developed by Canadian Centre for Climate Modeling and Analysis**

  - **CanCM4i**

  - **GEM-NEMO: Global Environmental Multiscale – Nucleus for European Modeling of the Ocean**

- **10-member ensembles producing 12-month forecasts**

- **NRCan uses temperature and precipitation data**

- **Skill of climate forecasts often best in coastal areas, poorer in lee of mountain ranges**

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Canadian Forest Fire Weather Index (FWI) System

Seasonal forecasts use the severity rating anomaly

Fire Weather Observations

Temperature Humidity, Wind, Rain

Wind

Temperature, Humidity, Rain

Temperature, Rain

Snow depth
Barometric Pressure
Horizontal Visibility
Cloud cover and type
Upper air data

Fuel Moisture Codes

FFMC
Fine Fuel Moisture Code

DMC
Duff Moisture Code

DC
Drought Code

Fire Behavior Indexes

ISI
Initial Spread Index

BUI
Buildup Index

FWI
Fire Weather Index

DSR/MSR/SSR
Severity Rating

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2023 Seasonal Predictions

What happens now???

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ENSO Forecasts
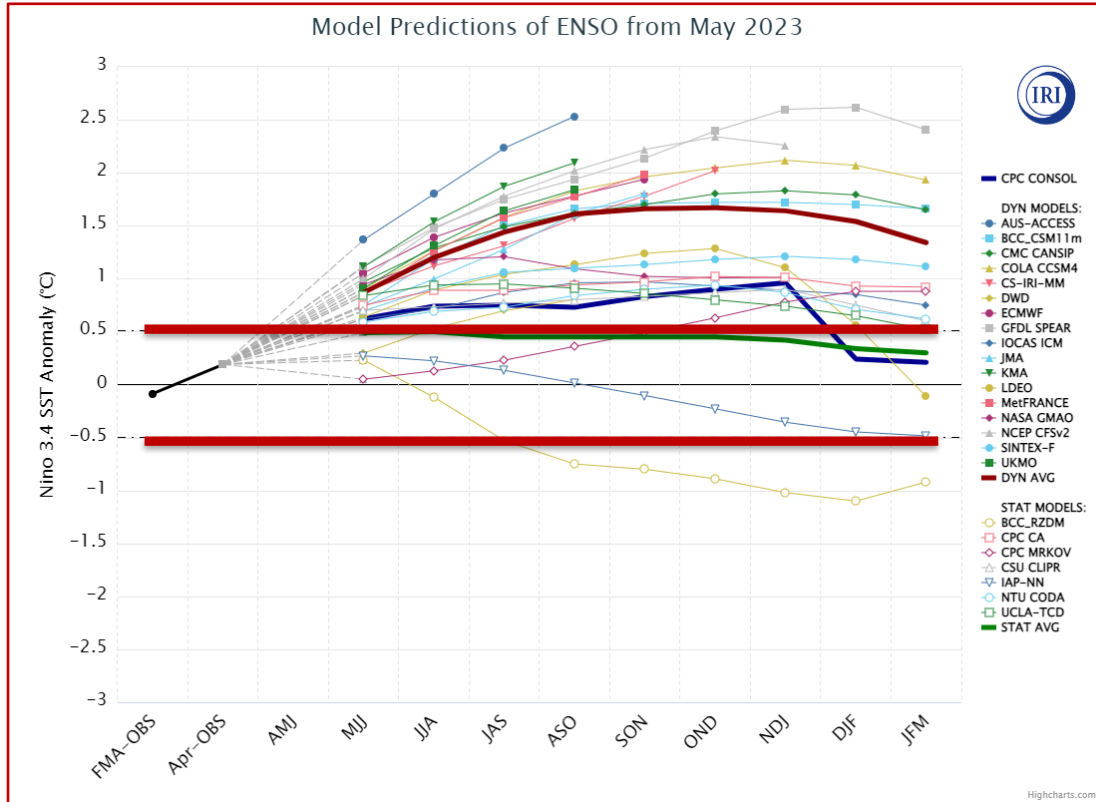
Moderate/strong El Nino looking likely by late summer

Model Predictions of ENSO from May 2023

May 19, 2023

Historical Nino 3.4 Sea Surface Temperature Anomaly

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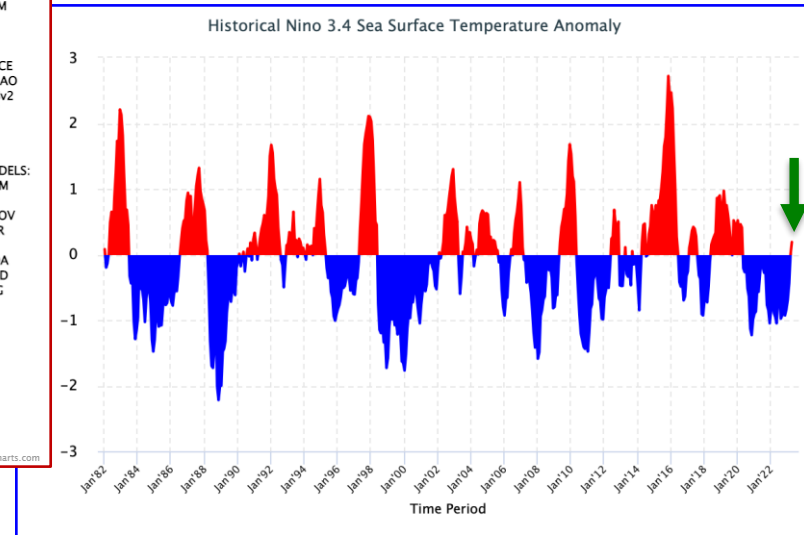
North American Multi-model Ensemble
NMME

June Precip

Dry central regions?
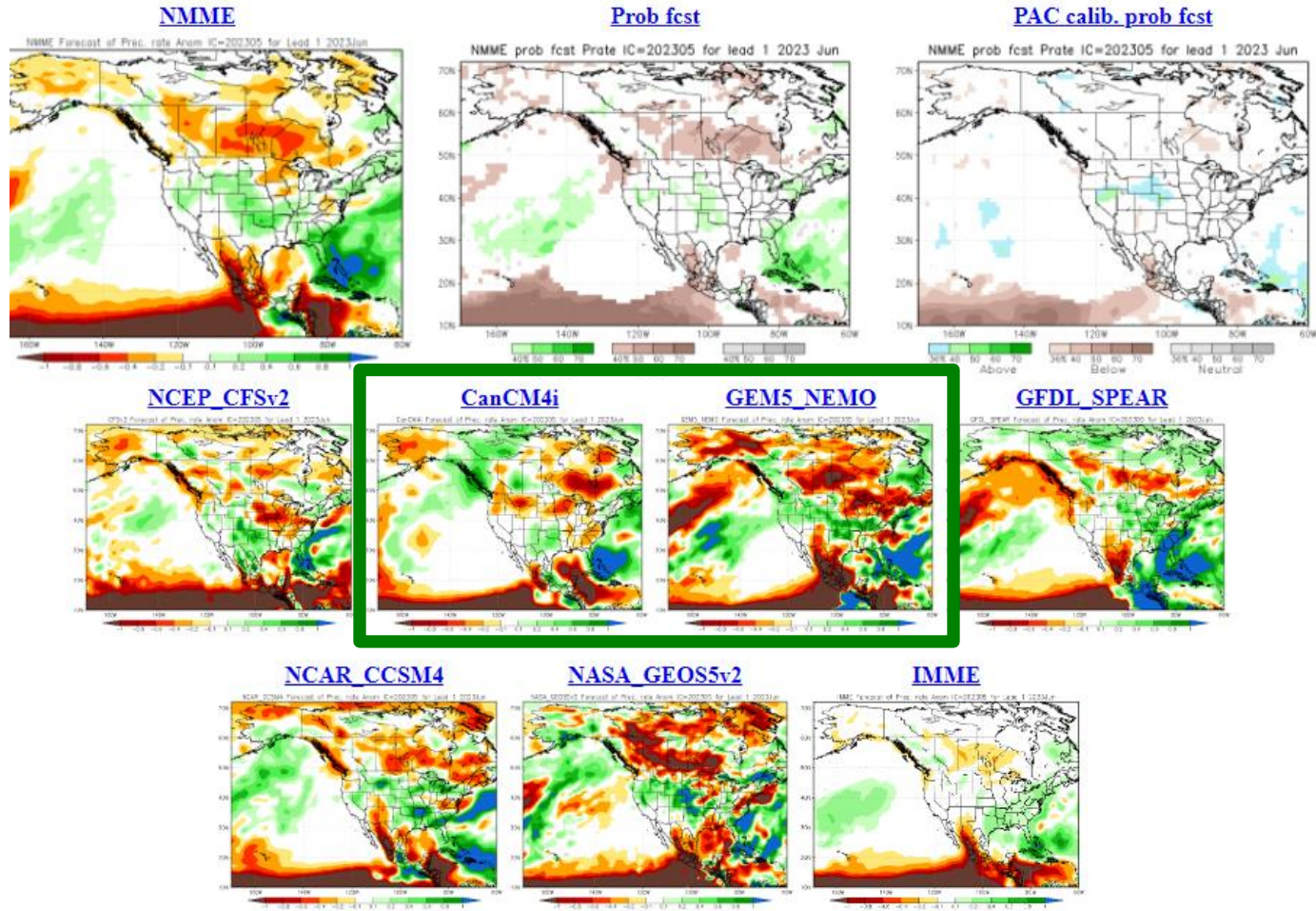
North American Multi-model Ensemble
NMME

July Precip

Rainfall increases in July?
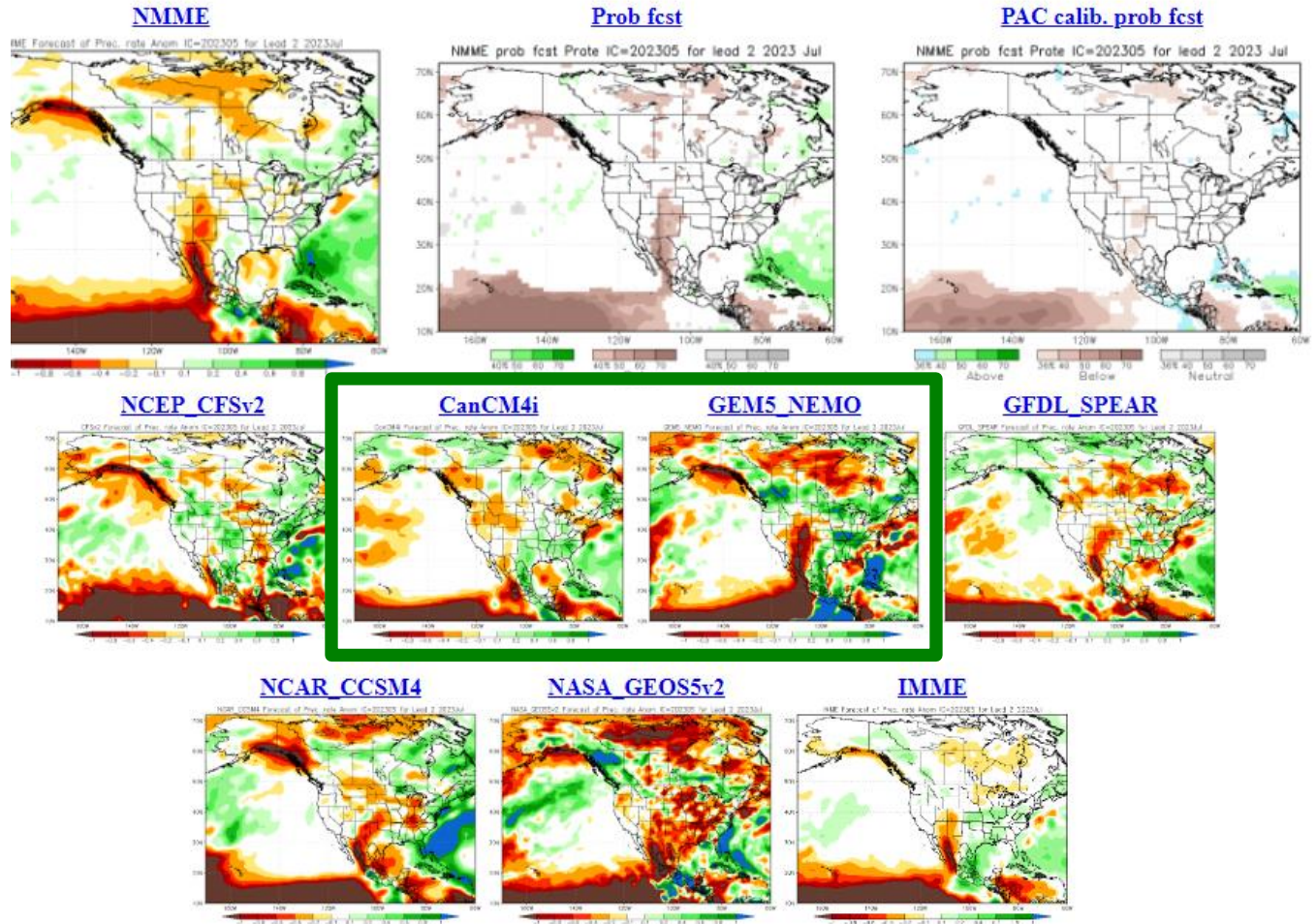
North American Multi-model Ensemble
NMME

August Precip

Dry signal strongest in central-eastern Canada
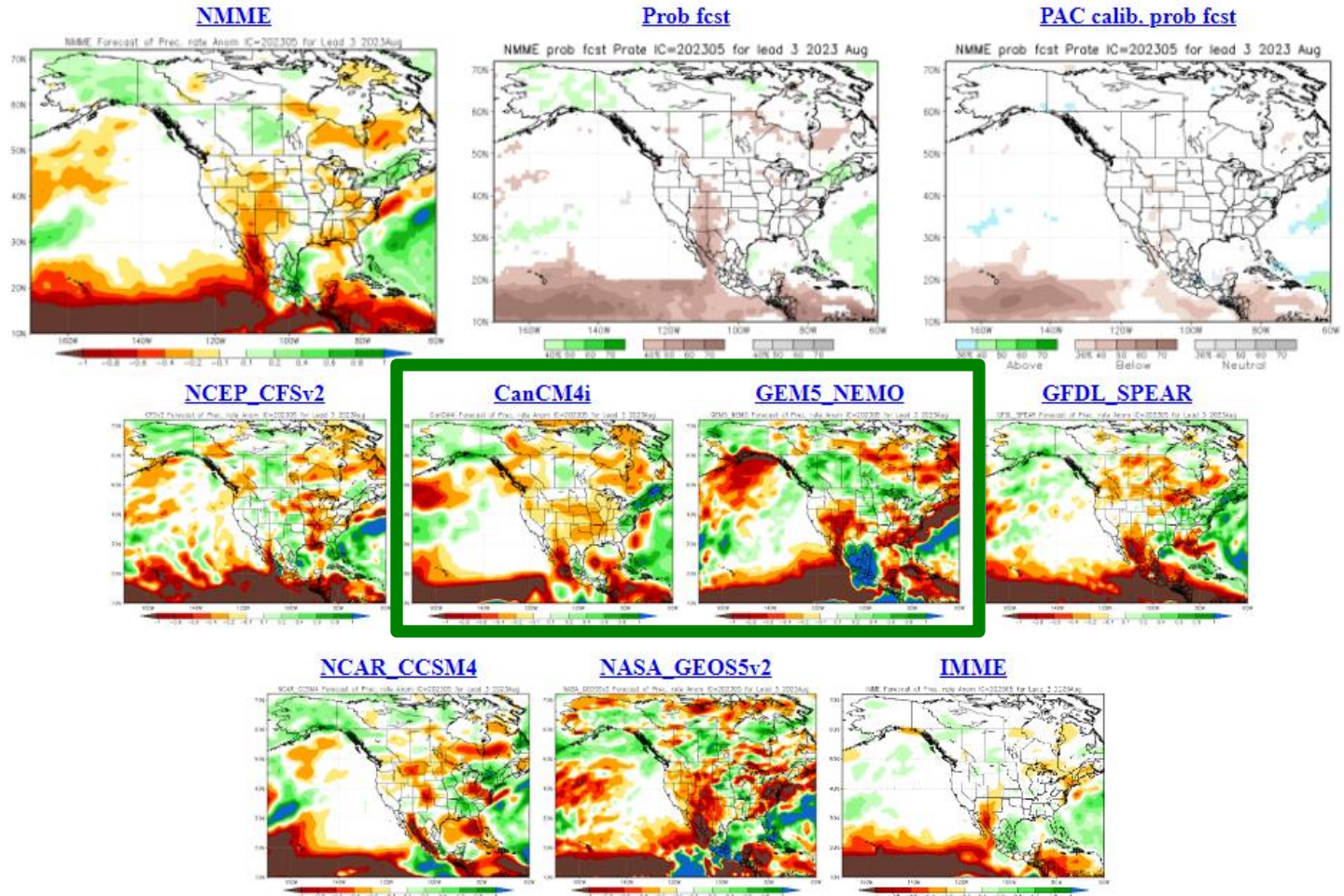
NMME Skills Maps

Two month lead (July forecast)

Temperature

Precipitation

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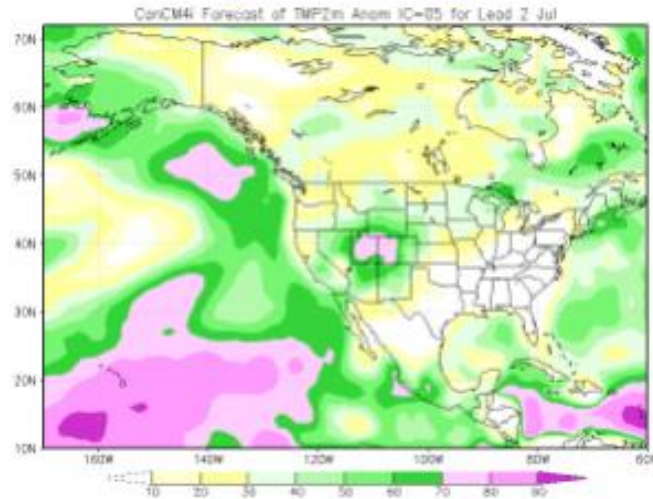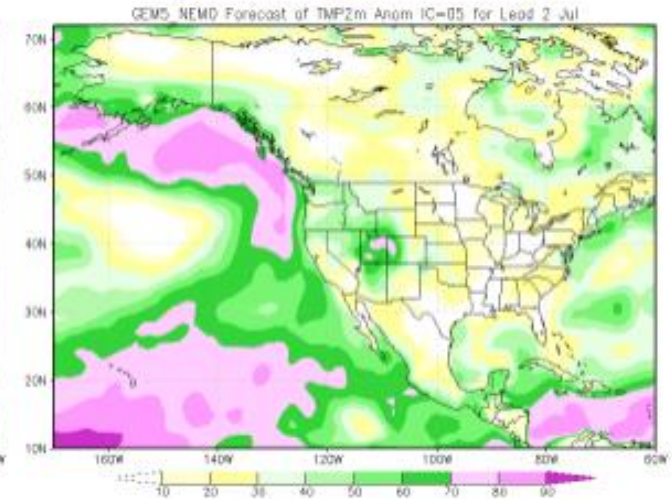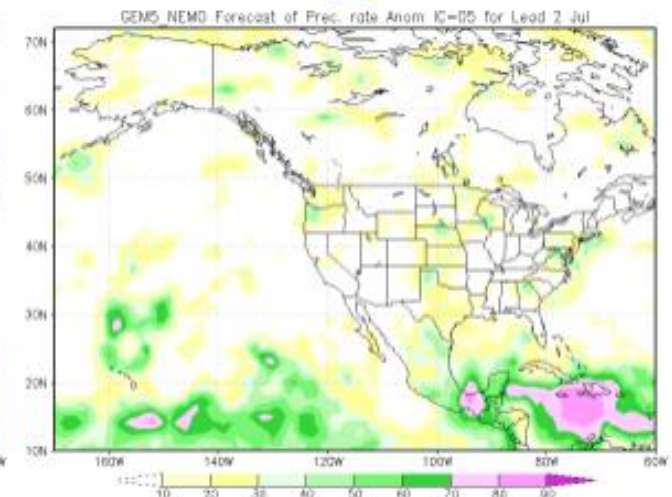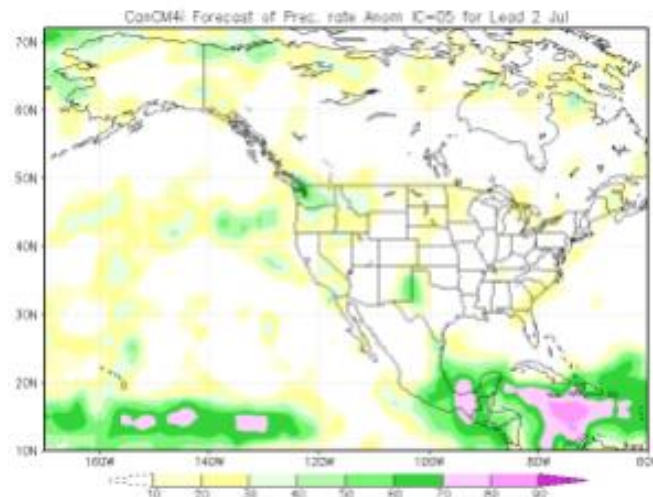
2023 NRCan-CFS Seasonal Prediction

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NRCan-CFS Prediction: June run, for June and July
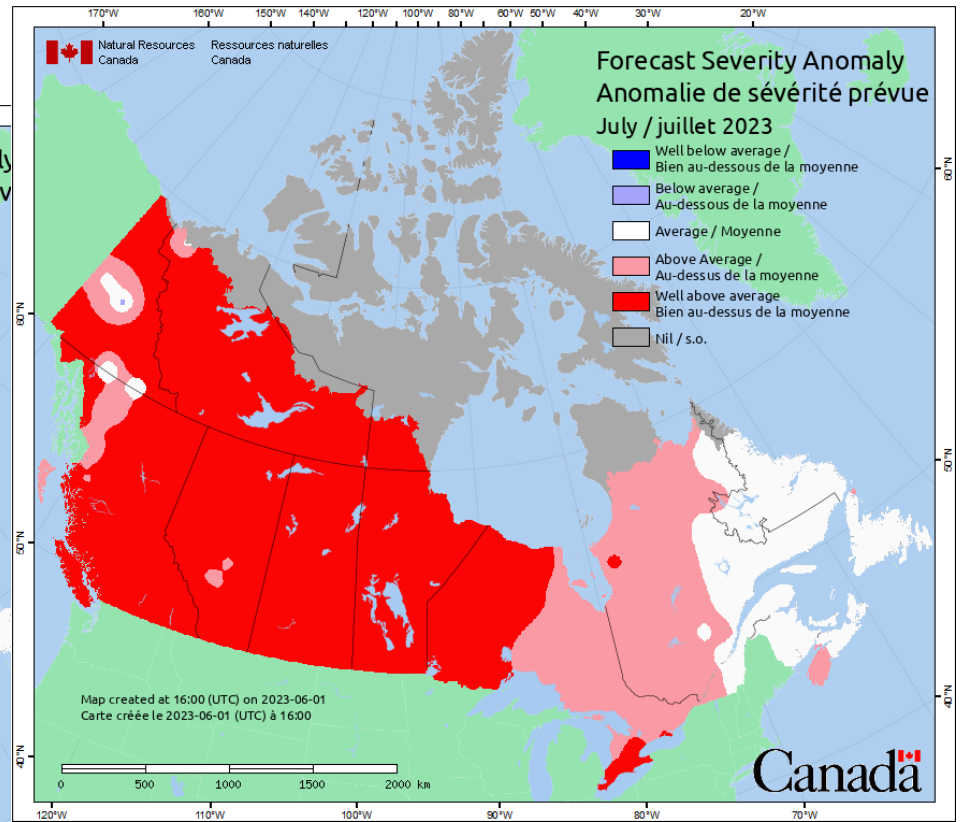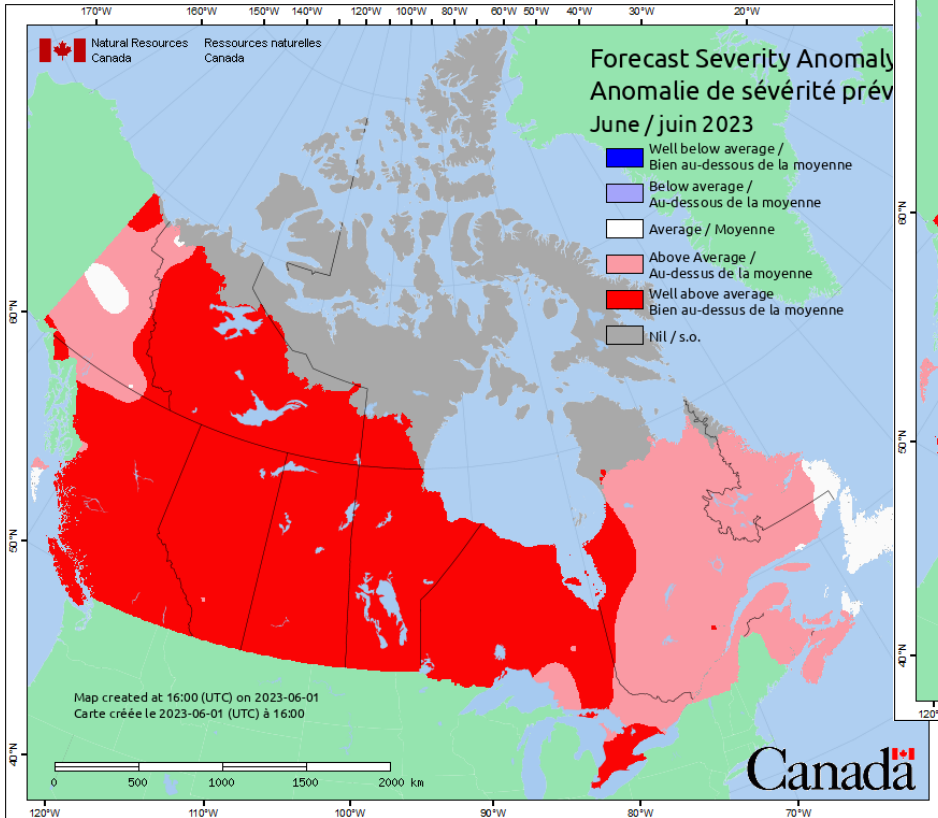
Anomaly
Predicted values normalized against average weather

NRCan-CFS Prediction: June run, for August and September
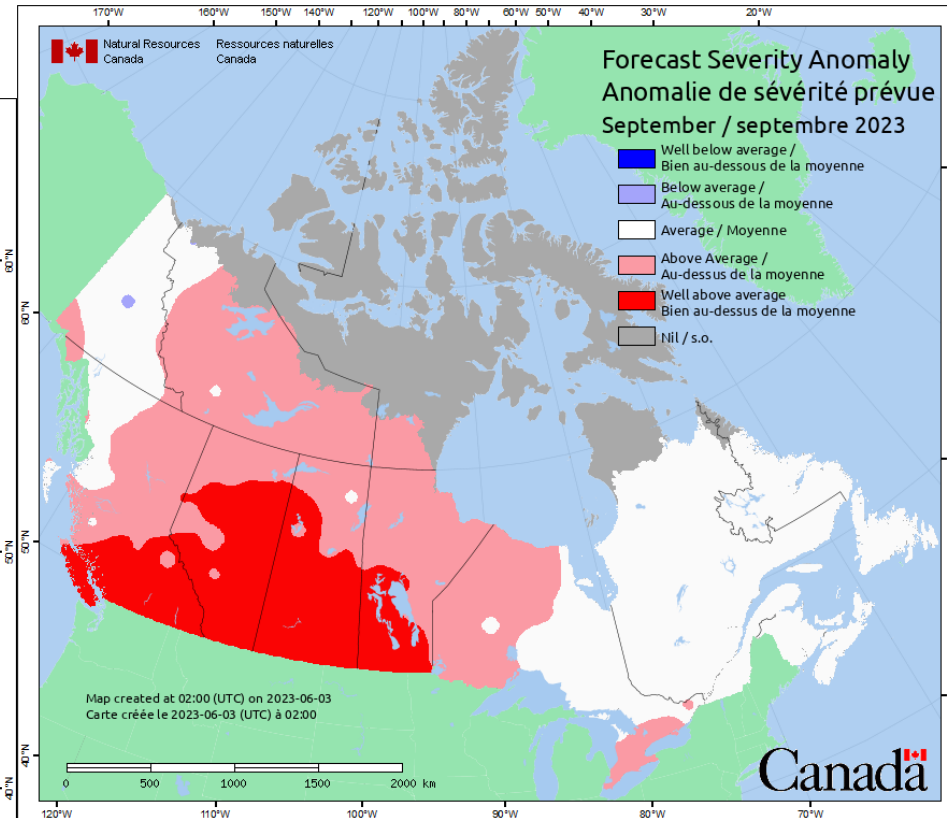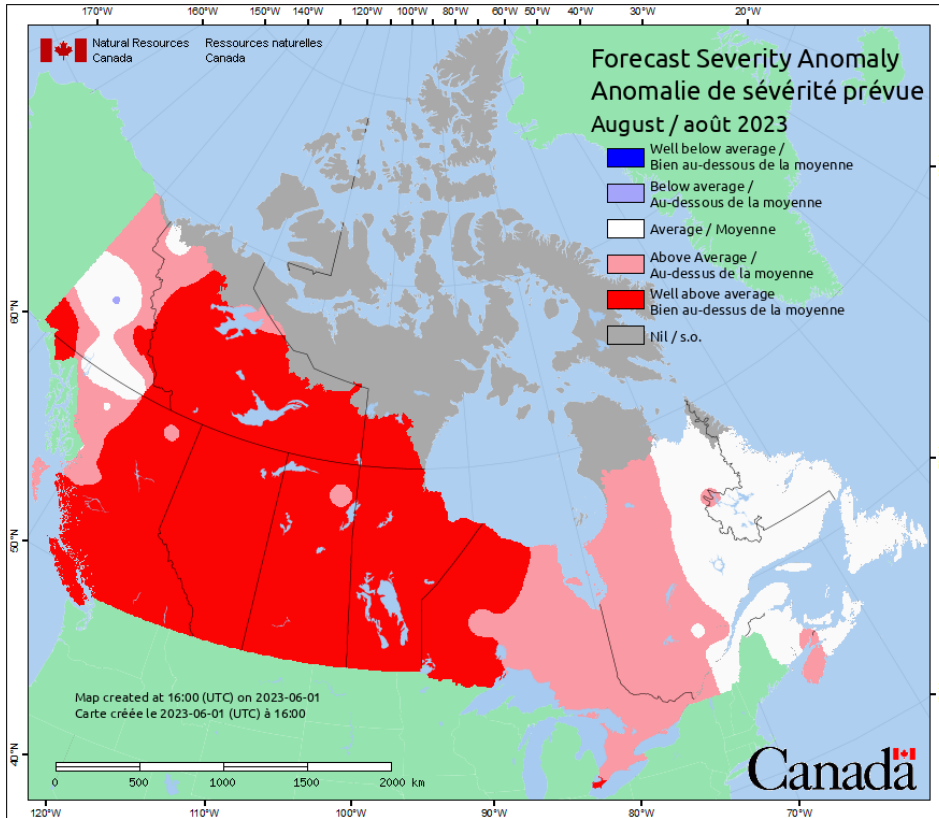
Anomaly
Predicted values normalized against average weather

Canadian Wildland Fire Information System (CWFIS)


Note: CWFIS web site will change, likely in 2023-24

Conclusions and Reminders

- Model consensus points to warm summer with many dry areas, but possible respite in July with better rainfall

- Serious fires can occur in any year

- Fire activity depends on ignitions; our forecast only predicts where potential exists

Remember to check updates …

- Seasonal forecast: first working day each month on CWFIS

- Daily conditions: provincial and/or CWFIS web sites
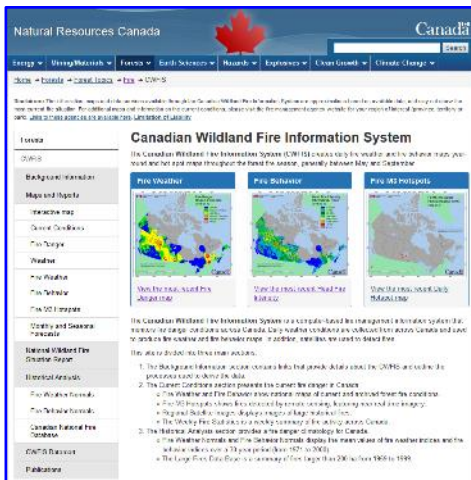
Government of Ontario

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Questions?

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