Wildfire Season Forecast 2024

Richard Carr, Wildland Fire Research Analyst,
Natural Resources Canada, Canadian Forest Service

I C L R

Forecast 2024

May 7, 2024

2023 in Review
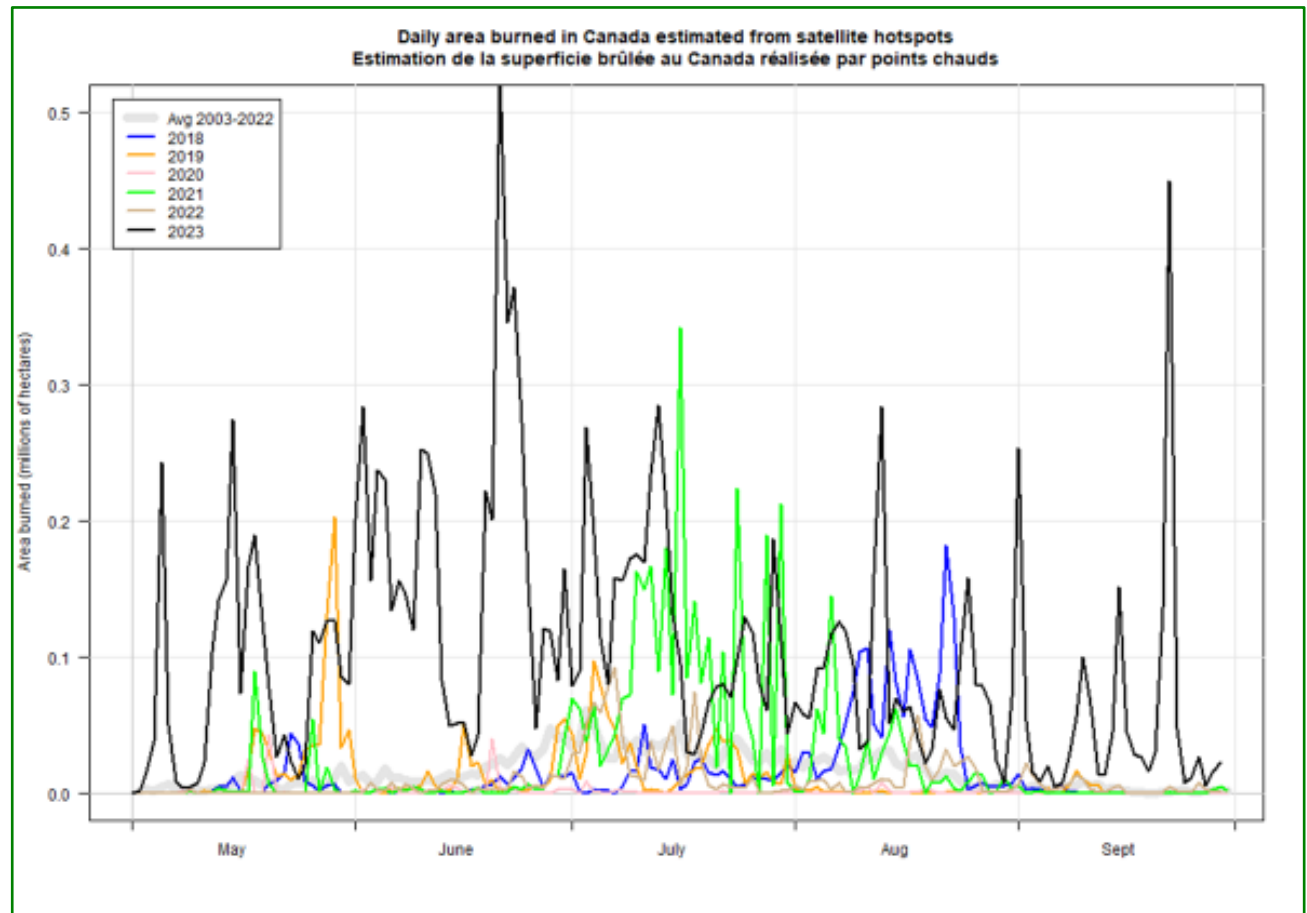
Quote and Media Response: May-Sept, 2023

- *"I don't want to comment on that since the numbers are changing so fast they are quickly outdated."*
    - **Richard Carr, comment on area burned during an unnamed media request**

- **Print media articles quoting NRCan-CFS researchers:**
  - **Total number of media requests:**   **450+**
  - **Total number of media articles:**   **5,500+**
  - **Daily record-high of media articles published:**   **545+**
  - **Daily average of media articles:**   **40**
  - **Number of countries with outlets:**   **34**
  - **Languages interviewed in or translated to:**   **22**

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2023 Fire Season Summary

Area burned estimates based on hotspots

Big spike in June and again Sept 22

Daily area burned in Canada estimated from satellite hotspots
Estimation de la superficie brûlée au Canada réalisée par points chauds

Area burned is often small in early spring and late summer (low amplitude of colored lines in these periods)

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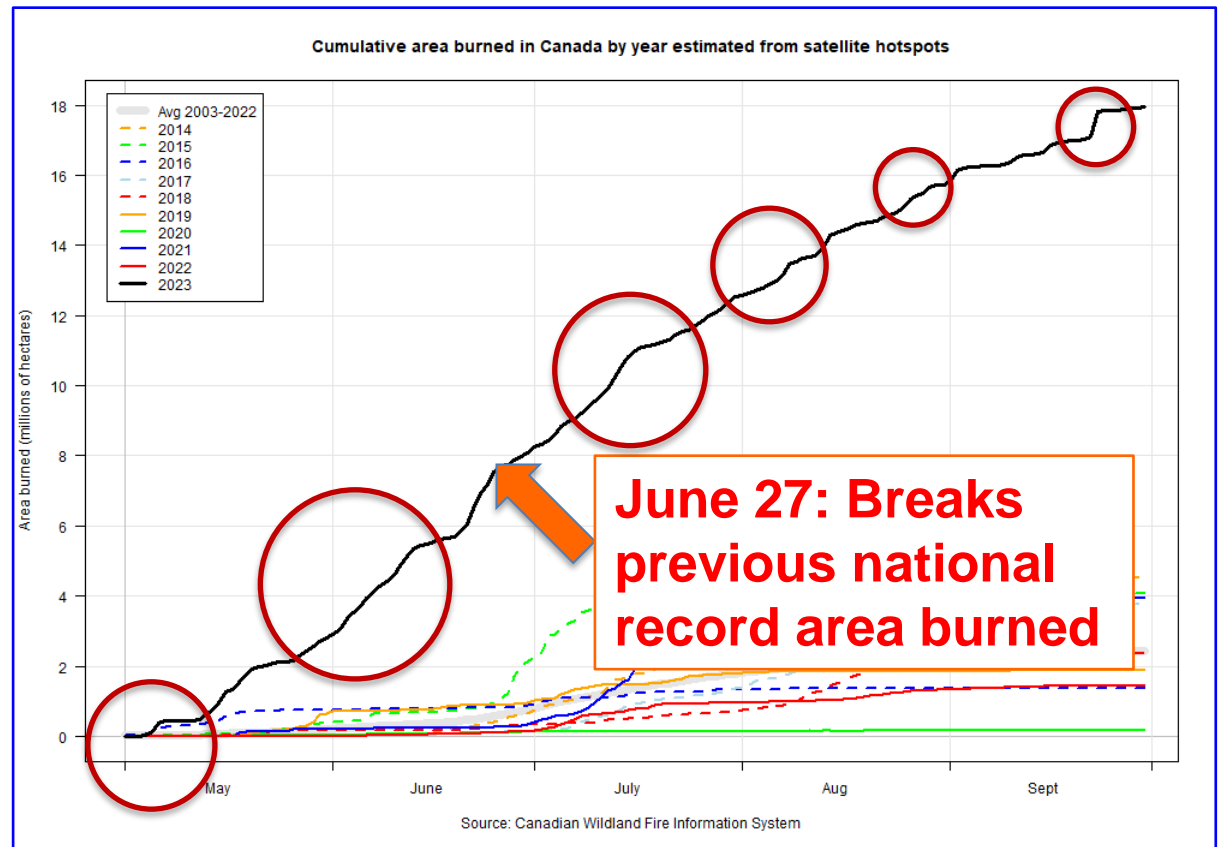
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2023 Fire Season Summary

August-Sept: **Wind events in northern BC/AB/NT. Much area burned end of August/start of September and September 22**

July: **NT/YT**

June: **ON/QC**

April-May: **west central AB, northeast BC, central SK, NT, NS**

Cumulative area burned in Canada by year estimated from satellite hotspots

Avg 2003-2022
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

Area burned (millions of hectares)

June 27: Breaks previous national record area burned

Source: Canadian Wildland Fire Information System

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Some Records set in 2023

- **Record area burned: BC, NT, AB, QC, NS**

- **Largest fires on record: BC, NS, QC**

- **CIFFC National Preparedness Level (NPL) at 5 May 11 to September 7 (earliest, longest on record at 120 days)**

  1   2   3   4   5

  - **International crews from 11 nations over season**

- **Smoke alerts (ECCC)**
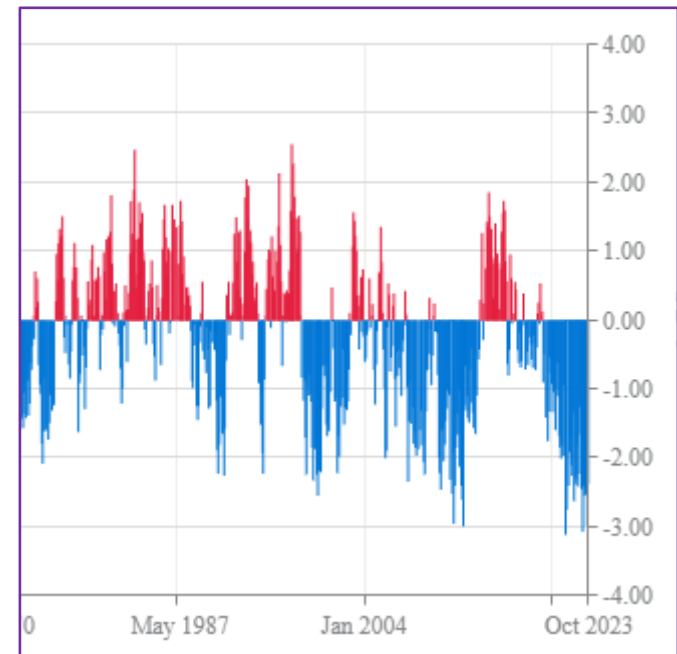
- **Evacuations (~270) and evacuees (~230,000)**

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2023 Lead-up/factors: Ocean/atmosphere

- **Quick transition to El Niño after extended La Niña**

- **"Warm negative" Pacific Decadal Oscillation (PDO)?**

  - **Warm sea surface temperatures during 2023**

September 7, 2023

https://www.ncei.noaa.gov/access/monitoring/pdo/

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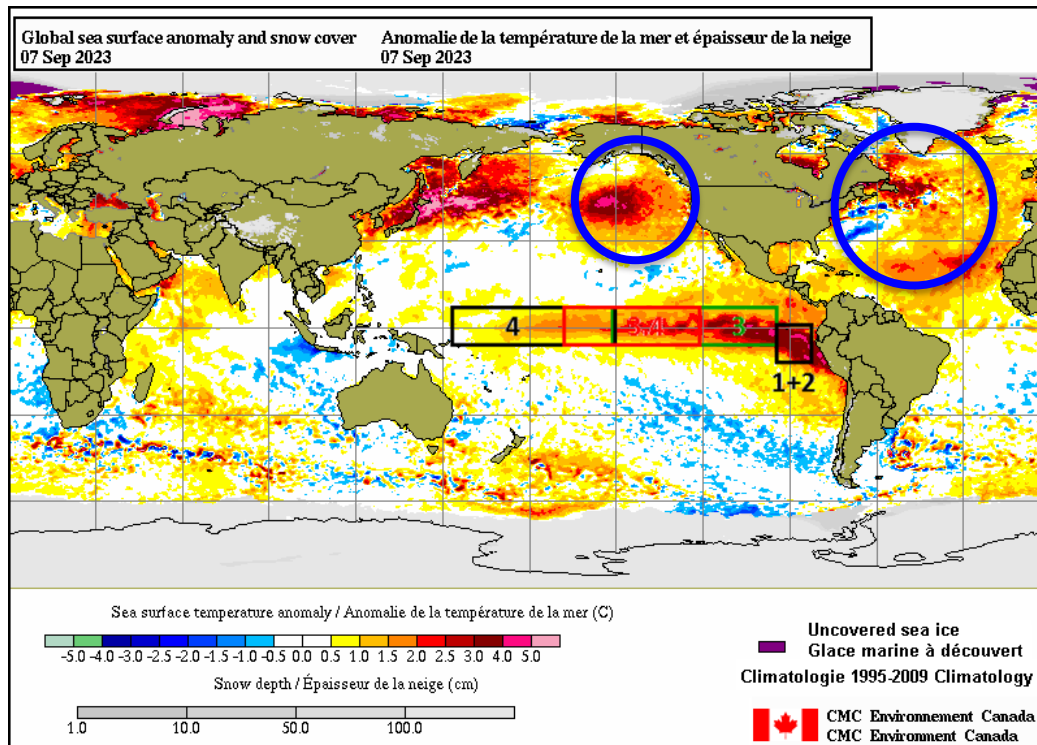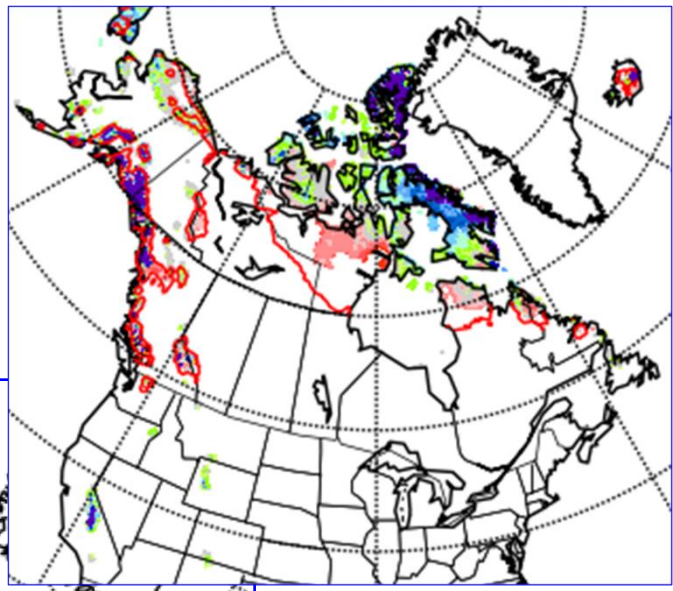
2023 Spring start-up conditions: Snow Cover

Affects spring fire more than summer
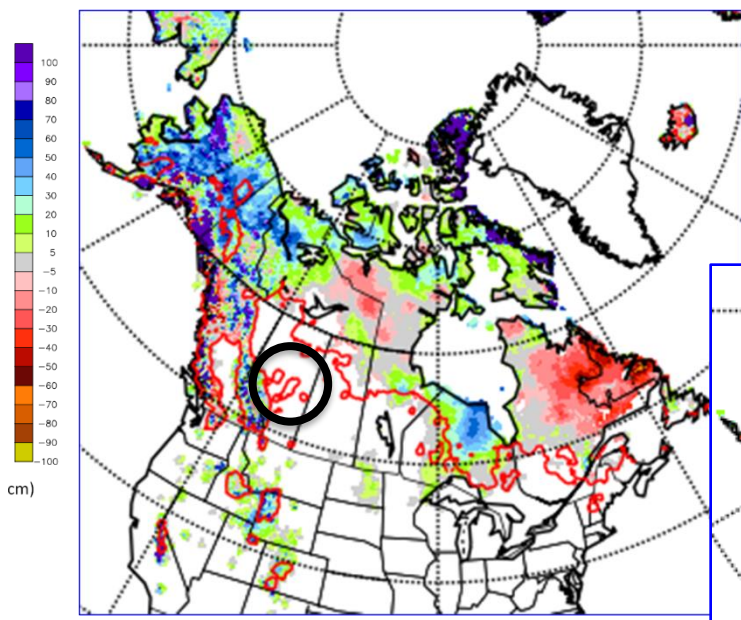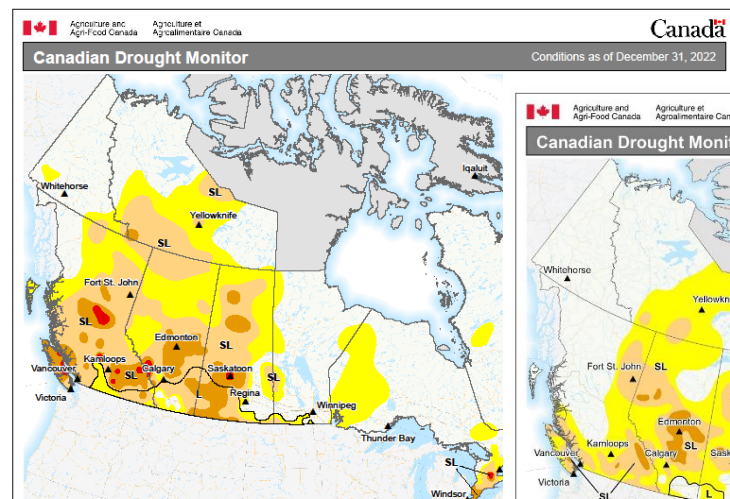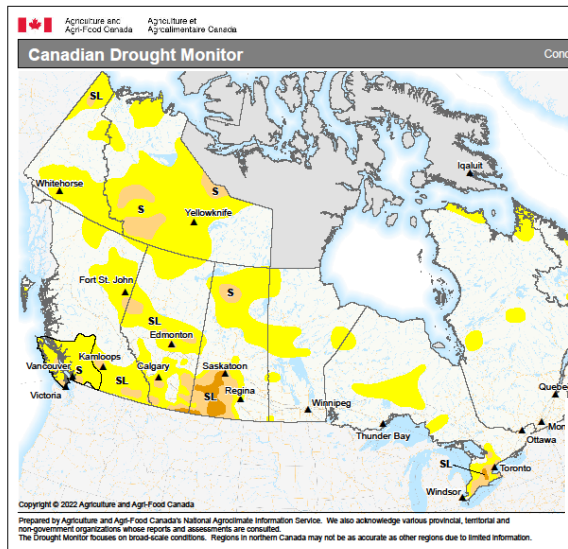

April 26, 2023

May 10, 2023

May 17, 2023

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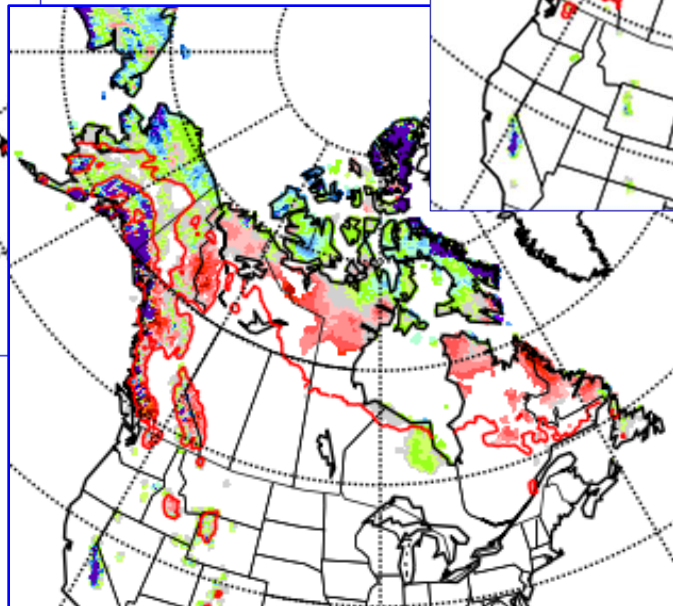
Drought Progression

- **Drought intensified in late 2022**
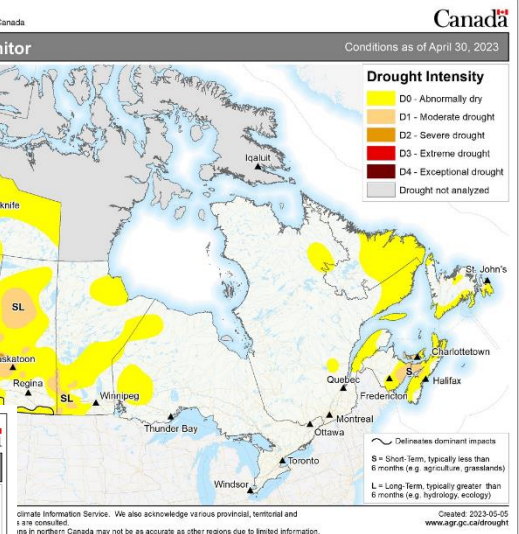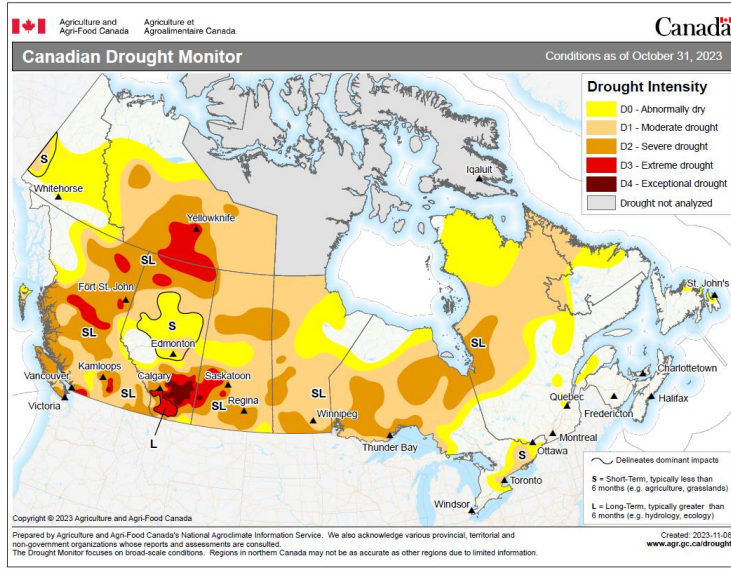
- **Widespread intensification over summer**

- **Some improvement over winter**

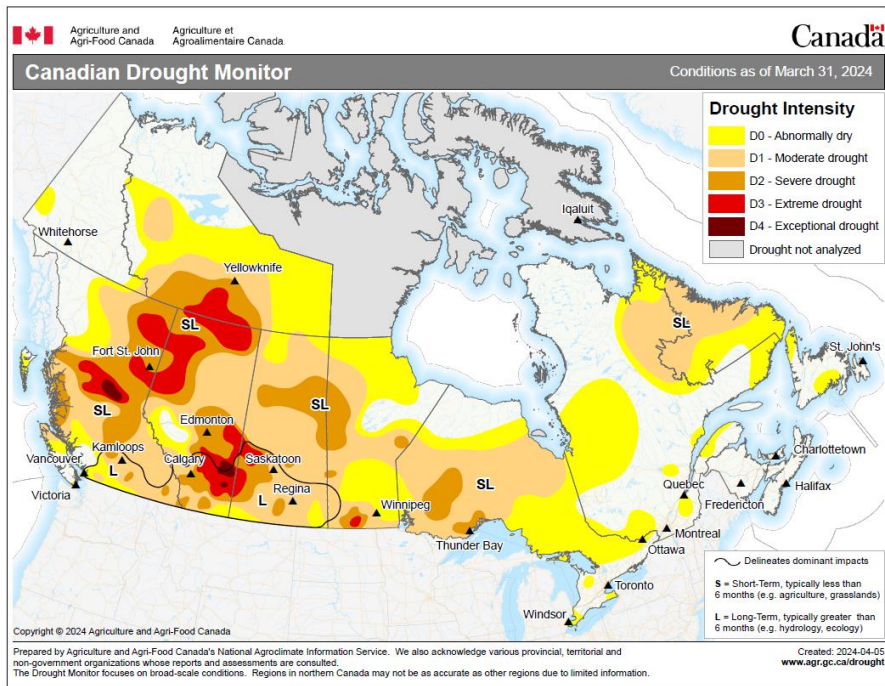# 2024 Season to Date

Natural Resources   Ressources naturelles
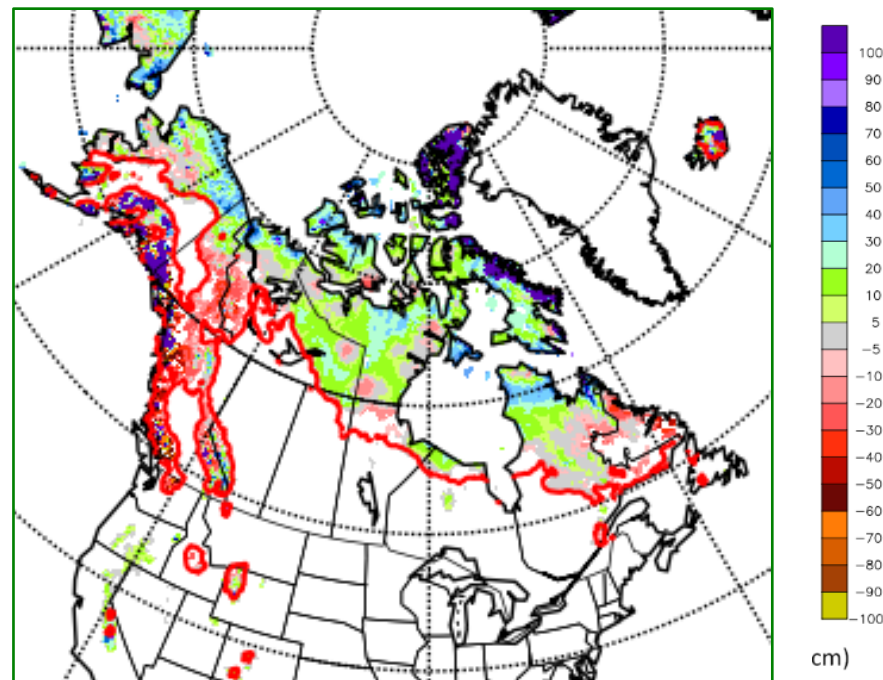Canada   Canada

Drought and Snow Cover

- **April 30 drought assessment coming in a few days**
  - **Probable improvement since March 31 in east, southern Prairies**
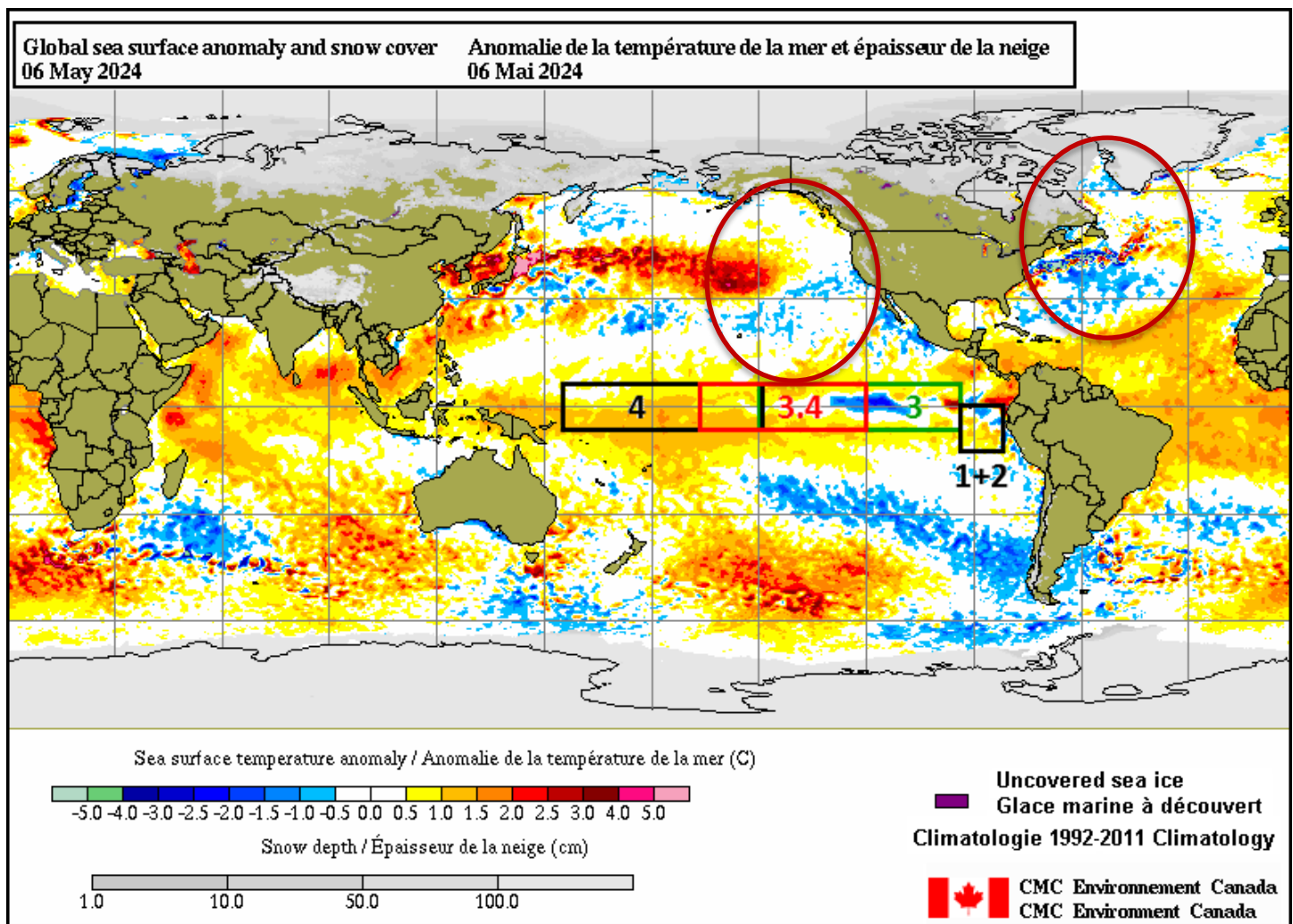- **Snow melt appears slower than in 2023**

March 31, 2024

May 6, 2024

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ENSO, PDO – Current SST

Global sea surface anomaly and snow cover / Anomalie de la température de la mer et épaisseur de la neige
06 May 2024 / 06 Mai 2024

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 1992-2011 Climatology

CMC Environnement Canada
CMC Environment Canada

El Niño fading

Cold water in eastern Pacific typical of a developing La Niña

North Pacific and Atlantic started cold in 2023 but 2024 La Niña may help cool north Pacific

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Fire problems in ENSO Springs

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
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	0.2	0.5	0.8	1.1	1.3	1.6	1.8	1.9	2.0
2024	1.8	1.5	1.1									

Large area burned → (1995)

Virginia Hills, AB → (1998)

Chisholm, AB → (2001)

Kelowna, BC → (2003)

Slave Lake, AB → (2011)

PDO positive phase → (2013, 2014, 2015)

Fort McMurray, AB → (2016)

Big years in BC → (2017, 2018)

Western half → (2021)

Most of Canada! → (2023)

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

Natural Resources Canada

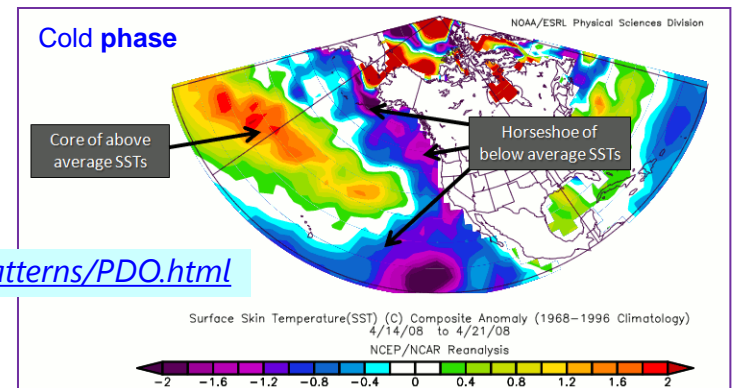Ressources naturelles Canada

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Pacific Decadal Oscillation

https://ds.data.jma.go.jp/tcc/tcc/products/elnino/decadal/pdo_month.html

Warm phase

Core of below average SSTs

Horseshoe of above average SSTs

Surface Skin Temperature(SST) (C) Composite Anomaly (1968–1996 Climatology)
4/14/83 to 4/21/83
NCEP/NCAR Reanalysis

Cold **phase**

Core of above average SSTs

Horseshoe of below average SSTs

Surface Skin Temperature(SST) (C) Composite Anomaly (1968–1996 Climatology)
4/14/08 to 4/21/08
NCEP/NCAR Reanalysis

http://climate.ncsu.edu/climate/patterns/PDO.html

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North Atlantic Oscillation

https://www.ncei.noaa.gov/access/monitoring/nao
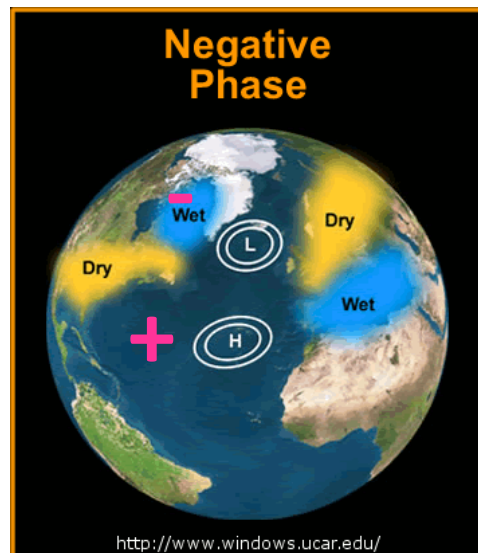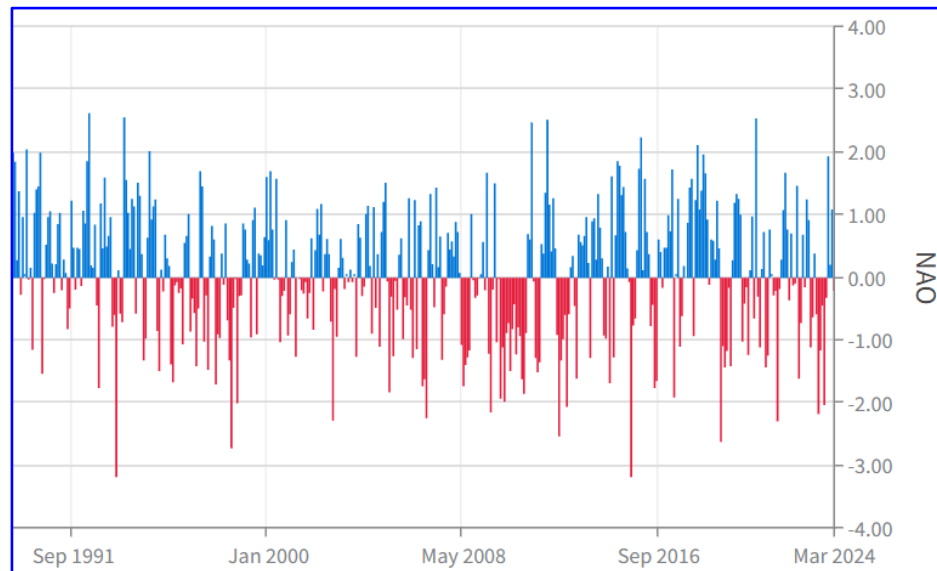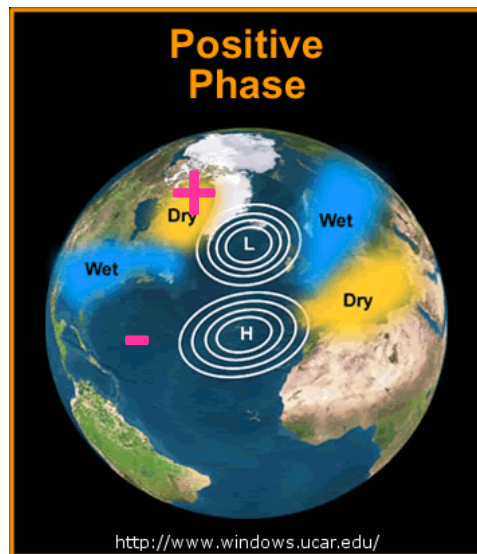
Quebec Area Burned (NFDB, ha*1000)

Year	Area
2023	5000*
2015	5
2013	1900
2010	315
2008	1
2007	343
2006	136
2005	800
2004	3
2002	1000

Early years may not include area burned in northern (unmanaged) region

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2023 Activity Continues: Holdover Fires

- aka "zombie" or "carryover" fires (latter also applies to delay between lightning strikes and fire arrival)

- Prolonged smoldering in deep organic layers
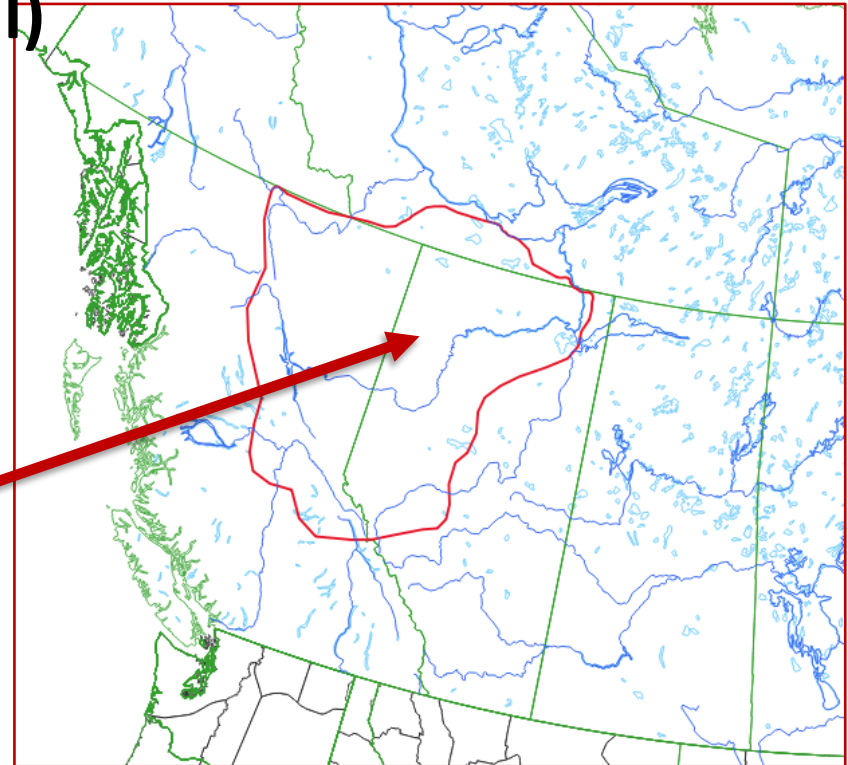
Heavy equipment working on hotspots on the southwest perimeter of the Basset fire (HWF058). February 12, 2024. *https://srd.web.alberta.ca/high-level-area-update/february-12; accessed April 22, 2024*

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Holdover Fires

- **Winter remediation includes searching for heat signatures, turning over soil, applying water**

- **As of early 2024:**
  - **BC: ~90**
  - **AB: 55-60**
  - **NT: 2+**

NWT confirms first fires of 2024 are holdovers from last year

Ollie Williams · April 29, 2024
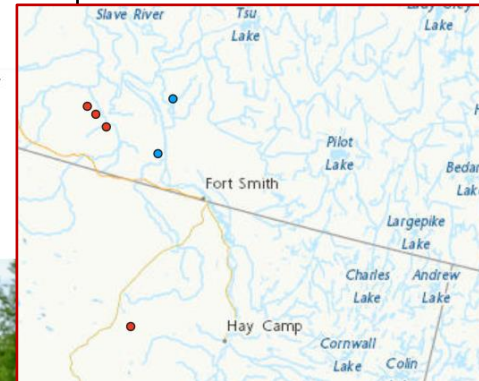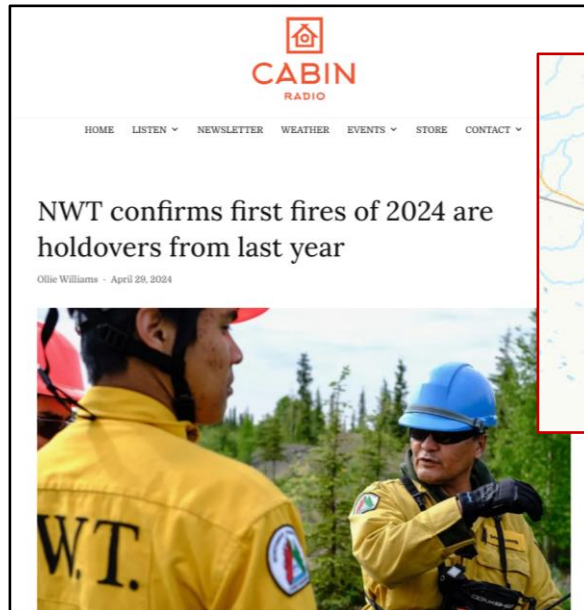
- **BC and AB averages are probably <10 per year**

Fire numbers and area burned by region

- **Some regions with more fires but less area burned than average**
- **Still early in the fire season! (May 1 data)**

Number of fires by province

Area burned by province

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2024 Seasonal Predictions

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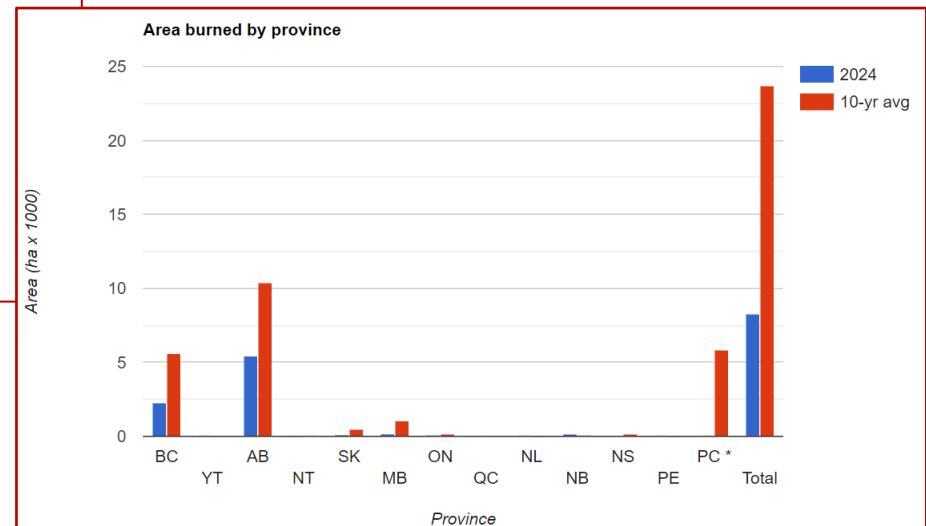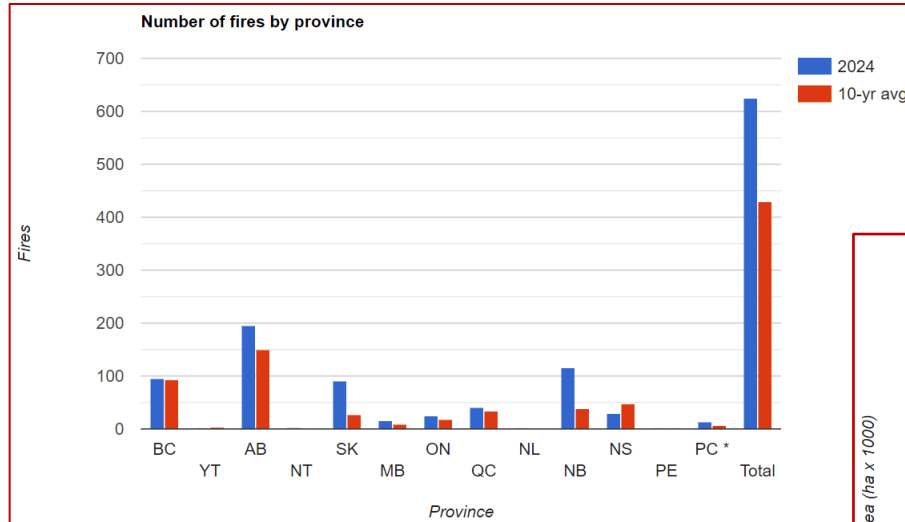
IRI ENSO Forecast

https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-sst_table
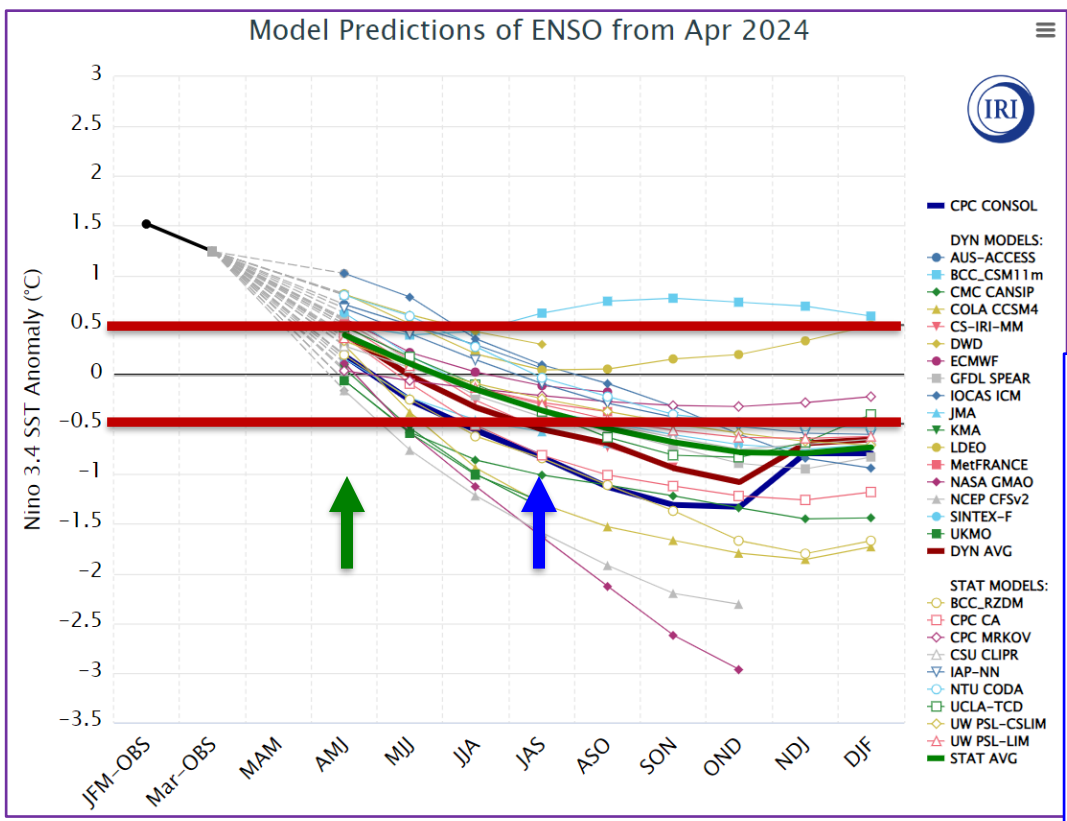
April, 2024

La Niña likely developing over summer
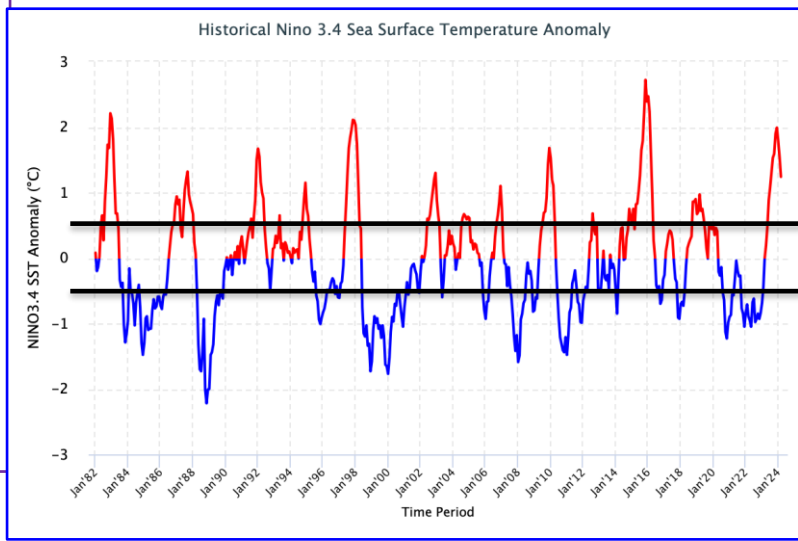
Time series to January 2024

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Transition to La Niña: Recent analog years

- **Area burned in 2016, 2017, 2019, 2020 (red arrows)**

Number of Fires and Area Burned in Canada by Year
Source: Canadian National Fire database (CNFDB)
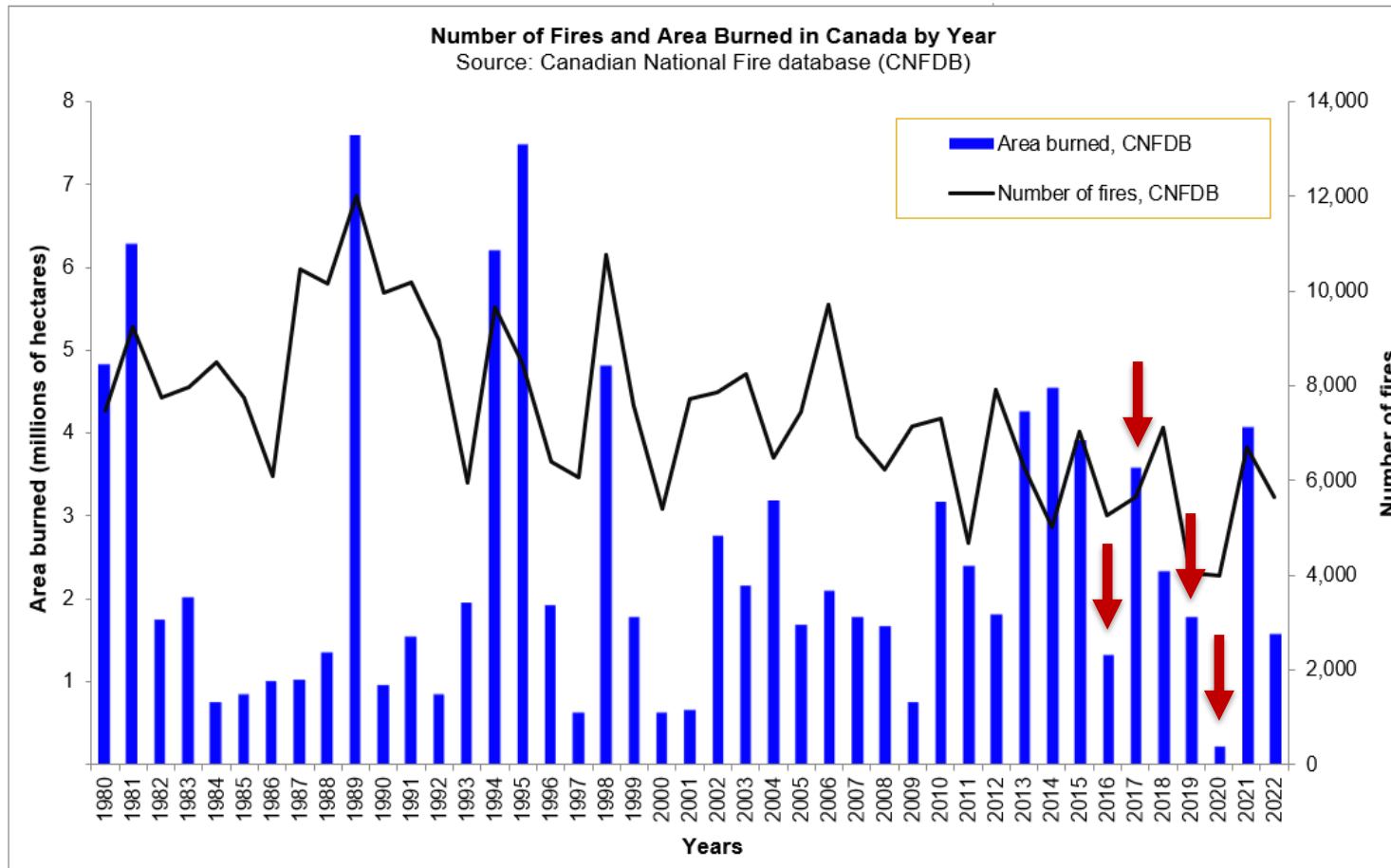
North American Multi-model Ensemble
NMME

June Temp

GEM-NEMO often predicts cool
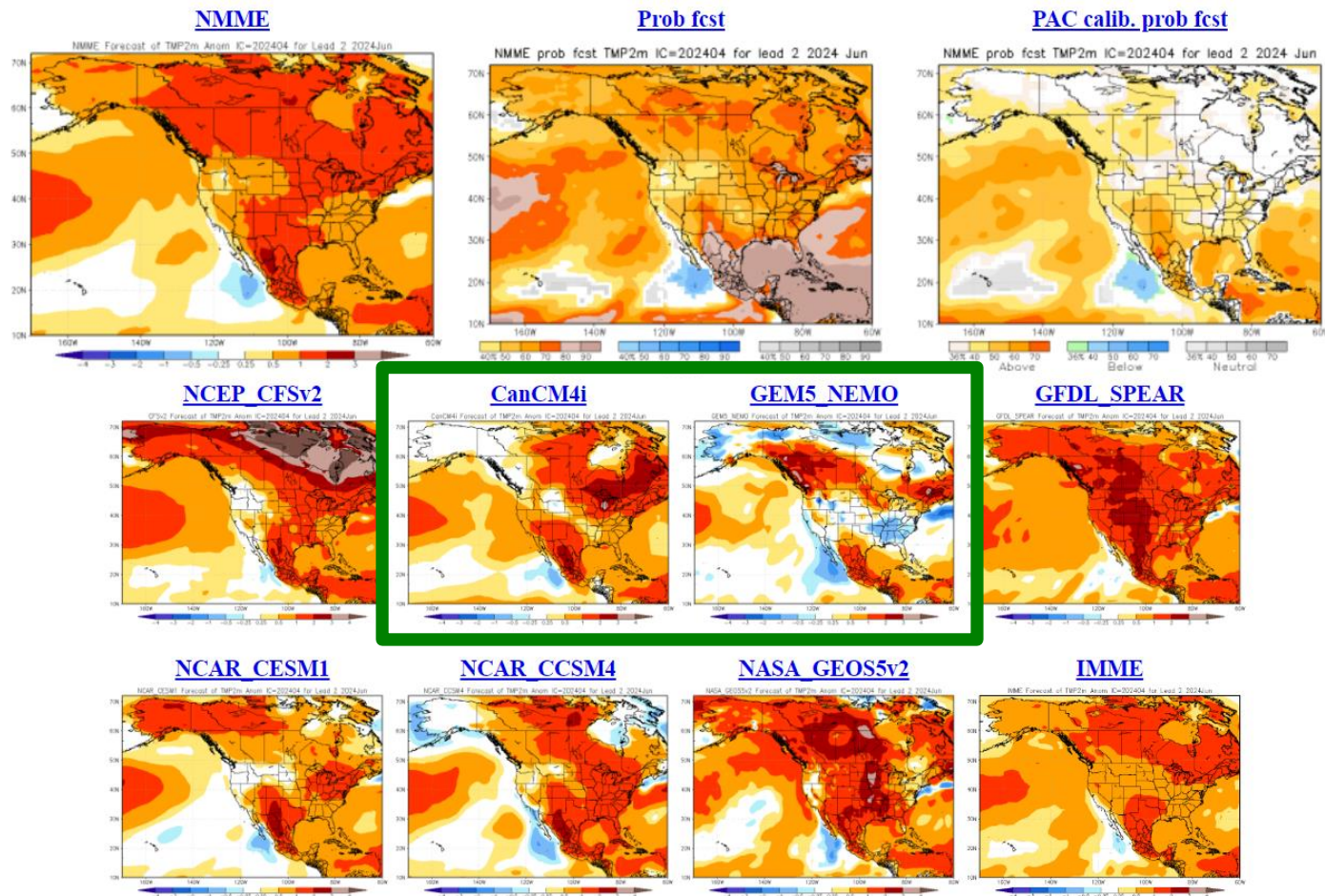
North American Multi-model Ensemble
NMME

June Precip

Dry central regions?
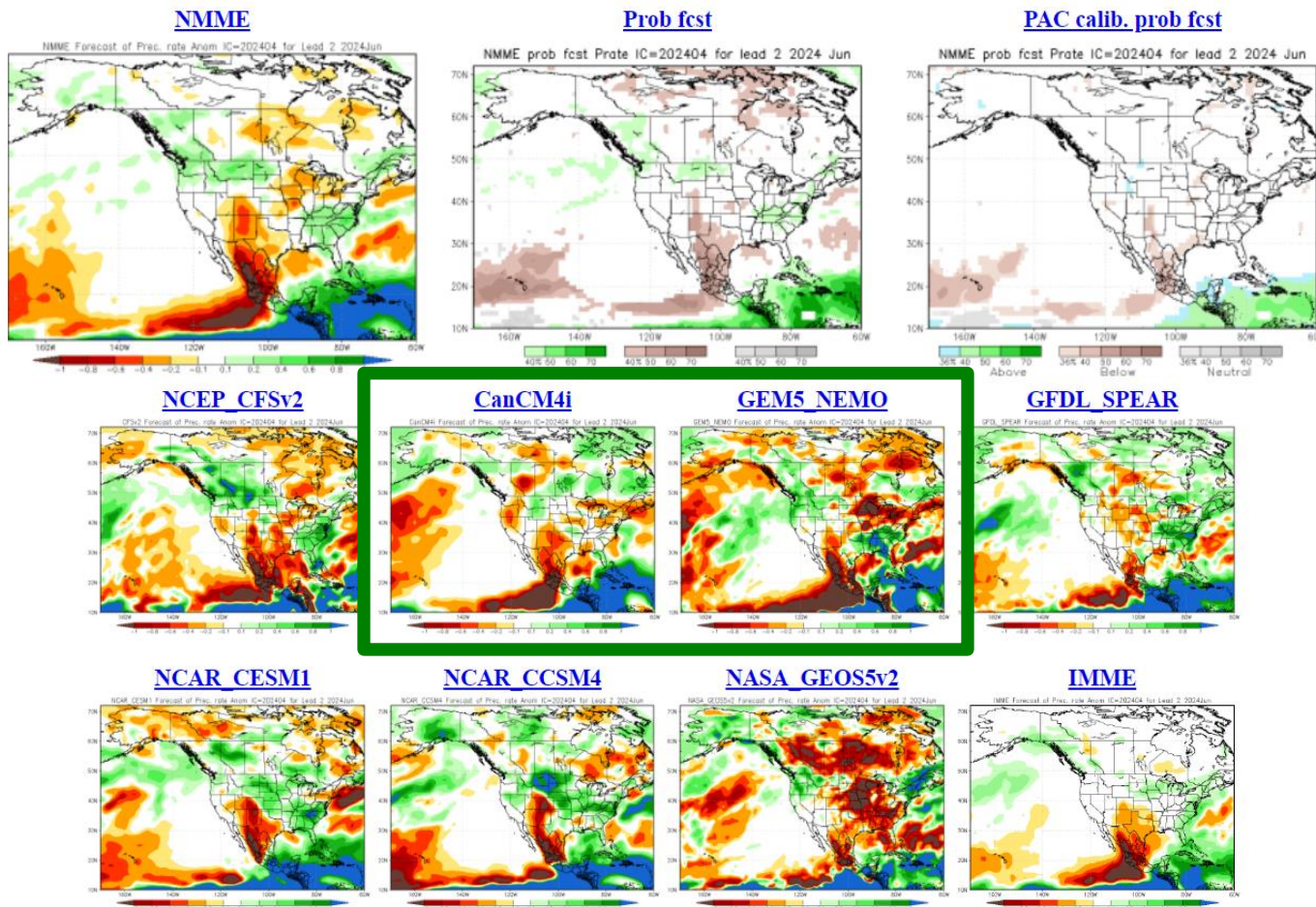
North American Multi-model Ensemble
NMME

Precip skills

Little skill and variation
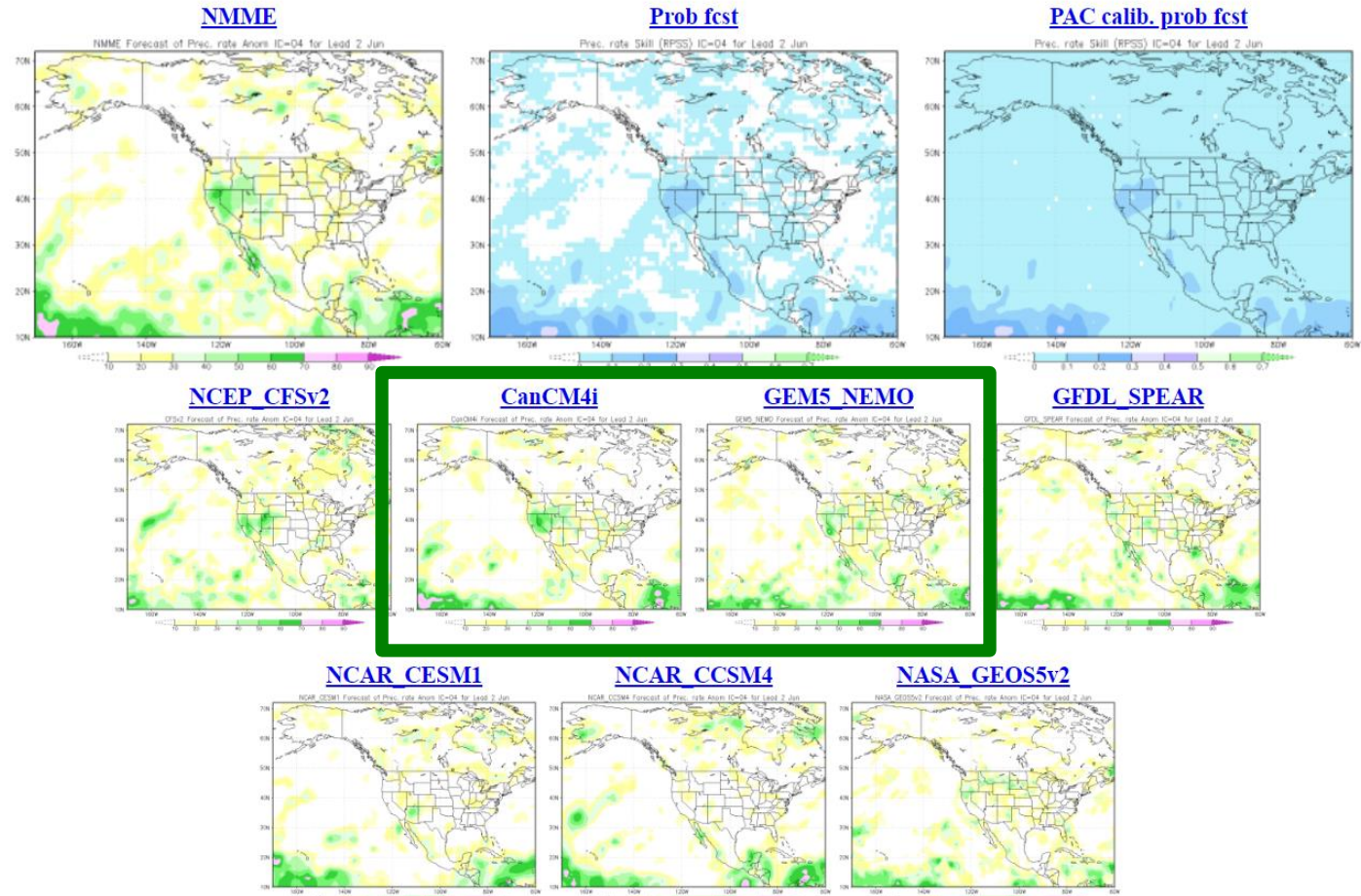
North American Multi-model Ensemble
NMME

July Temp

Good agreement for normal to above normal

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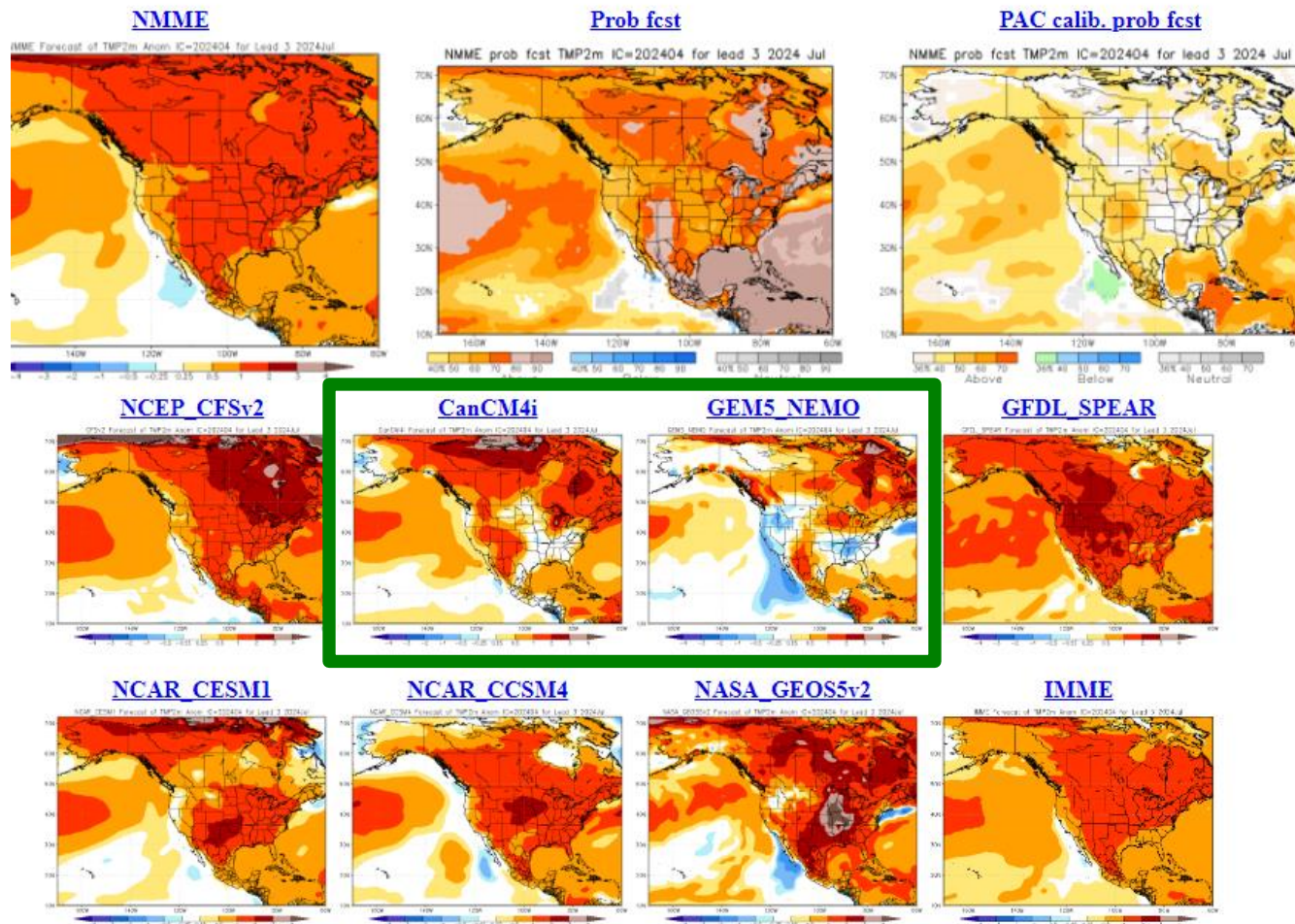
North American Multi-model Ensemble
NMME

July Precip

*Ambiguous
predictions*

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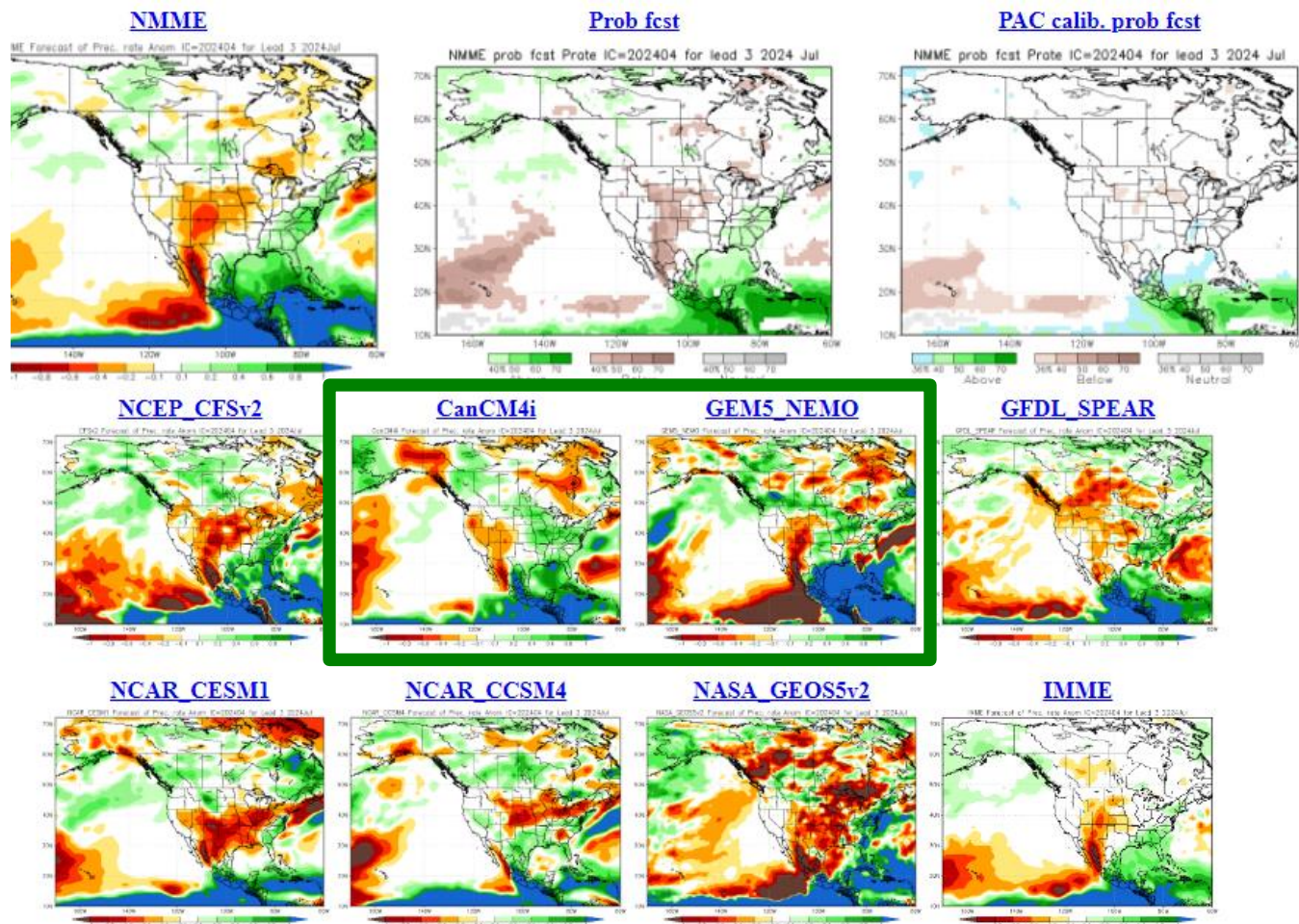
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North American Multi-model Ensemble
NMME

August Temp

Continues normal to above normal signal

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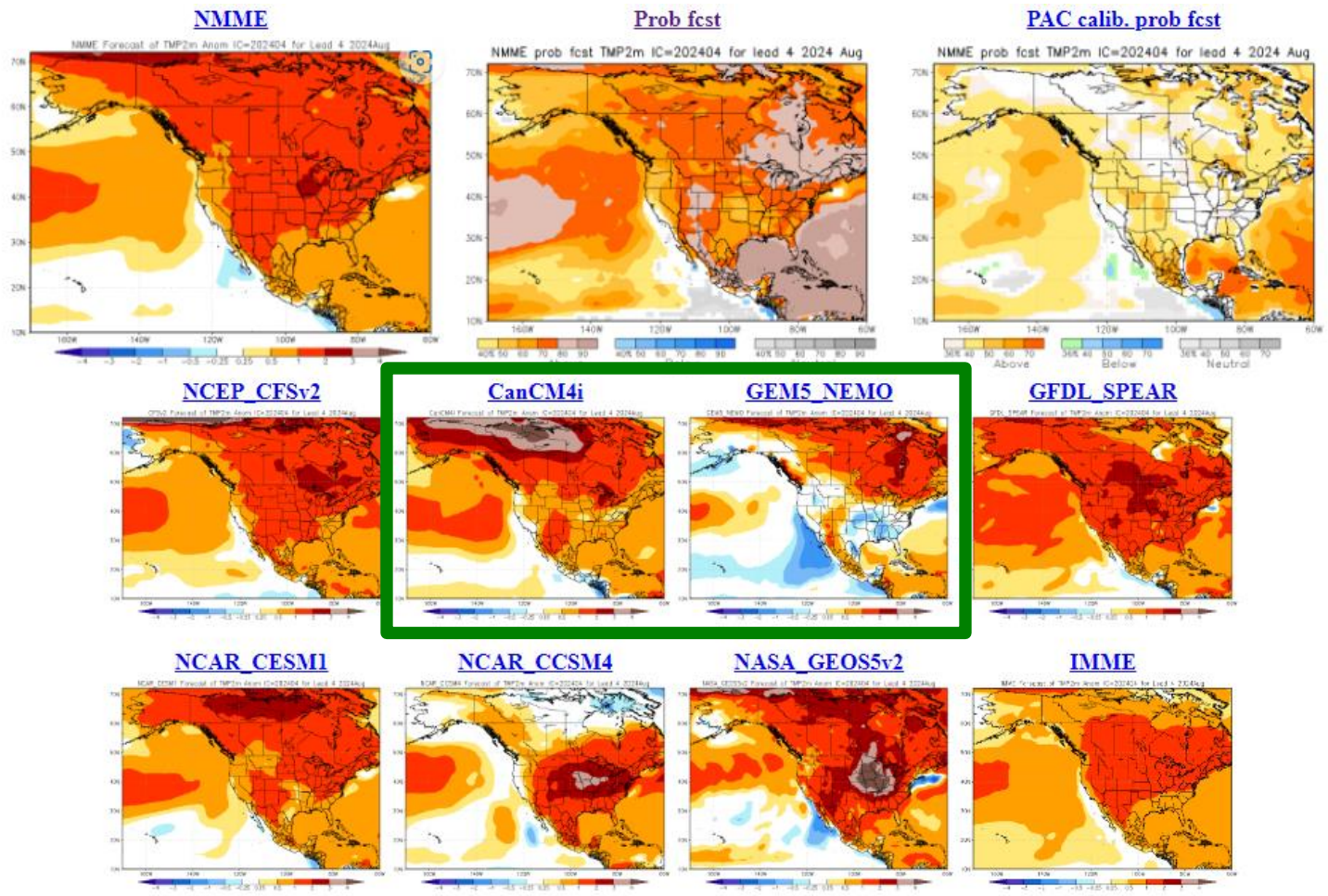
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North American Multi-model Ensemble
NMME

August Precip

Mixed result continues
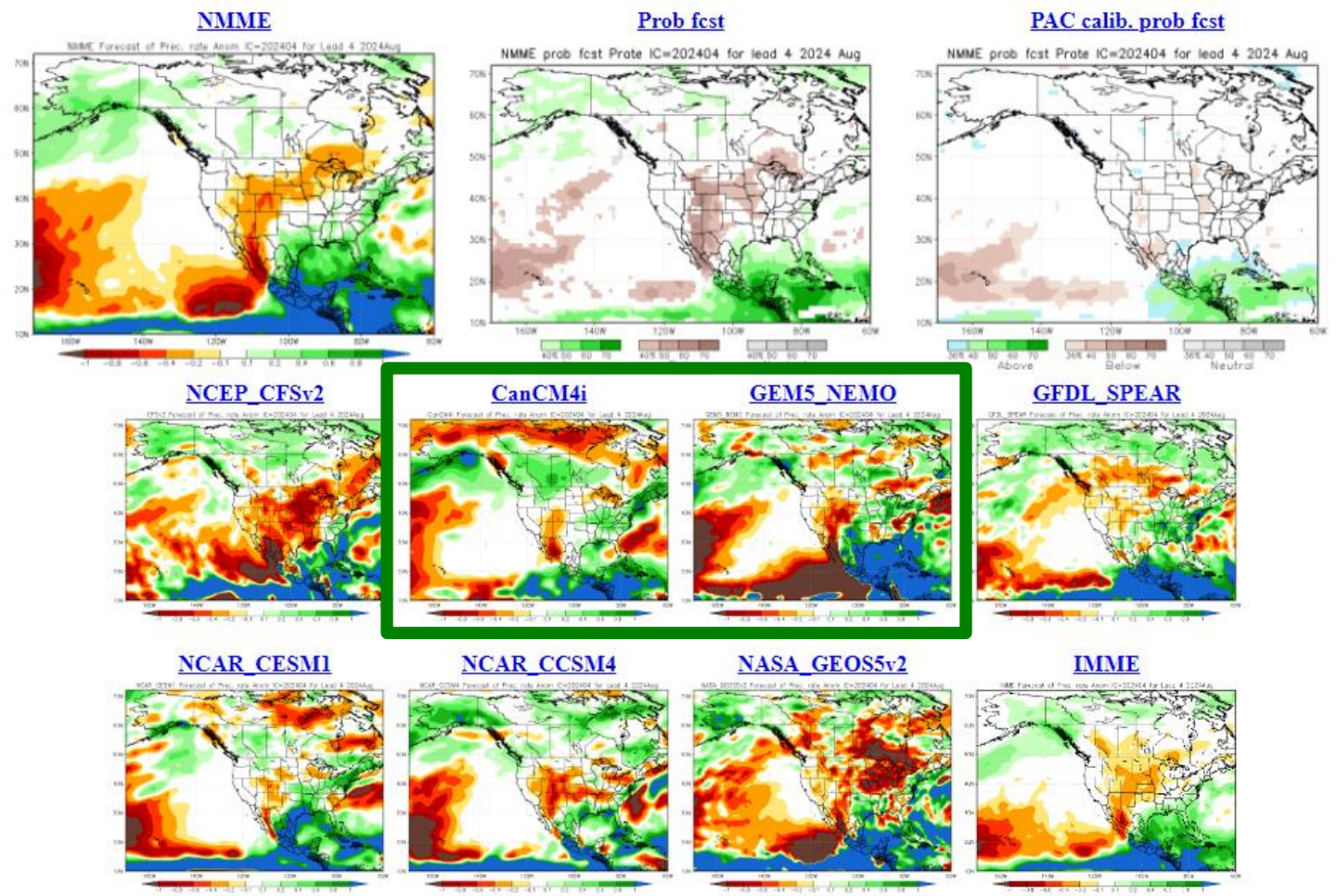
2024 NRCan-CFS Seasonal Prediction

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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 → **FFMC** Fine Fuel Moisture Code

Wind

Temperature, Humidity, Rain → **DMC** Duff Moisture Code

Temperature, Rain → **DC** Drought Code

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

Fuel Moisture Codes

Fire Behavior Indexes

ISI Initial Spread Index

BUI Buildup Index

Fire Danger

FWI Fire Weather Index

DSR/MSR/SSR Severity Rating

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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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NRCan-CFS Prediction: *May run, for May/June*
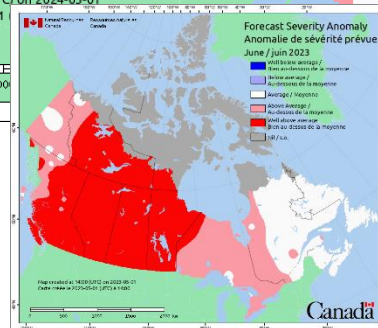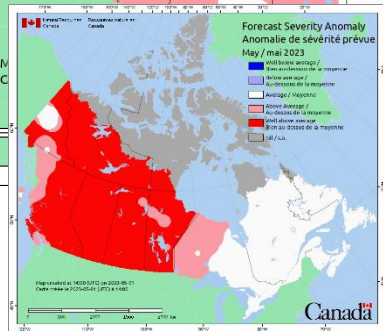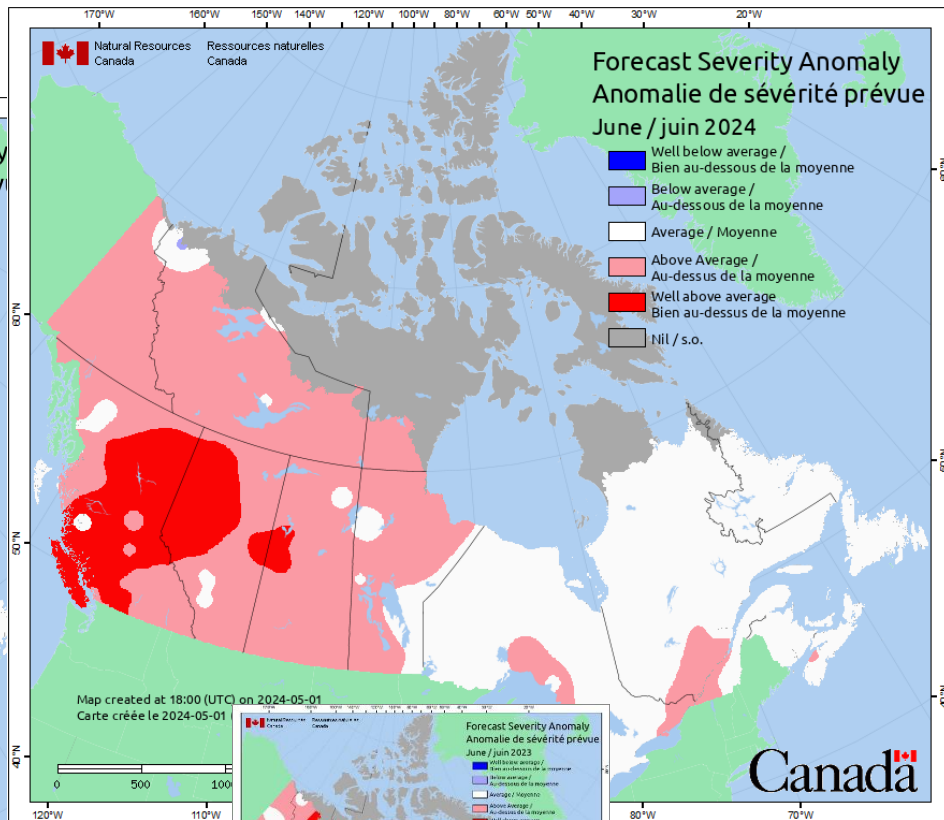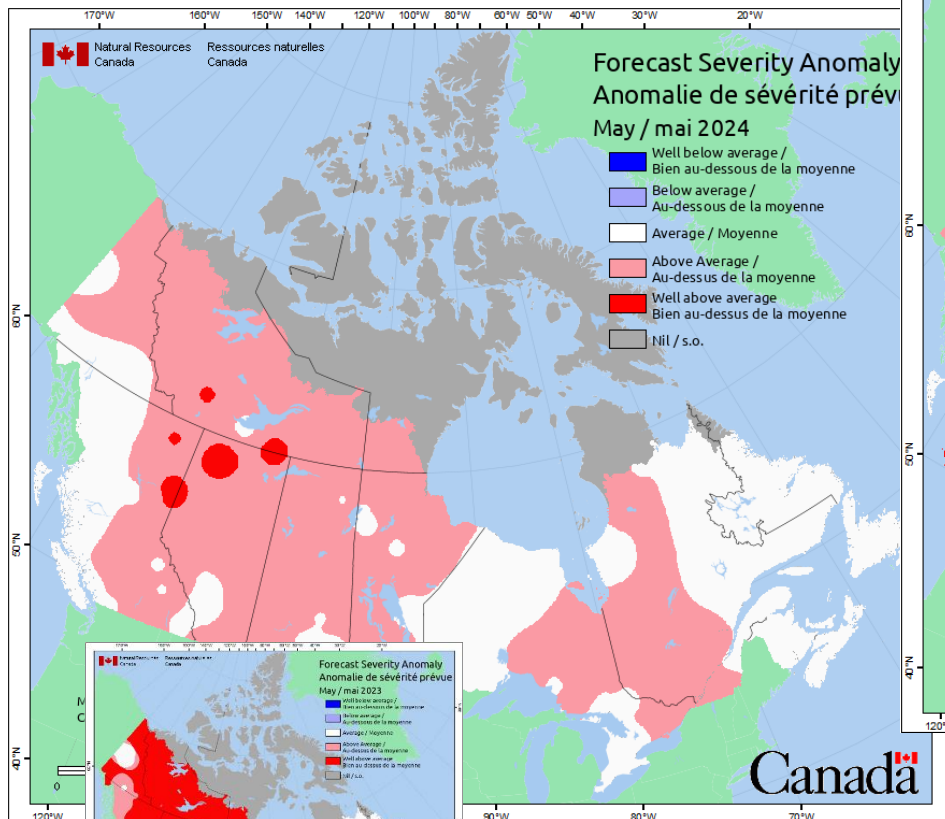
Anomaly

Predicted values normalized against average weather

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NRCan-CFS Prediction: *May run, for July-Sept*
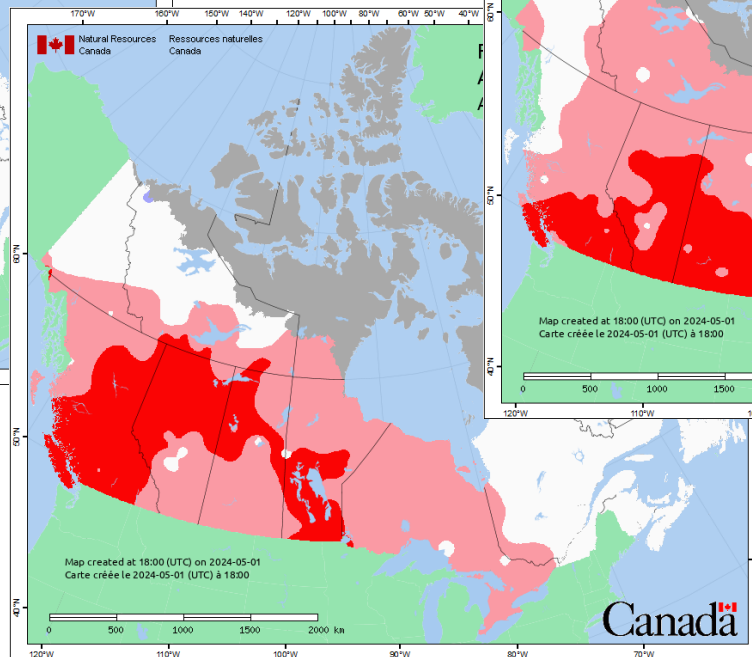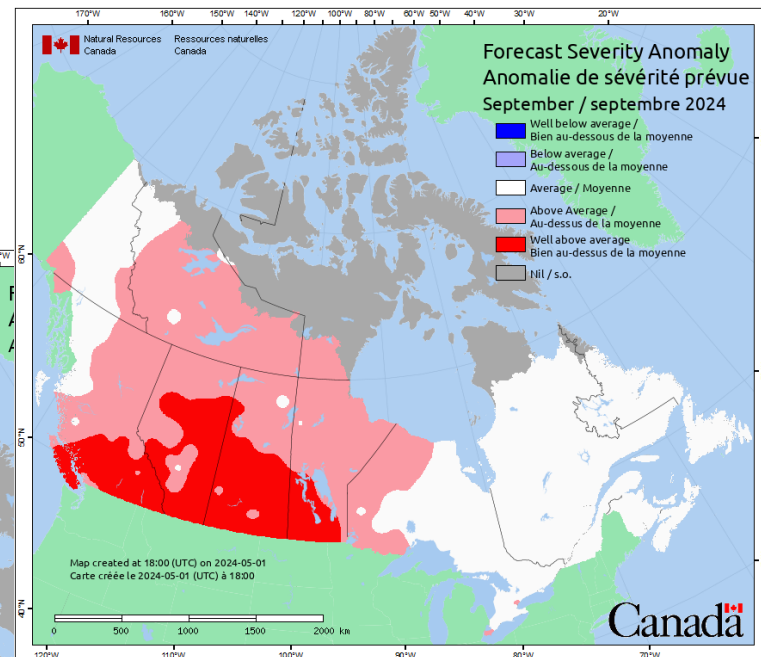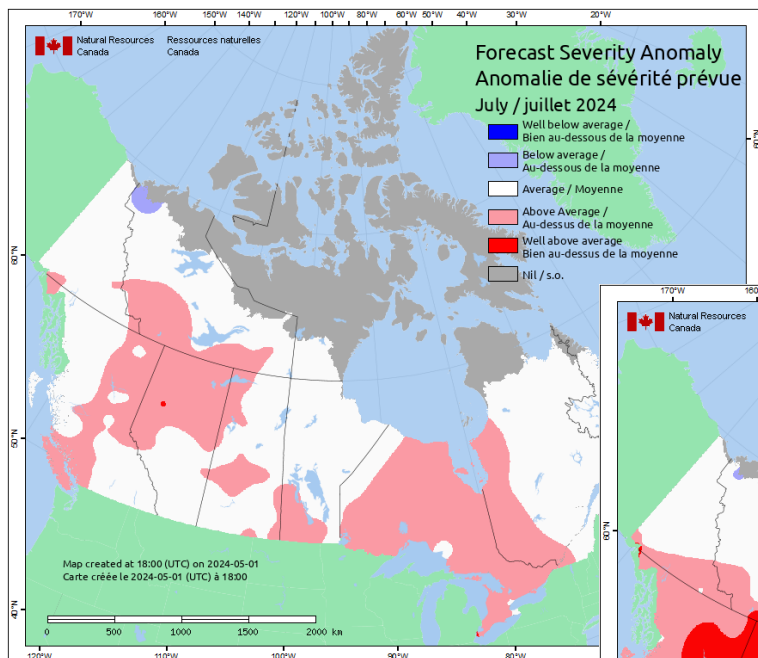
Anomaly
Predicted values normalized against average weather

Canadian Wildland Fire Information System (CWFIS)

**Note: CWFIS web site will change, likely in 2024-25**

Conclusions and Reminders

- **2023 was likely an outlier statistically (2020's opposite)**

- **Model synthesis indicates**

  - **Warm summer (may be common with warming climate)**

  - **Rainfall uncertain but La Niña may help boost amounts**

  - **Possible quieter July but active late summer**

- **Serious fires can occur in any year**

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

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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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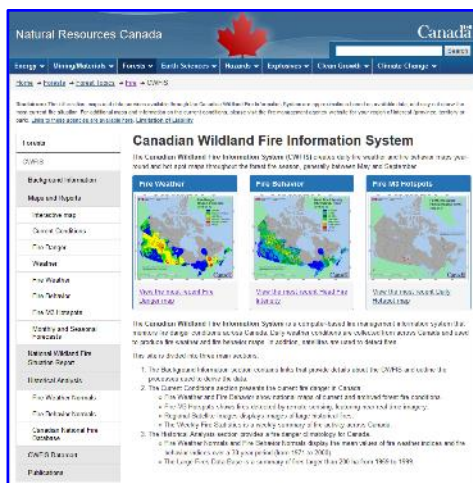
Questions?

Contact:

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