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S589: Weather Data Sources

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Heading: Arial 32pt centred, vertical=0.5cm²

Section Title: Corbel 40pt centred hor.

Text: Level 1 = Calibri 28 pt

Text level 2 = Calibri 24pt

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Objectives

- Look at differences between federal public and fire weather network data sources
- Sample a few data products and sites
 - FBAN/Specialist may not use these directly, should be aware of them
 - Can discuss usage with your fire weather office
- Learn some uses and caveats of ensemble models

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ECCC and Fire Management Agency Products

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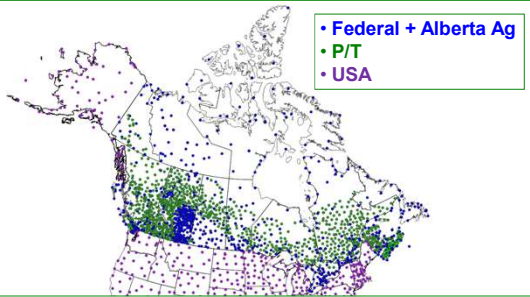
Fire Weather Product and Services

- Provincial and territorial (P/T) fire management networks in place for 40-60 years
- Federal fire weather presence varied over the years
 - Renewed interest in fire response after 2016
- Most P/T offices provide observed and forecast services
 - Some may use private contractor (e.g. NT, Atlantic)
- Let us look at Canadian weather stations ...

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Weather Stations used in the CWFIS



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Public vs Fire Weather Forecast

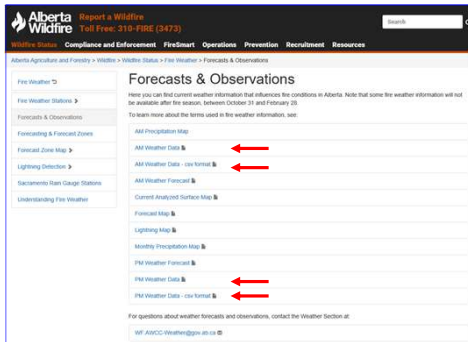
7

- P/T usually have web or internal sites
 - Little standardization between appearance or products
- Fire weather observations and forecasts include RH, wind direction
- CFFDRS indexes
- ECCC data mart provides a large variety of data
 - Observations, model output, expert discussions
- Does not contain all elements necessary for fire weather

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Sample fire weather page: Alberta

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Sample Fire Weather Forecast

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- **Synopsis:** a text description of weather features expected to shape the fire environment today and tomorrow
- **Regional Weather Forecasts:** specific weather data/forecast values for each region in tabular format:
 - **Today:** maximum T, minimum RH, maximum afternoon wind speed and average direction (significant wind shifts highlighted), comments
 - **Tonight:** overnight low T, maximum RH (RH recovery), average wind speed and direction, comments
 - **Tomorrow:** maximum T, minimum RH, maximum afternoon wind speed and average direction (significant wind shifts highlighted), comments
 - **500 mb Actual and Forecast Values:** Trend in heights for each region for the next 24-48 hours.
- **Outlook:** A text discussion of weather features expected over the next 5 days.
- Gives general weather conditions over a large geographical area. For site-specific forecasts, a spot forecast should be requested.

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ECCC Public Forecast (1/2)

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High Level, AB

Current Conditions

Observed at: High Level Airport
Date: 9:00 AM MST Thursday 2 September 2021

Condition: **Mainly Sunny**
Precip: **0.0 mm**
Tendency: **Rising**

Temperature: **18.0°C**
Dew point: **7.2°C**
Humidity: **62%**

Wind: **NNW 12 km/h**
Visibility: **24 km**

Forecast

Day	Fr 3 Sep	Sat 4 Sep	Sun 5 Sep	Mon 6 Sep	Tue 7 Sep	Wed 8 Sep
Temp	19°C	21°C	22°C	21°C	18°C	22°C
High	21°C	22°C	23°C	21°C	18°C	22°C
Low	5°C	7°C	6°C	5°C	4°C	7°C
Cloud	0%	0%	0%	0%	0%	0%

Forecast for Friday, September 3, 2021

Day: A mix of sun and cloud. Becoming sunnier this morning. Fog patches dissipating this morning. High 19. UV index 4 or moderate.
Night: Clear. Fog patches developing overnight. Low plus 3 with risk of frost.

Fr, 3 Sep
Day: Sunny. Fog patches dissipating in the morning. High 21. UV index 4 or moderate.
Night: Clear. Low 6.

Sat, 4 Sep
Day: Sunny. High 22.
Night: Clear. Low 9.

Sun, 5 Sep
Day: A mix of sun and cloud. High 21.
Night: Cloudy periods. Low 11.

Mon, 6 Sep
Day: A mix of sun and cloud with 60 percent chance of showers. High 18.
Night: Cloudy periods. Low 6.

Tue, 7 Sep
Day: A mix of sun and cloud. High 22.
Night: Cloudy periods. Low 6.

Wed, 8 Sep
Day: A mix of sun and cloud. High 22.

Summary: Sunrise: 6:50 MST. Sunset: 20:48 MST.

Averages and extremes

	28 Aug	30 Aug	31 Aug	01 Sep	02 Sep	04 Sep	06 Sep	07 Sep
Average high	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C
Average low	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C
Highest temperature (1971-2020)	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C
Lowest temperature (1971-2020)	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C
Monthly maximum of precipitation	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm

Yesterday's Data

Max: 18.0°C
Min: 6.0°C
Total Precipitation: 2.0 mm

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ECCC Public Forecast (2/2)

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Hourly Forecast for Saturday, September 4, 2021

Hour	00:00	03:00	06:00	09:00	12:00	15:00	18:00	21:00
Temp	20°C	21°C	22°C	23°C	23°C	22°C	21°C	20°C
Cloud	0%	0%	0%	0%	0%	0%	0%	0%

Hourly Forecast for Sunday, September 5, 2021

Hour	00:00	03:00	06:00	09:00	12:00	15:00	18:00	21:00
Temp	19°C	20°C	21°C	22°C	21°C	20°C	19°C	18°C
Cloud	0%	0%	0%	0%	0%	0%	0%	0%

Averages and extremes

	28 Aug	30 Aug	31 Aug	01 Sep	02 Sep	04 Sep	06 Sep	07 Sep
Average high	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C	18.0°C
Average low	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C	8.0°C
Highest temperature (1971-2020)	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C	27.2°C
Lowest temperature (1971-2020)	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C	-0.0°C
Monthly maximum of precipitation	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm

Yesterday's Data

Max: 18.0°C
Min: 6.0°C
Total Precipitation: 2.0 mm

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ECCC Data Mart

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Index of /

File Name	Last Modified	Size	Description
alpha_bulletins/	2019-04-04 20:13	528	
ensemble/	2019-04-04 20:14	-	
model_grib/	2019-04-04 20:14	-	
vertical_profiles/	2019-04-04 20:14	-	

Alphanumeric Bulletins → alpha_bulletins/

Ensemble → ensemble/

Model GRIB output → model_grib/

Vertical profiles → vertical_profiles/

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ECCC Datamart: Vertical Profiles

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**Also known as
"Prog Tephis"**

About 325 locations

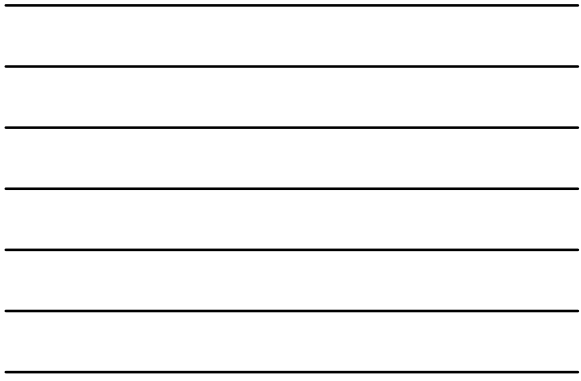
00Z and 12Z runs



ECCC Analysis and Modeling Web Page

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**Focus on content
– top and bottom
of actual page
are cropped**



Radar Imagery

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- Designed for populated areas
- Some usage for forest fire apps
- New S-band dual-polarization
 - Extends range
 - Helps eliminate false echoes
- False echoes:
 - Hills/mountains
 - Insect swarms or bird flocks
- Non-precipitation echoes can be useful
 - Frontal disturbances

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Satellite Imagery

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- Visible
 - Snow cover
 - Low cloud
 - Smoke
- Infrared
 - Cloud tops and heights
 - Water vapor

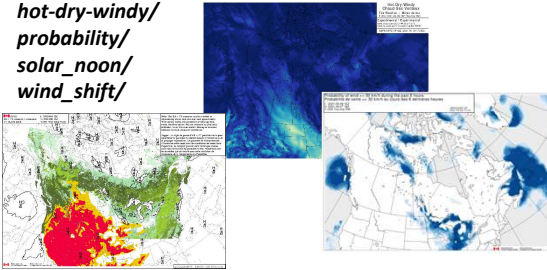
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ECCC/NRCAN Products

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https://collaboration.cmc.ec.gc.ca/cmc/cmop/NRCAN_CFS/

***grib2/
hot-dry-windy/
probability/
solar_noon/
wind_shift/***



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Other Sources of Observed and Modeled Data

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Overview

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- These are only a few of the many data sources
 - They sample the types of information easily available
 - A comprehensive list would take days to complete and deliver
 - Likely more sources of plotted and/or modeled data than observations

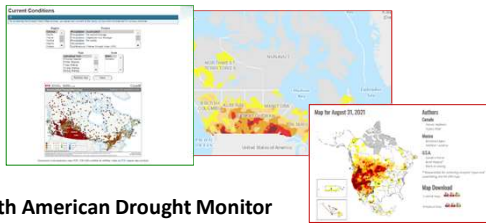
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Drought

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Canadian Drought Monitor – AAFC

<https://agriculture.canada.ca/en/agriculture-and-environment/drought-watch-and-agroclimate>



North American Drought Monitor

NCEI: <https://www.ncdc.noaa.gov/temp-and-precip/drought/nadm/>

NDMC: <https://drought.unl.edu/droughtmonitoring/Tools.aspx>

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USA Data

DRI-WRCC RAWS

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The figure is a collage of three screenshots. The top left is the NOAA NCEP/NWS 'Model Analysis and Guidance' page. The top right is the 'RAWs USA Climate Archive' showing a map of the United States with a legend. The bottom left is the 'USFS - WFAS' 'Fire Danger Rating' page. The bottom right is a smaller map of the United States.

USFS-WFAS

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Global Observations

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- WMO mandate
- Fire weather or other networks may exist but are not included

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SpotWx (A Canadian fire weather site)

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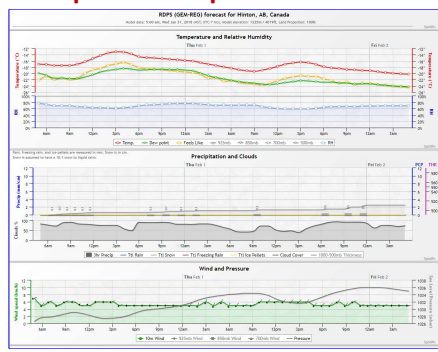
<https://spotwx.com>

- Free for casual use
- Nominal fee may apply for subscription service

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SpotWx Sample Time Series

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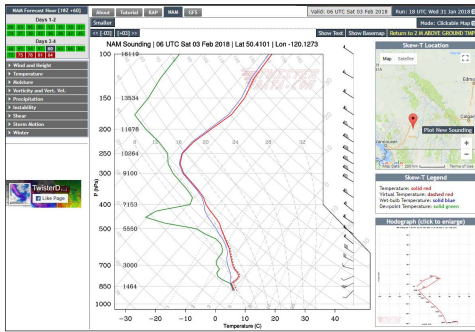
TwisterData.com (U of Oklahoma origin) 25

<http://www.twisterdata.com>

The screenshot shows the TwisterData.com website interface. At the top, there is a navigation menu with options like 'Home & 6', 'Forecast', 'About', 'FAQ', 'Help', and 'GFS'. Below the menu, there is a 'Why are we?' section with a sub-section 'Why?' containing text about the site's origin at the University of Oklahoma. To the right, there is a weather map showing a low-pressure system. The bottom of the page features a 'Will you charge for data?' section and a 'Future plans' section.

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TwisterData.com Sample Model Profile 26

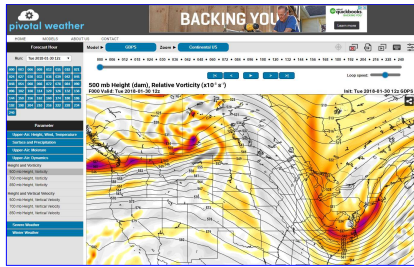


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Pivotal Weather 27

<https://pivotalweather.com>

- Good site for model scenario comparison



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Using Model Data

Model Characteristics

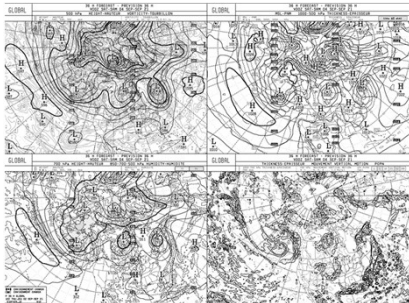
Every decade, we increase accurate forecast period by 1 day

- High resolution: Finer features/processes resolved
Shorter forecast period
- Short time step: Improved feature timing and position
- Model grid arrangement, physics packages may differ
- Raw (e.g. GRIB), specialized text, and graphical products

	Resolution (km)	Domain	Forecast (hrs)
HRDPS	2.5	Sub-continental	48
RDPS	10	Continental	48
GDPS	15	Global	240
GEPS	0.5 degree	Global	384, 768*
CanSIPS	2.5 degrees	Global	12 months

Deterministic Models

- Conventional Numerical Forecast
 - One Model
 - One Solution



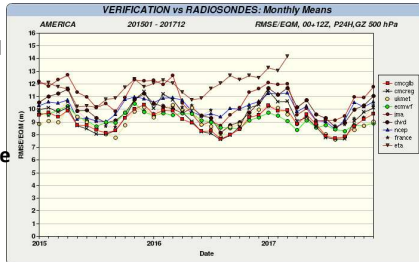
How well do models perform? 500 hPa height 24-hour forecast

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- RMS errors vs observation

- ECMWF and CMC Global good

- NCEP may be better now



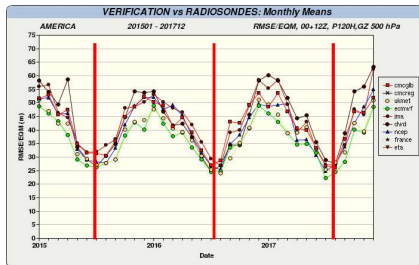
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How well do models perform? 500 hPa Seasonal Comparison: 120-hour

32

- RMS errors vs observation

- Correlation best in summers

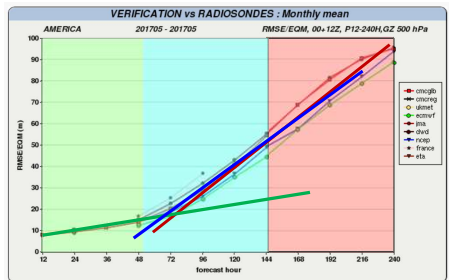


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Verification vs Radiosondes

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- Monthly mean
- May 2017 shown here



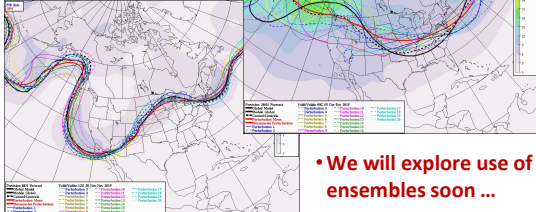
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Ensemble Models

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Recent trend towards probabilistic forecasting

- Many models
- Many solutions
- Weather or climate



- We will explore use of ensembles soon ...

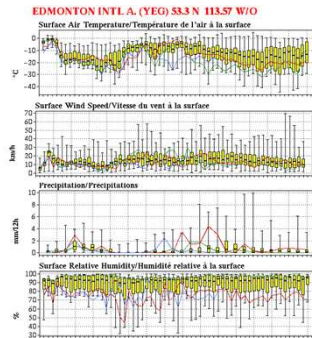
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Ensembles: NAEFS EPSGrams

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- Available on ECCC web site

- This display is pieced together from 2 drop-down selections

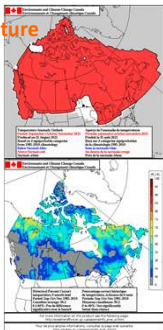


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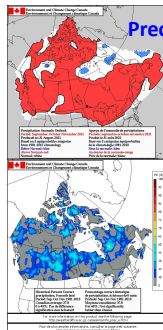
ECCC Deterministic Seasonal Forecast

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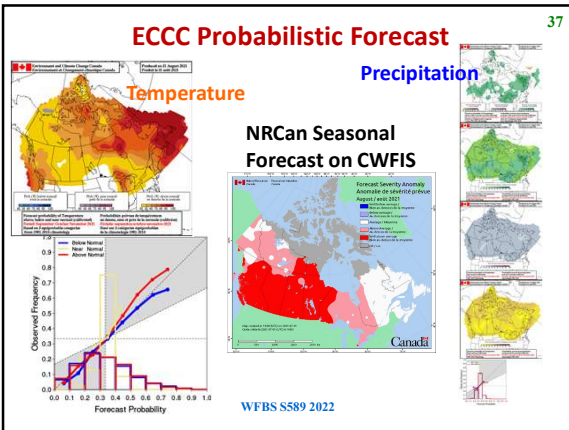
Temperature



Precipitation



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Unit II-B Part 1 Exercise

- Study the NWP maps ([S589-II-B-1_Exercise_2022.pptx](#)) and NAEFS forecast data ([2019111800_SACRAMENTO.xlsx](#))
- Do the model groups (ECCC, NCEP) predict the same wind and RH trends?
- Do the elements within a single model group predict the same trends?
- What wind event is more likely, Santa Ana (near Los Angeles) or Diablo (near San Francisco)?
- Is Sacramento a suitable station for this event?

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Using Ensembles

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Ensemble Forecasts

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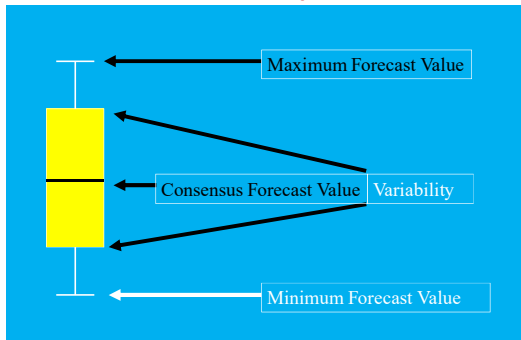
- Ensemble means/median are a form of averages
 - Averages may mask extreme events
 - Extreme events drive big fire runs
 - Individual ensemble elements may be useful
- Ensemble element agreement indicates forecast confidence



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Box Plot Composition

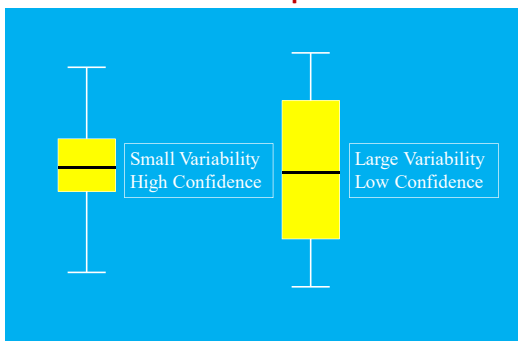
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Box Plot Interpretation

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Temp. Forecast: Consensus vs Variability ⁴³

Date	Time	Consensus	Lower End	Upper End
2011-02-15	17:00	-4.4	-6.4	-1.3
2011-02-16	17:00	-16.7	-18.4	-11.0
2011-02-17	17:00	-18	-21.3	-14.3
2011-02-18	17:00	-18.5	-22.0	-12.0
2011-02-19	17:00	-8.4	-12.2	-4.5
2011-02-20	17:00	-5.6	-10.4	-2.4
2011-02-21	17:00	-5.6	-11.2	-2.7
2011-02-22	17:00	-4.3	-7.7	-2.3
2011-02-23	17:00	-6.4	-12.8	-2.4
2011-02-24	17:00	-11	-17.3	-6.0
2011-02-25	17:00	-12.5	-19.4	-6.0
2011-02-26	17:00	-14.7	-21.9	-9.3
2011-02-27	17:00	-13.9	-23.3	-6.9
2011-02-28	17:00	-11.5	-24.5	-6.3
2011-03-01	17:00	-13.5	-20.2	-2.9

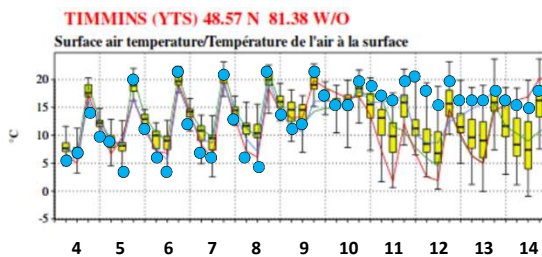
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Ensemble Precipitation Forecasts ⁴⁴

- *“Ensemble means/medians have little meaning for discontinuous weather elements”*
 - Many solutions forecast no precipitation on a particular day
 - Forecasts may differ due to weather system timing, or different convective capabilities
- *“Reduce the consensus precipitation amounts”?*
 - *“BUI values trend higher”*
- Consider timing of rain and effects on fire weather

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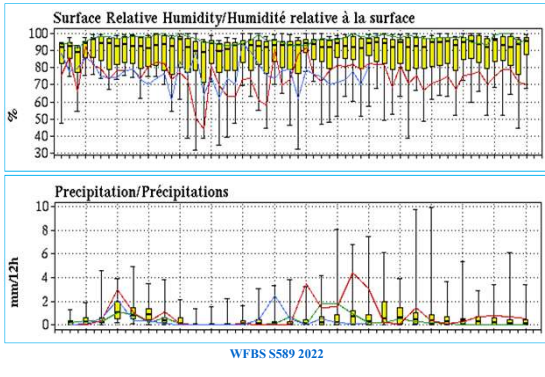
Box Plot Confidence vs Accuracy ⁴⁵



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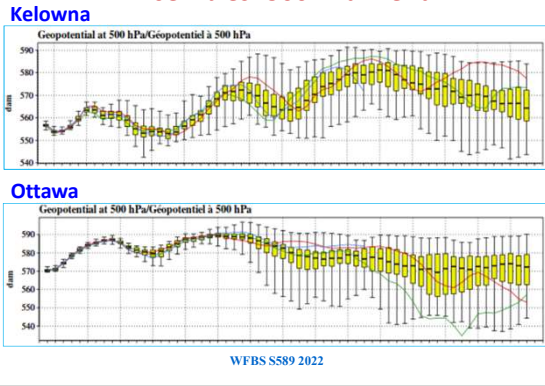
Box Plots: RH and Precipitation

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Ensembles: 500 hPa Trend

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Ensemble Forecast Reminder!

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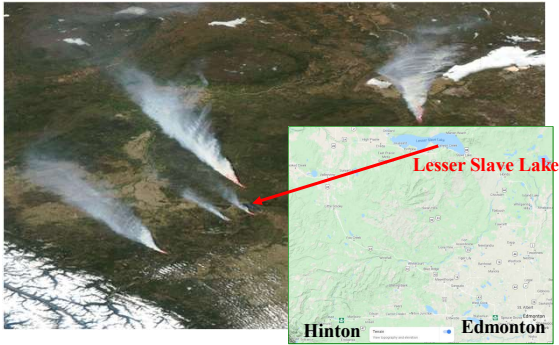
- Ensemble forecast interpretation is challenging!
- Much research into ensemble usage still needs to be done with regards to fire weather
- Discuss usage and questions with your fire weather office
- They may have answers for your questions, but an offer expert assessment

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Ensemble Case Study: Flattop Complex, May 15, 2011

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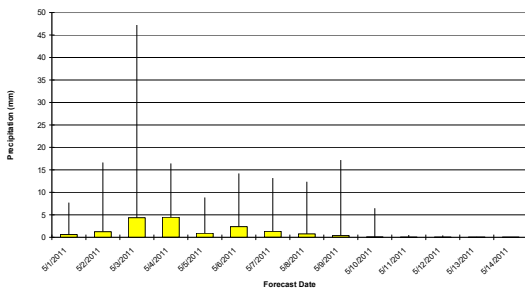
Flattop Complex Setting



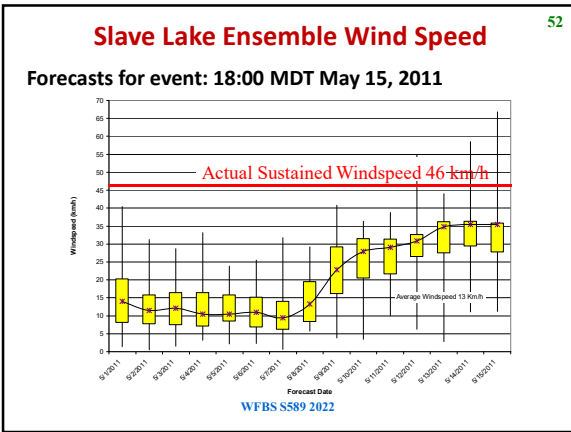
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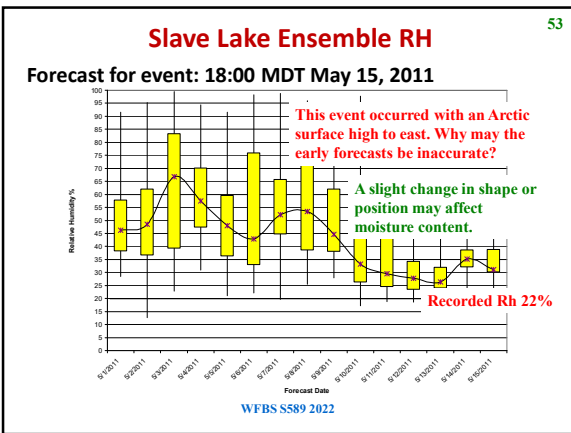
Slave Lake Ensemble Rainfall

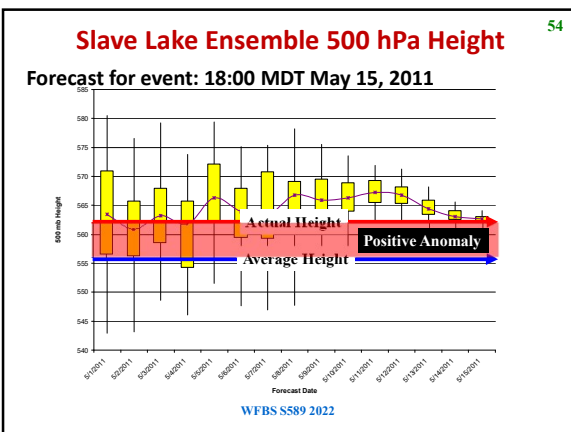
Forecasts for event: 18:00 MDT May 15, 2011

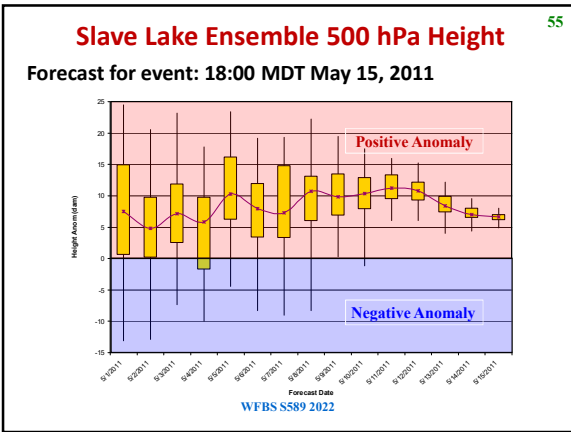


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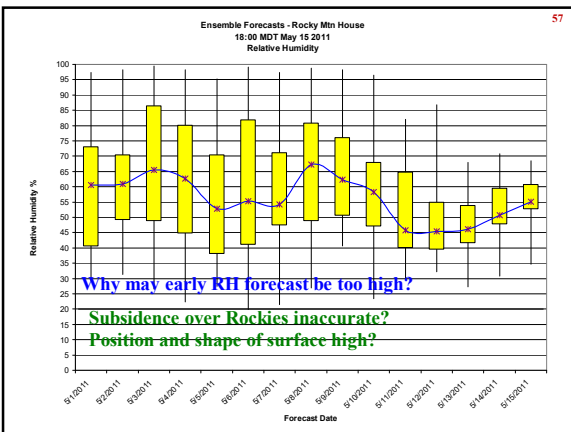


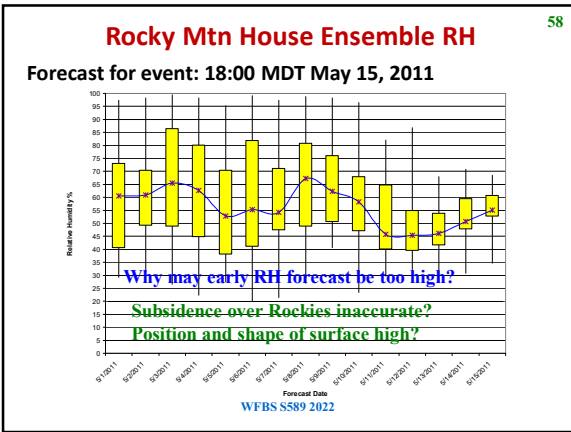


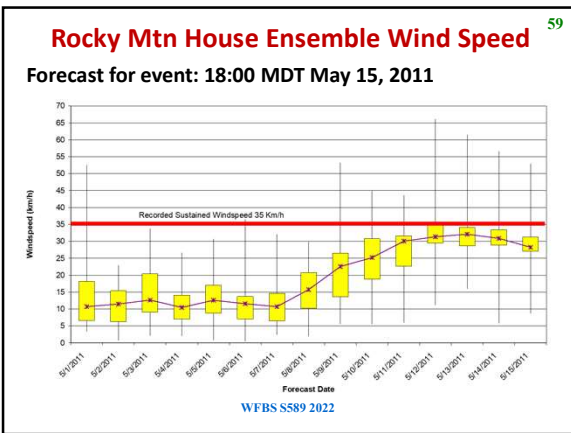
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Ensemble Case Study: Lee of Rockies

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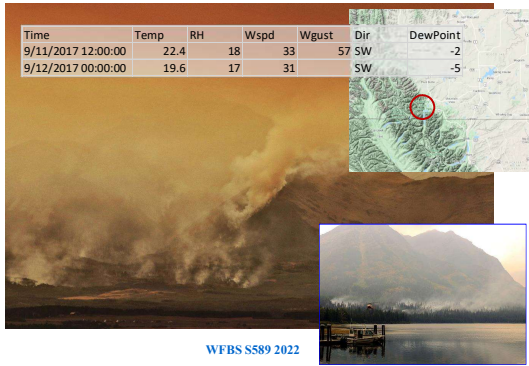
60

Ensemble Case Study: Kenow Fire

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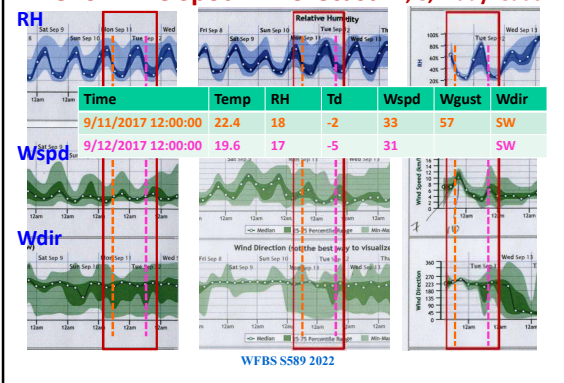
Kenow Fire Ensemble Forecasts

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Kenow Fire SpotWx Forecast 14, 8, 1 day leads

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Summary

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Networks: know major differences between

- Provincial/territorial fire weather
- Federal sources

View a sampling of other data sources

- Modeled data
- Plots or maps of observed or modeled data
- USA fire weather data sources

Deterministic and Ensemble models

- Understand some basic differences
- Ensembles: know some caveats and basic usage

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Contact Information

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?

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Contact:
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Title

Text level 1
Text level 2

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