

An Example of Extreme Fire Behaviour Associated with a Dry Cold Front Passage: the 2012 Zama Wildfire Complex in Northwestern Alberta

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Introduction

Fire Location



The Fire's Significance

- A classic upper ridge break-down and cold frontal passage triggered the extreme fire behaviour

Zama City

- The fire's major run led to an emergency evacuation of Zama City and surrounding areas

Fire

Chronology

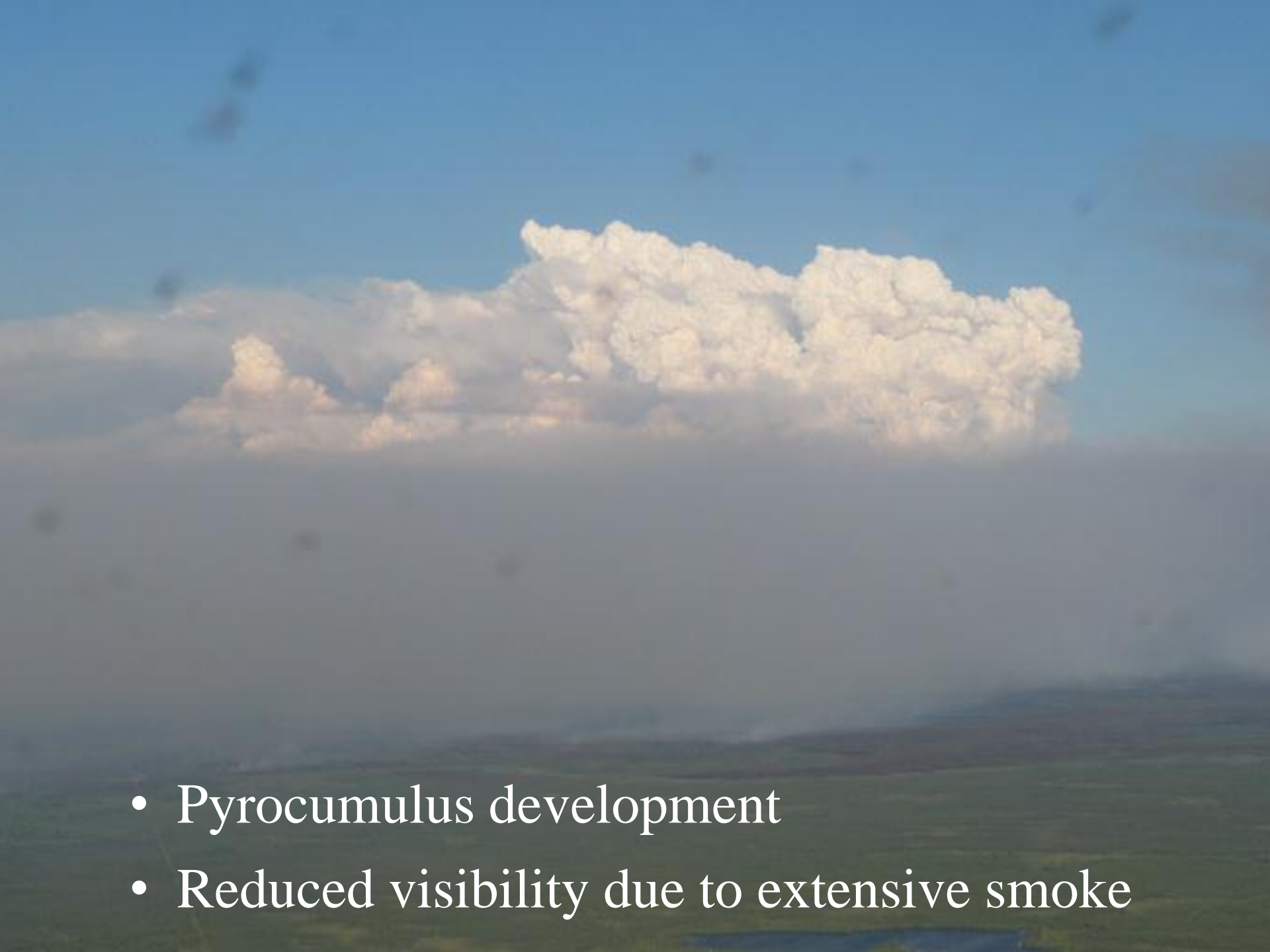
- Fire started by lightning on June 21
- Initially burning in an eco-zone
- Subjected to initial attack and subsequently classified as “being held”
- Fire was periodically monitored thereafter
- Gradually grew in size to approximately 13,000 ha by late afternoon of July 10



- At ~1800 MDT on July 10, the fire blows up!
- ~60% of the final area burned (~135,000 ha) occurred during the major run

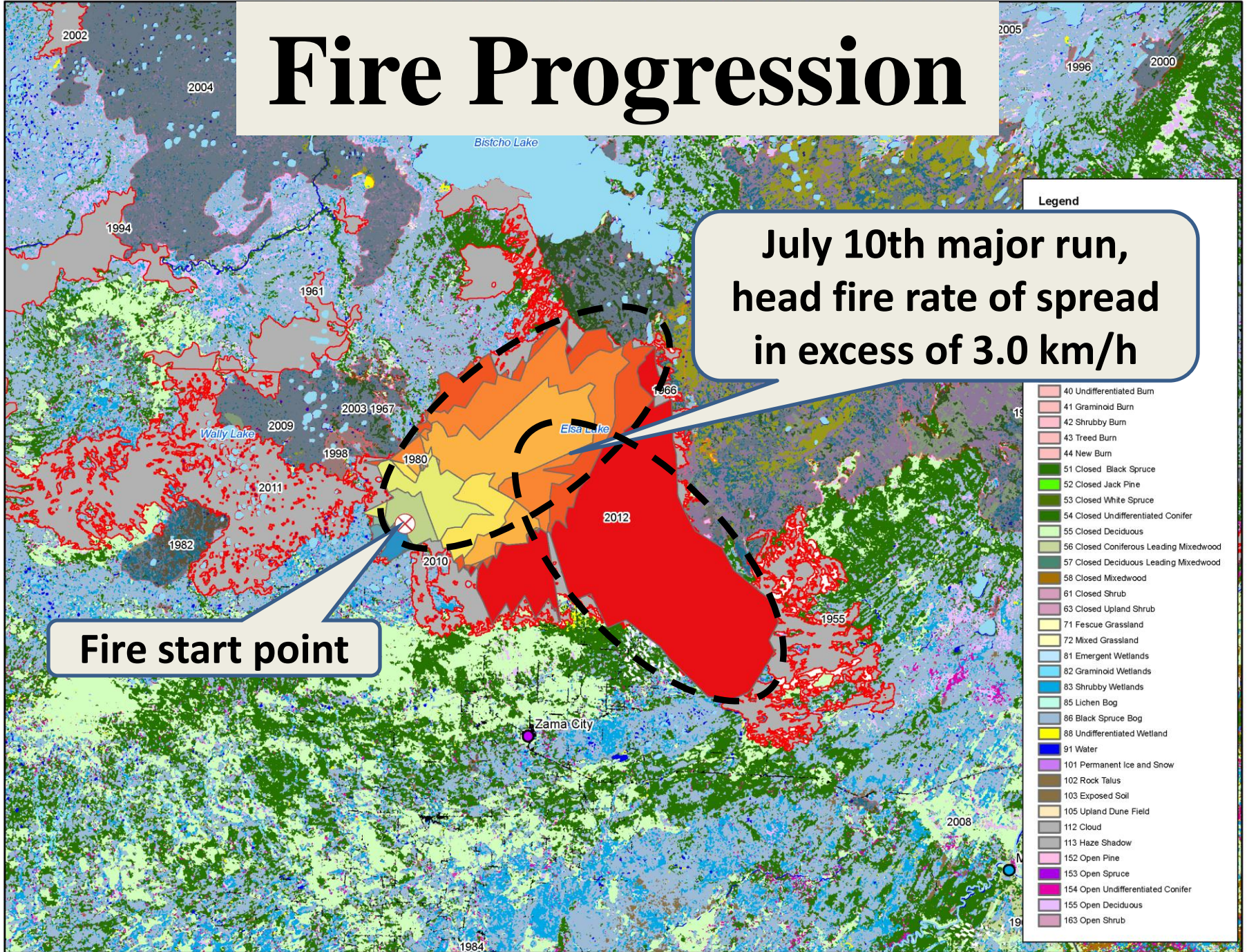
- Crowning, high rates of spread and intensities, prolific spotting





- Pyrocumulus development
- Reduced visibility due to extensive smoke

Fire Progression



Fire

Environment

Fire Behavior Triangle



Topography

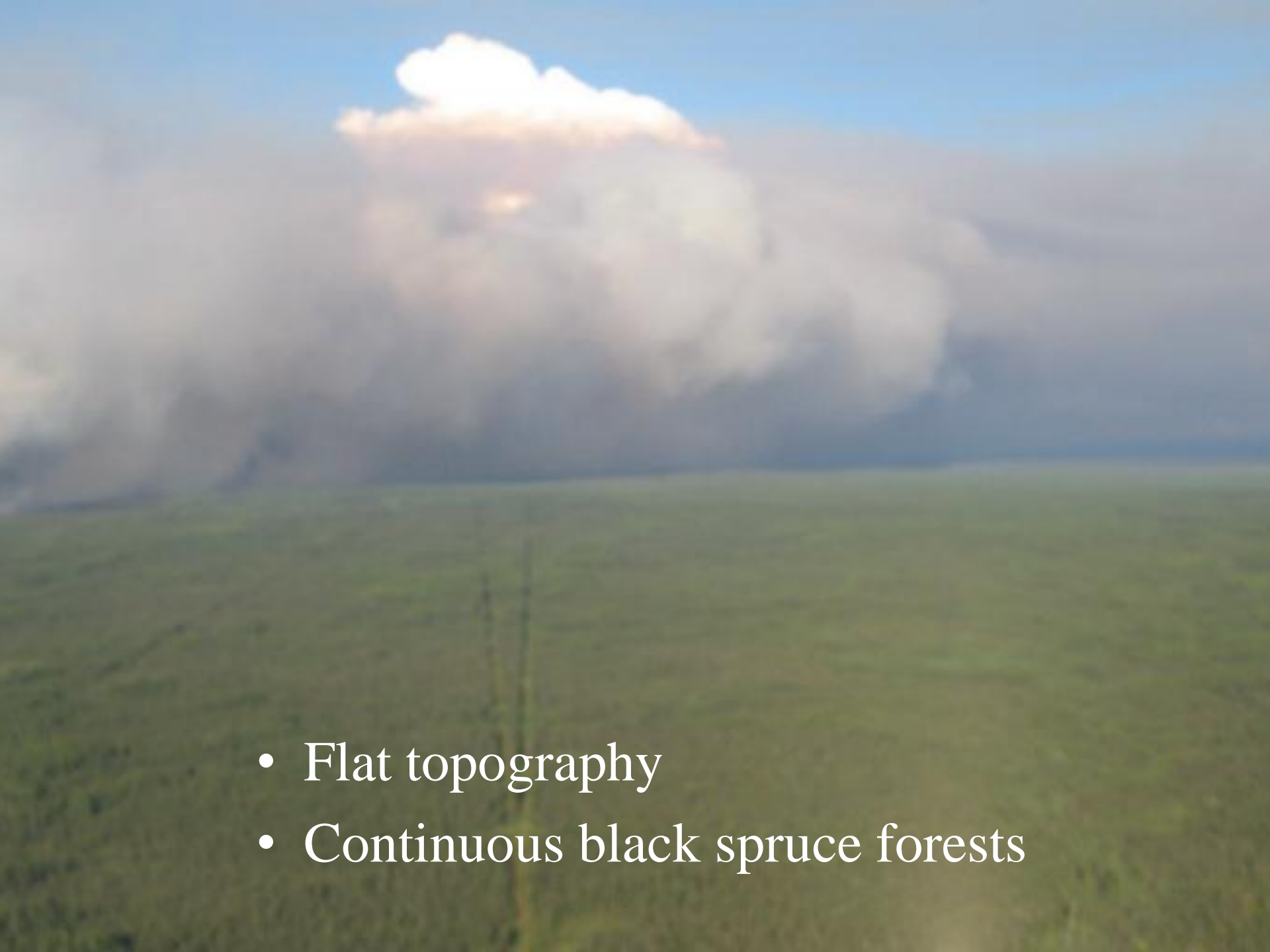
- Flat or slopes
- Aspect

Weather

- Wind
- Temperature
- Relative Humidity
- Precipitation
- Instability

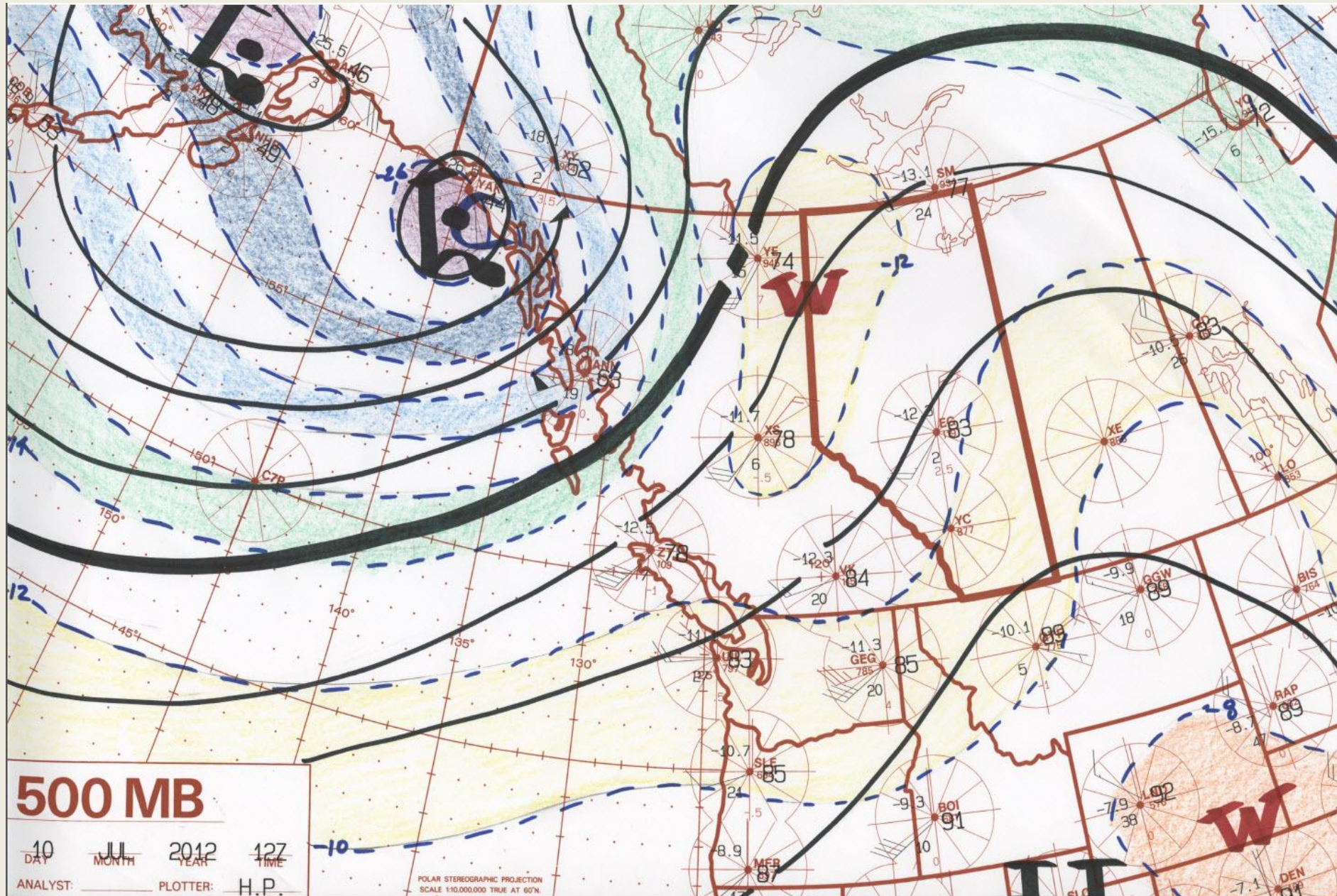
Fuel

- Fine or Heavy
- Arrangement & continuity
- Fuel Moisture

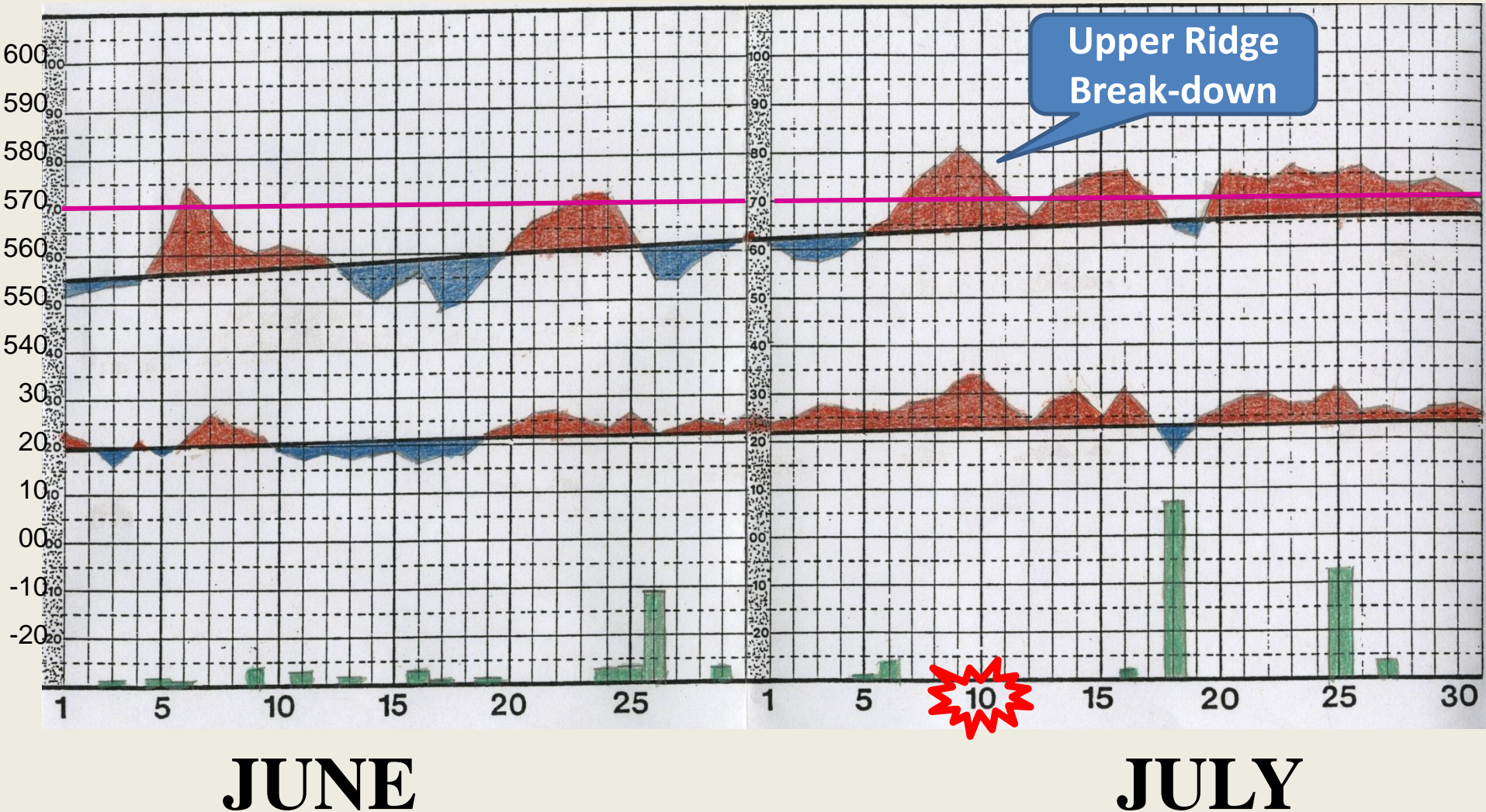


- Flat topography
- Continuous black spruce forests

Flow pattern at 500 mb level of July 10th 2012



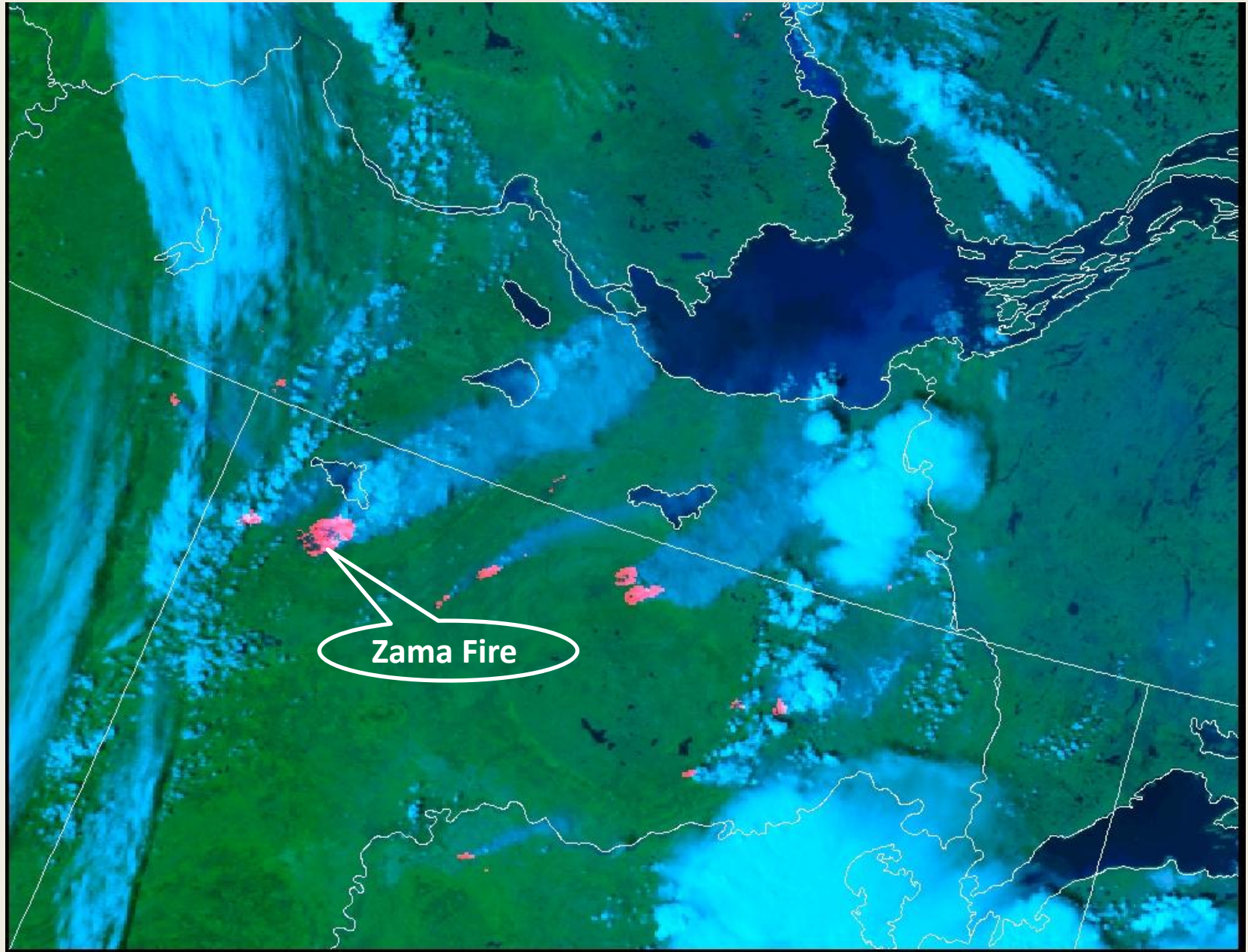
Anomalies of the 500mb Heights, Max Surface Temperatures and 24hr precipitation of High Level airport station in June and July 2012



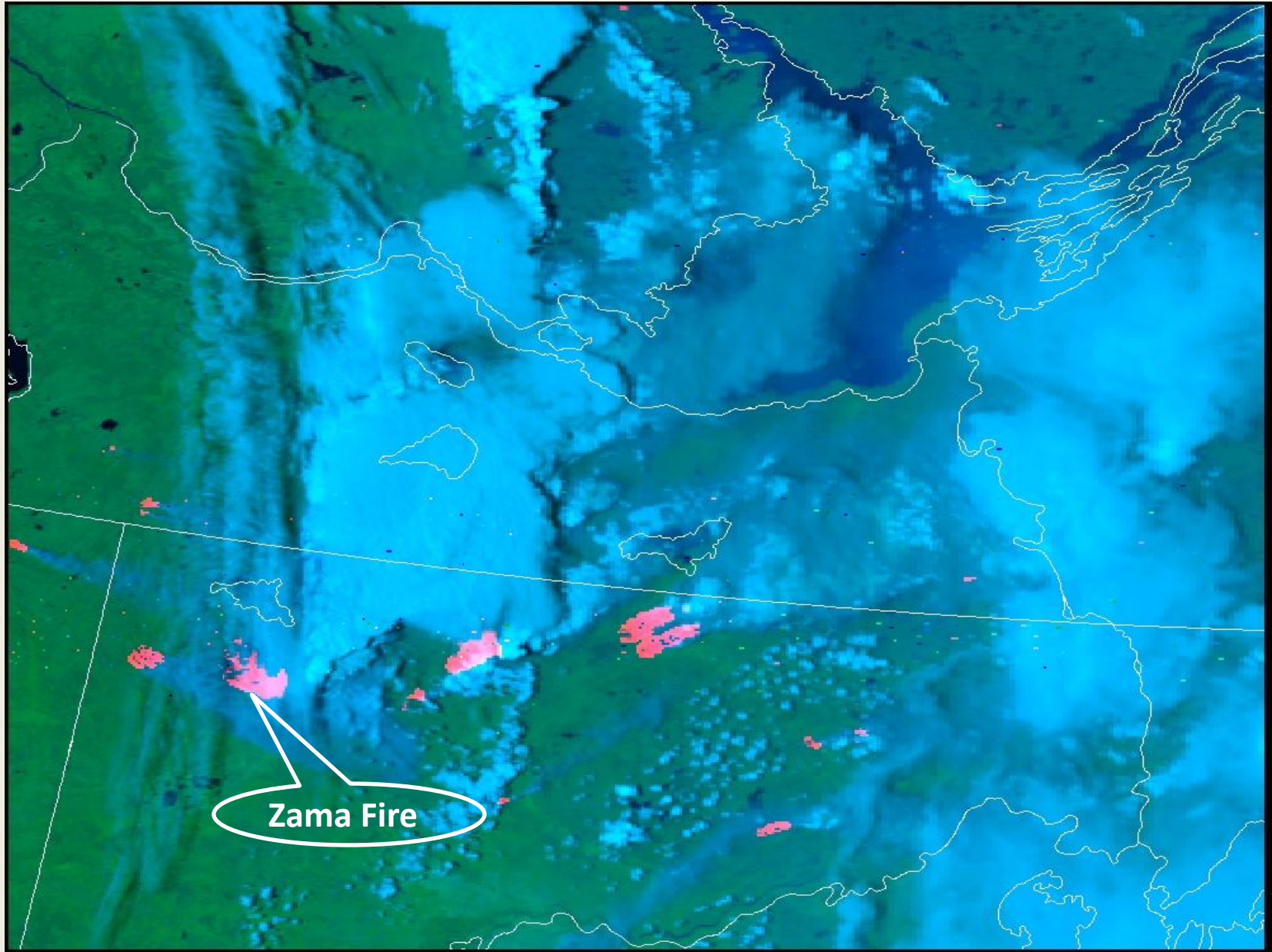
Surface Flow Analysis of July 10th 2012



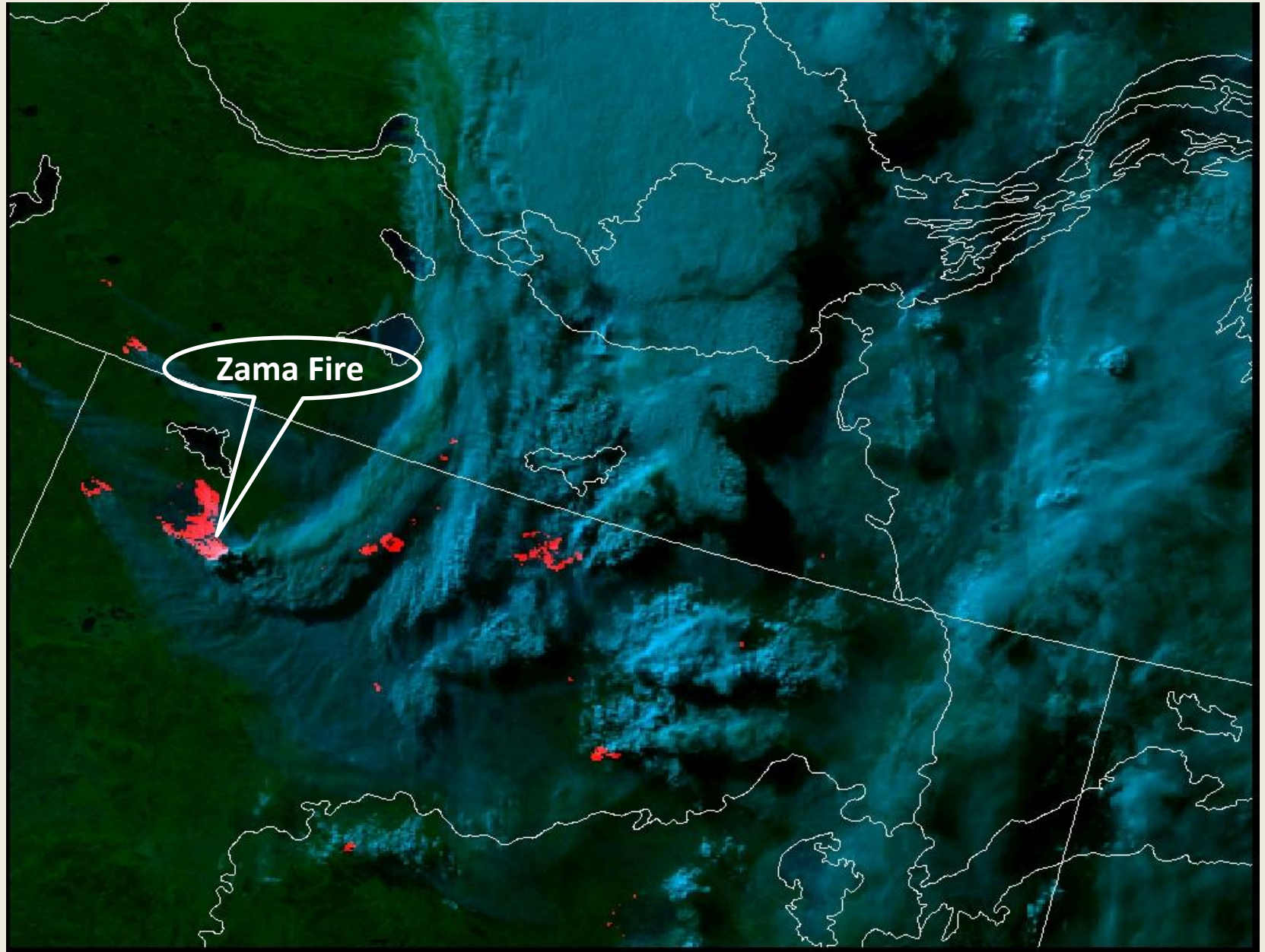
Satellite Image of July 10th at 1515 MDT



Satellite Image of July 10th at 1809 MDT



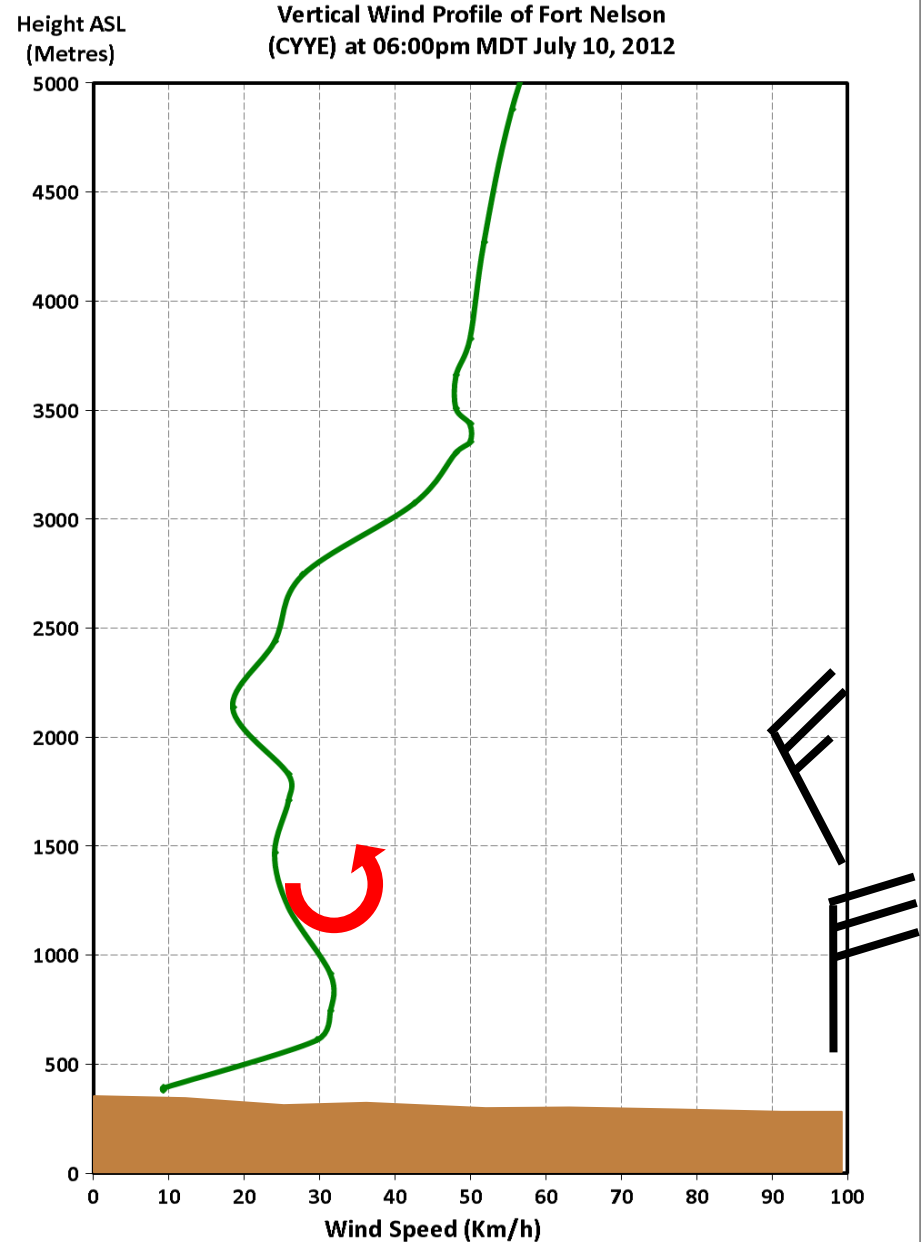
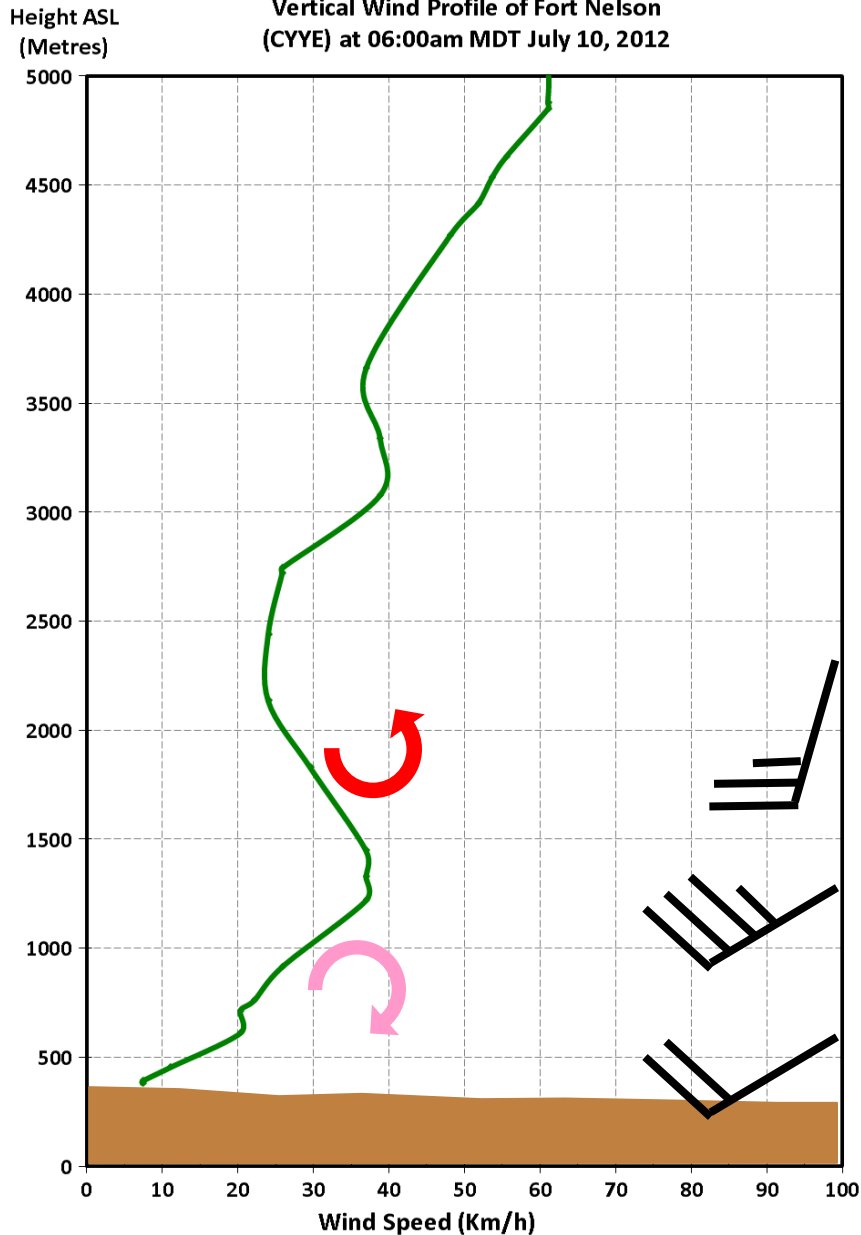
Satellite Image of July 10th at 2102 MDT



Loop of the Satellite Images

http://rammb.cira.colostate.edu/templates/loop_directory.asp?data_folder=dev/lindsey/loop_ops/10jul12_alberta_pyrocb_vis&image_width=1020&image_height=720

Vertical wind profile of Fort Nelson on July 10th



Fire Weather Observations

Max Temperature for the day ($^{\circ}\text{C}$) – 32

Min Relative Humidity (%) – 21

Average Maximum Wind Speed (km/h) – 24

Max Gust Wind Speed (km/h) – 44

Number of Days Since Rain – 12

FWI System Components

Fine Fuel Moisture Code (FFMC) – 96

Duff Moisture Code (DMC) – 42

Drought Code (DC) – 385

Initial Spread Index (ISI) – 35

BuildUp Index (BUI) – 66

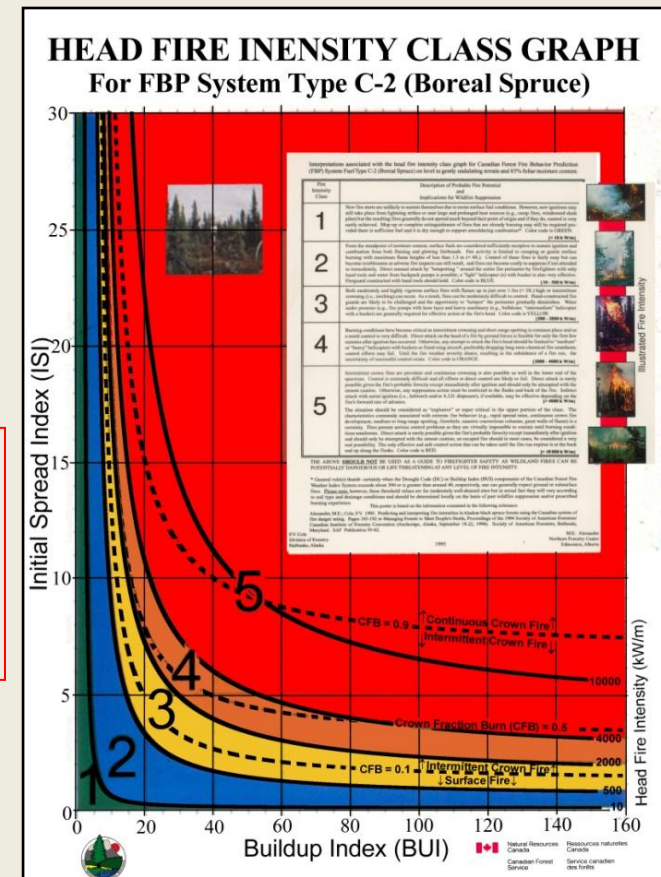
Fire Weather Index (FWI) – 55

Fire Behaviour Analysis

FBP System Outputs for Fuel Type C-2 (Boreal Spruce)

- Head fire rate of spread ~ 50 m/min (3 km/h)
- Continuous crowning
- Head fire intensity class 6+ ($>10,000$ kW/m)

“The situation should be considered as explosive ...”



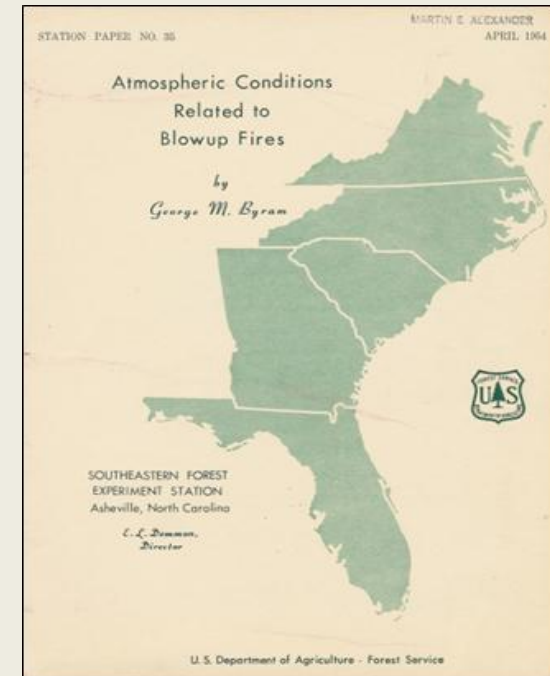
Byram's Conditions for Blow-up Fires

✓ Dry and plentiful fuels

✓ Unstable atmospheric conditions

✓ Surface wind speed of at least 29 km/h

✓ Winds decrease with height for thousand or more metres above fire



Conclusion

Was the Fire's Behaviour Predictable?

We presently have the tools for judging the likelihood of “blow-up” fire events.

In the case of the Zama Fire:

- The cold frontal passage was accurately forecast.
- The FWI System components were reflective of the burning conditions.
- The FBP System correctly assessed the potential for extreme fire behaviour.



Thank you !

Are there any questions?

Acknowledgement

- *Nick Nimchuk – Head of the AESRD Fire Weather Section*
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