Seasonal Climate Forecasting Applied to Wildland Fire Management in Alaska

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Thursday August 3, 2017

Aggie Creek Fire (Summer 2015), 30 miles north of Fairbanks, US Forest Service photograph

- **Goal: Use seasonal forecasts to make products for decision support several months before fire season.**

Motivation

- Boreal wildland fire in Alaska **burns many acres**.

- Fires are **costly** (e.g., The record fire year of 2004 resulted in 6.5 million acres burned and was costly from property loss (> $35M) and emergency personnel (> $17M).

- **Information a season in advance** (March) would help decision makers and has potential to save $ by allocating resources more effectively.
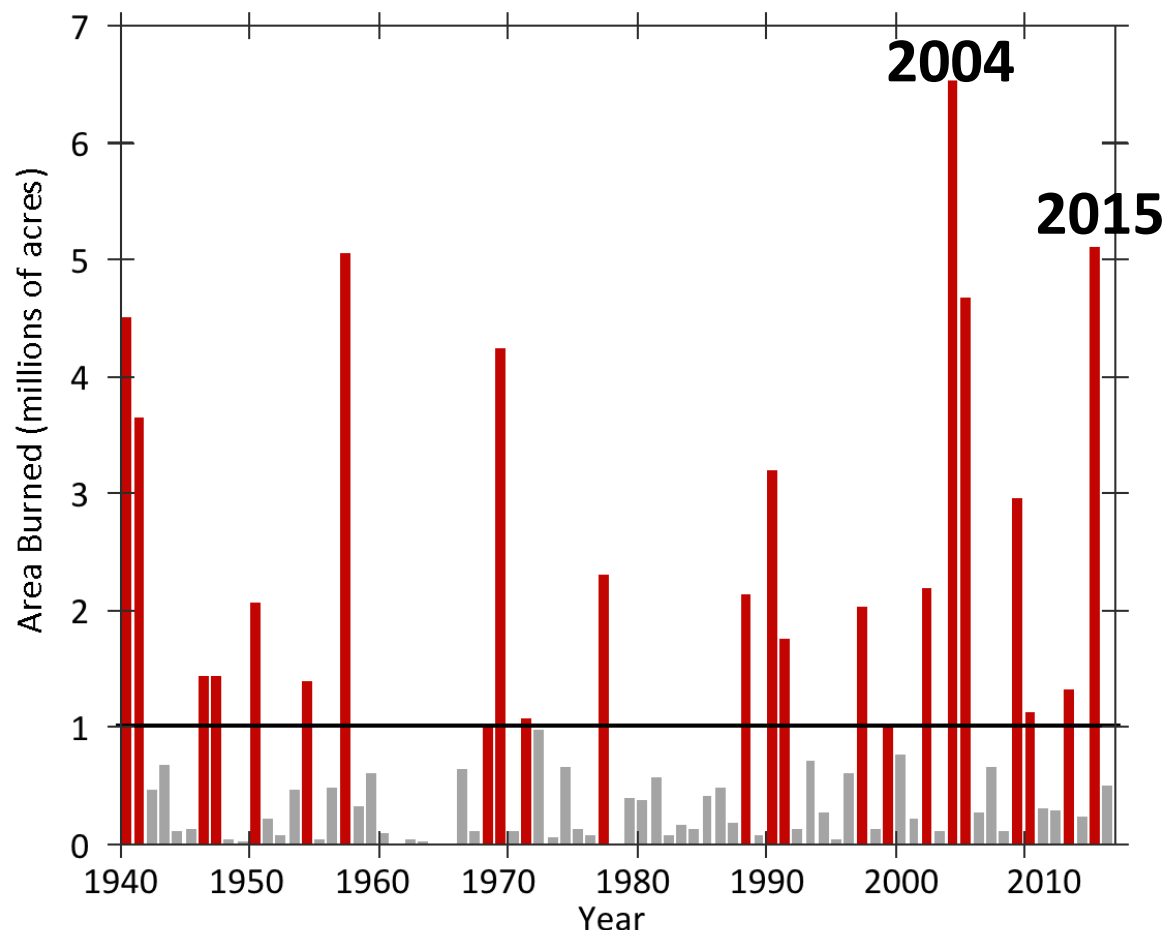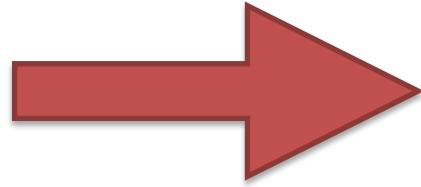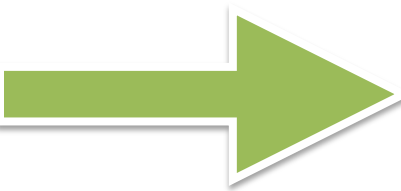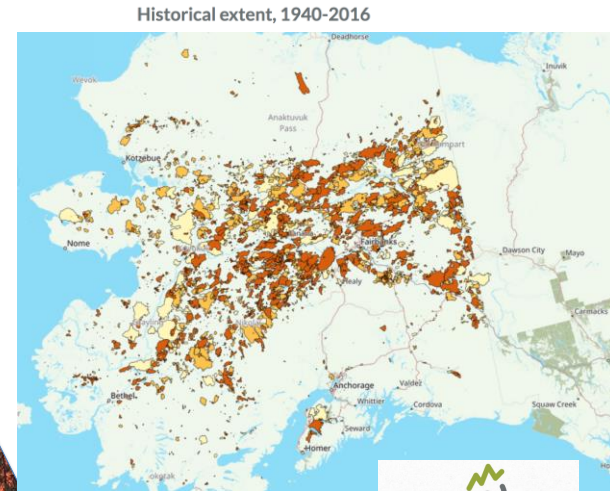

Acres burned in Alaska
2017 0.6 Million acres

[Updated from Partain et al. 2016]

Three items are needed for wildland fire

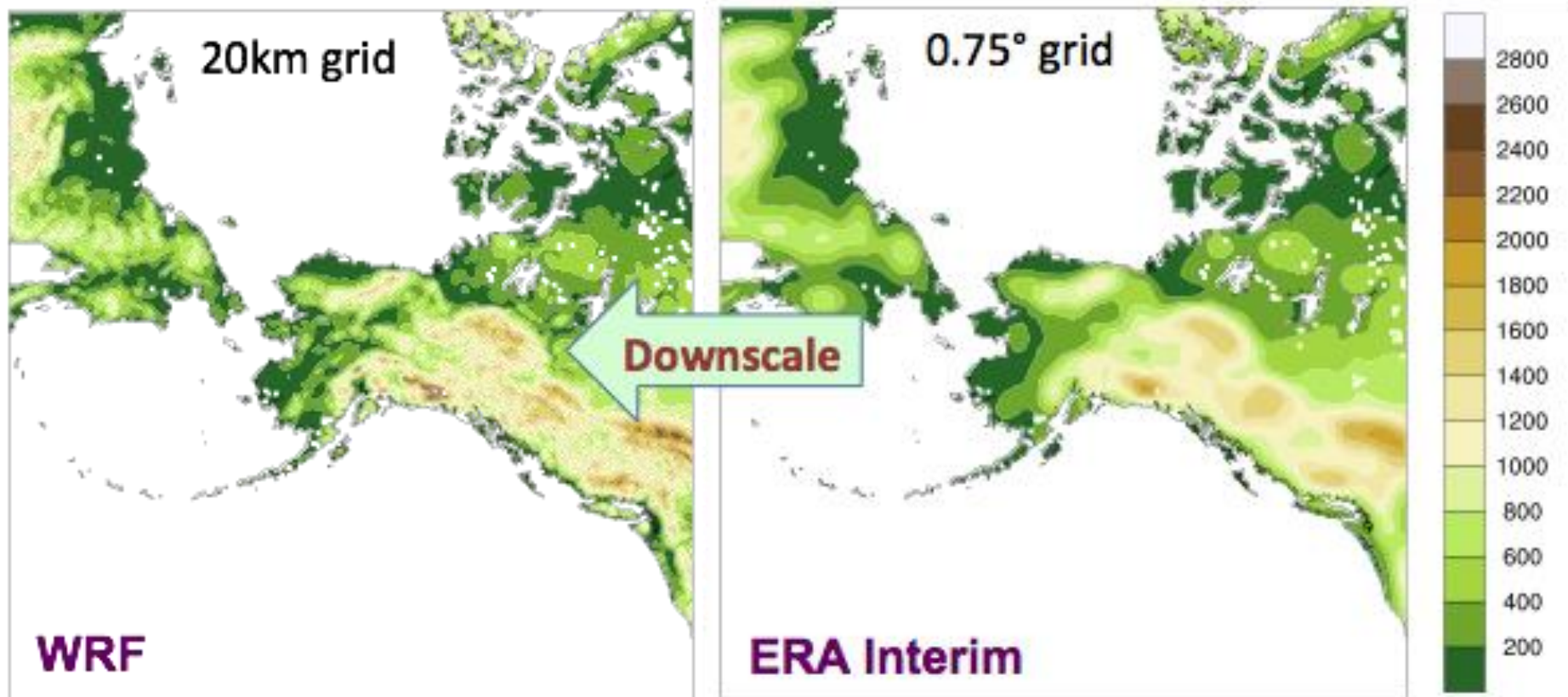**Weather**

Ignition

Fuel

Historical extent, 1940-2016

Scenarios Network
FOR ALASKA + ARCTIC PLANNING

Slide from Scott Rupp

Data

- Apply NMME (Kirtman et al. 2014) seasonal forecasts to wildland fire products in Alaska.
- 'Observations' - Dynamically downscaled ERA-Interim for Alaska . **[Bieniek et al. 2016]**
- Calculate Canadian Forest Fire Weather Indices.
- Most acres burned are remote and lightning provides ignition. Lightning data is collected by BLM.

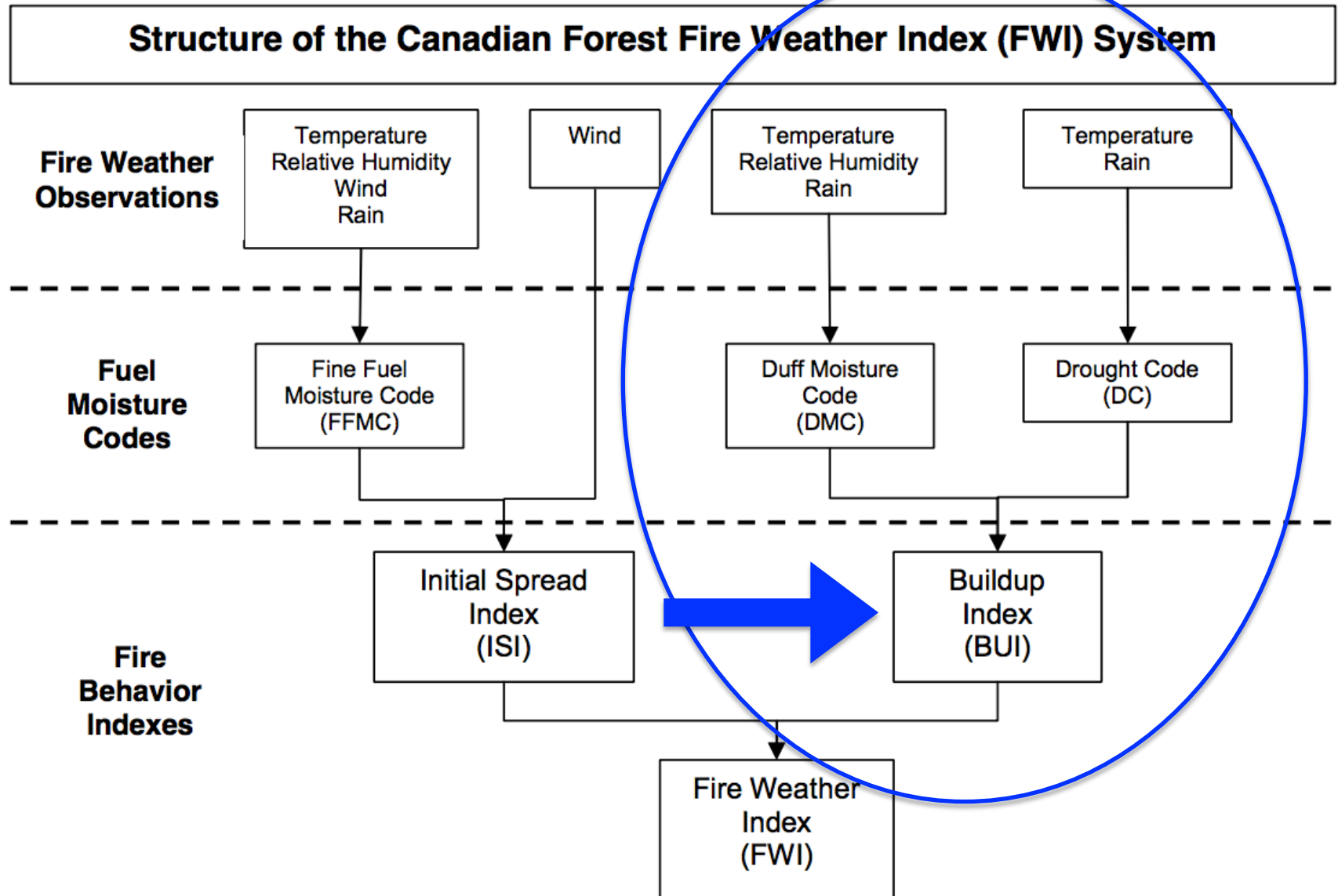# Dynamical Downscaling serves as 'Observations'

- WRF has more detailed terrain
- Reanalysis has broader high elevation areas
- Better resolves mesoscale features
- Downscaled temperature and precipitation more realistic

[Bieniek et al. 2016]

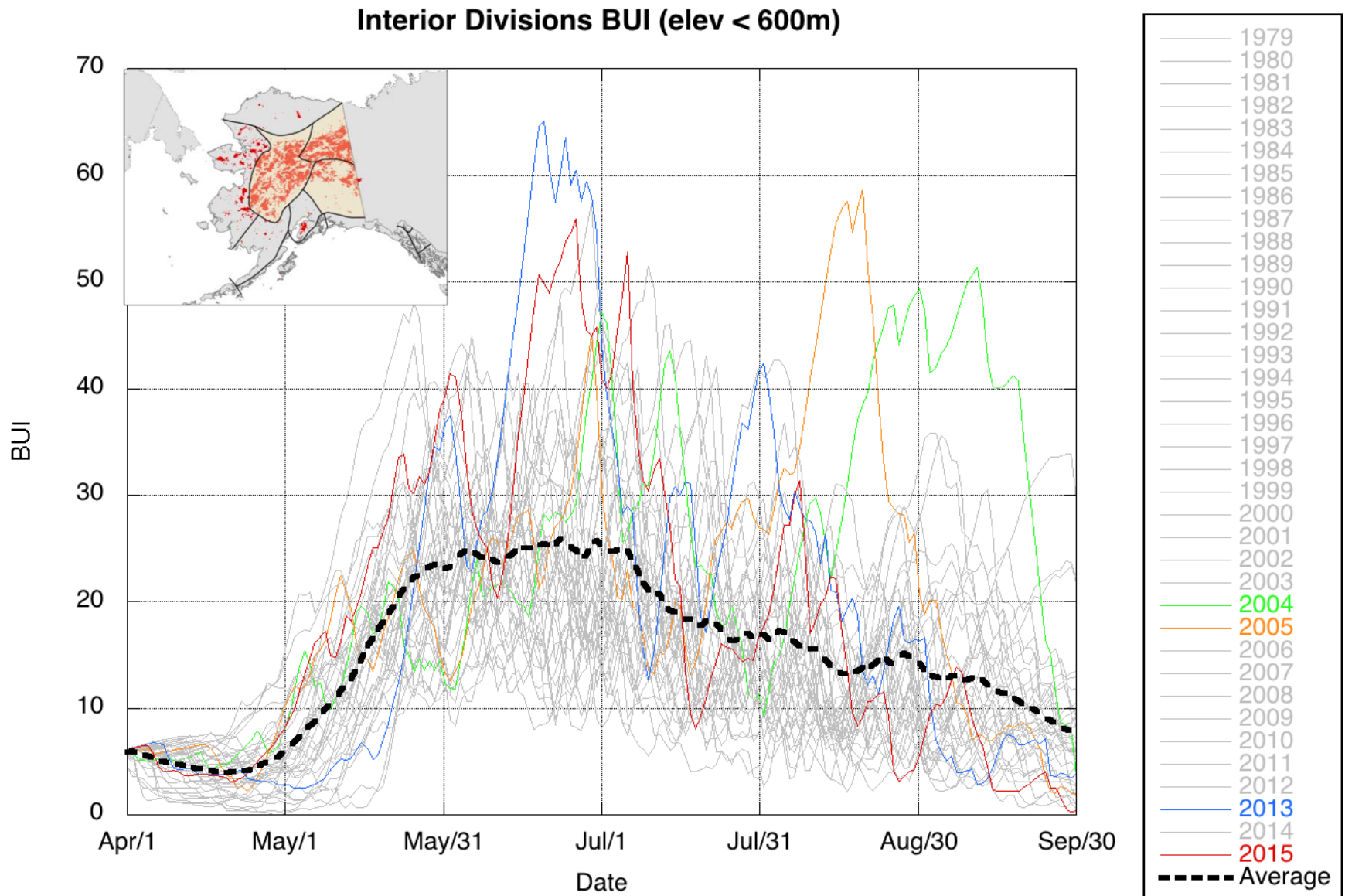# Canadian Forest Fire Weather Index System
Fire fighter field-use table

Summer-Spruce Calibration

- Buildup Index & Fine Fuel Moisture Code are first factors
- Air Temp
- Fire Weather Index

SPRUCE (Summer)	BUI < 40.0	BUI 40.0 to 59.9	BUI 60.0 to 89.9	BUI 90.0 to 109.9	BUI 110.0+
FFMC Less than 80.0	LOW	LOW	LOW	LOW	LOW
FFMC 80.0 to 81.9	LOW	LOW	LOW	LOW	MODERATE
FFMC 82.0 to 83.9	LOW	LOW	LOW	MODERATE	MODERATE
FFMC 84.0 to 85.9	MODERATE	MODERATE	MODERATE	MODERATE	HIGH
FFMC 86.0 to 88.9	MODERATE	MODERATE	HIGH	HIGH	HIGH
FFMC 89.0 to 89.9	HIGH	HIGH	HIGH	VERY HIGH	VERY HIGH
FFMC 90.0 to 91.9	HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH
FFMC 92.0 to 92.9	HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH
FFMC 93.0+ and Temp < 75.0	HIGH	HIGH	VERY HIGH	VERY HIGH if FWI is less than 36.0	VERY HIGH if FWI is less than 28.0
FFMC 93.0+ and Temp 75.0 to 79.9	HIGH	VERY HIGH if FWI is less than 40.0	VERY HIGH if FWI is less than 36.0	VERY HIGH if FWI is less than 36.0	VERY HIGH if FWI is less than 28.0
FFMC 93.0+ And Temp 80.0+	VERY HIGH if FWI <40 / EXTREME if FWI is at least 40.0	EXTREME if FWI is at least 40.0	EXTREME if FWI is at least 36.0	EXTREME if FWI is at least 36.0	EXTREME if FWI is at least 28.0

- Data needed: early afternoon values of
  - 2-m air temperature
  - relative humidity
  - 10-m winds
  - daily total precipitation.
- **Expand currently available 48 hour lead CFFWIS to longer leads.**

Panel displays categories of fire danger for spruce (http://mesowest.org/akff/captures/InteriorSpruce.png) based on the indices.

Canadian Forest Fire Weather Index System

Structure of the Canadian Forest Fire Weather Index (FWI) System

[De Groot 2004]

Buildup Index Climatology from 'Obs' & CFSv2 forecast
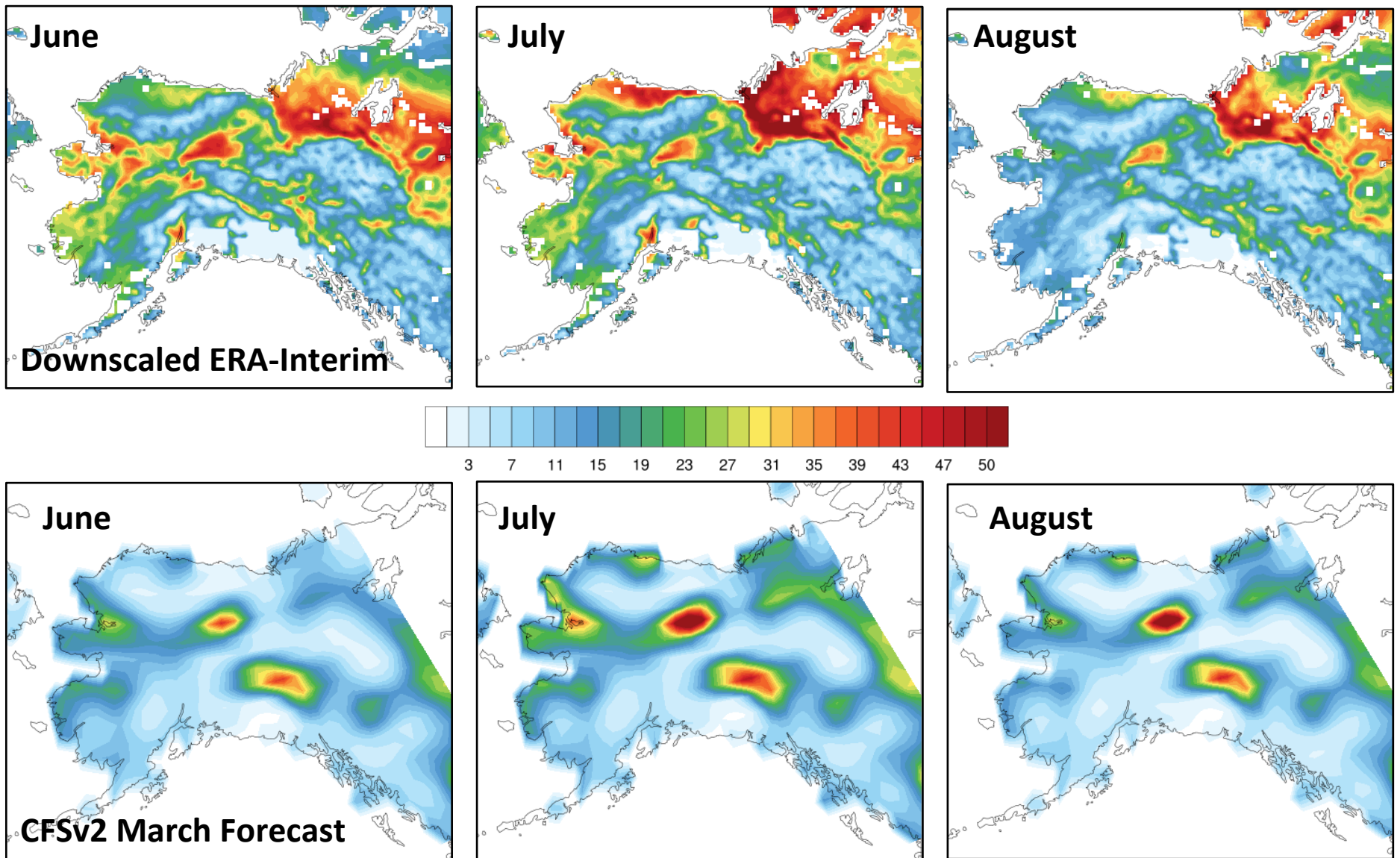
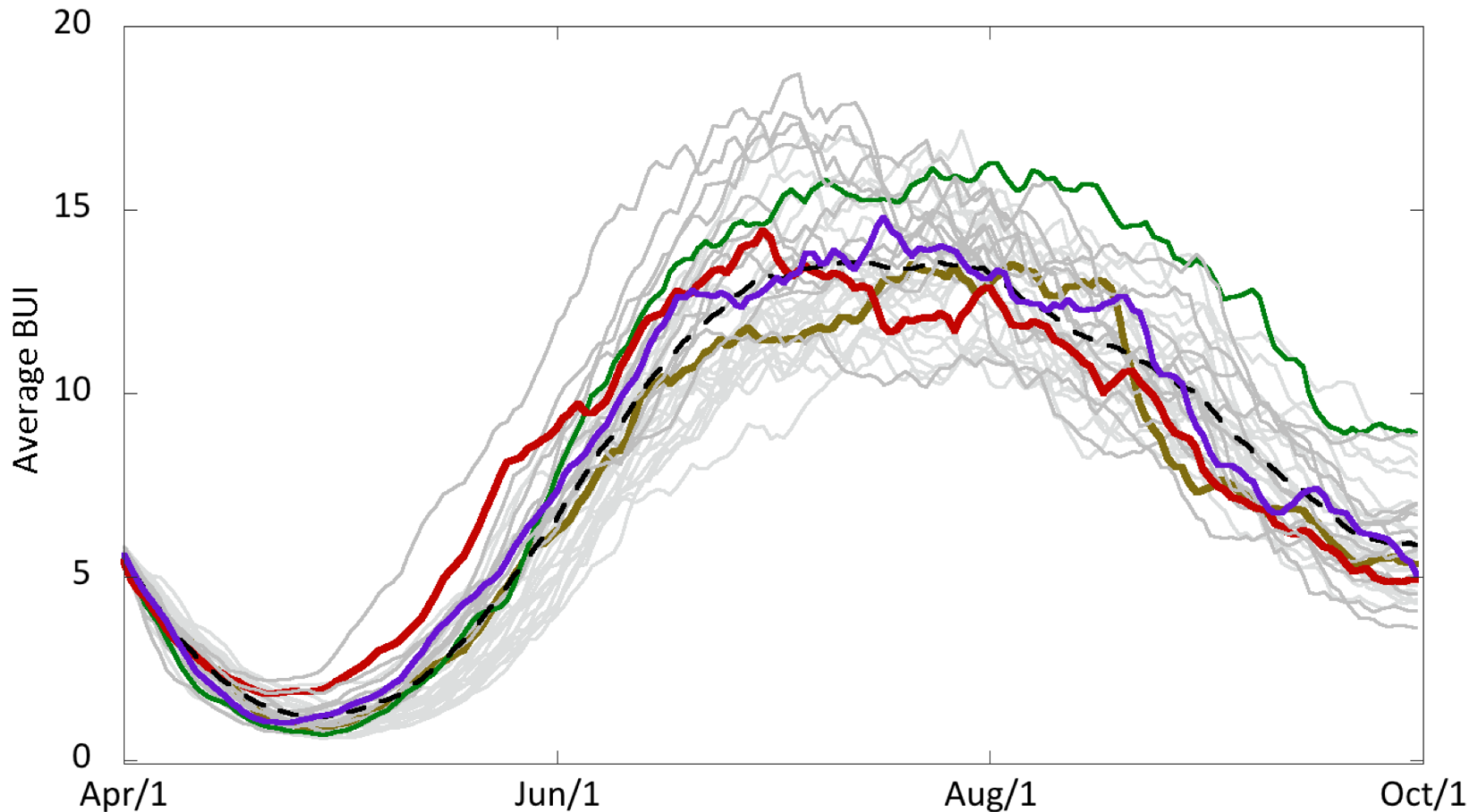**Summer Buildup Index is underestimated**

'Observed' Interior AK average BUI

Interior Divisions BUI (elev < 600m)

Station-based BUI: Large magnitudes

Fairbanks 2015 BUI
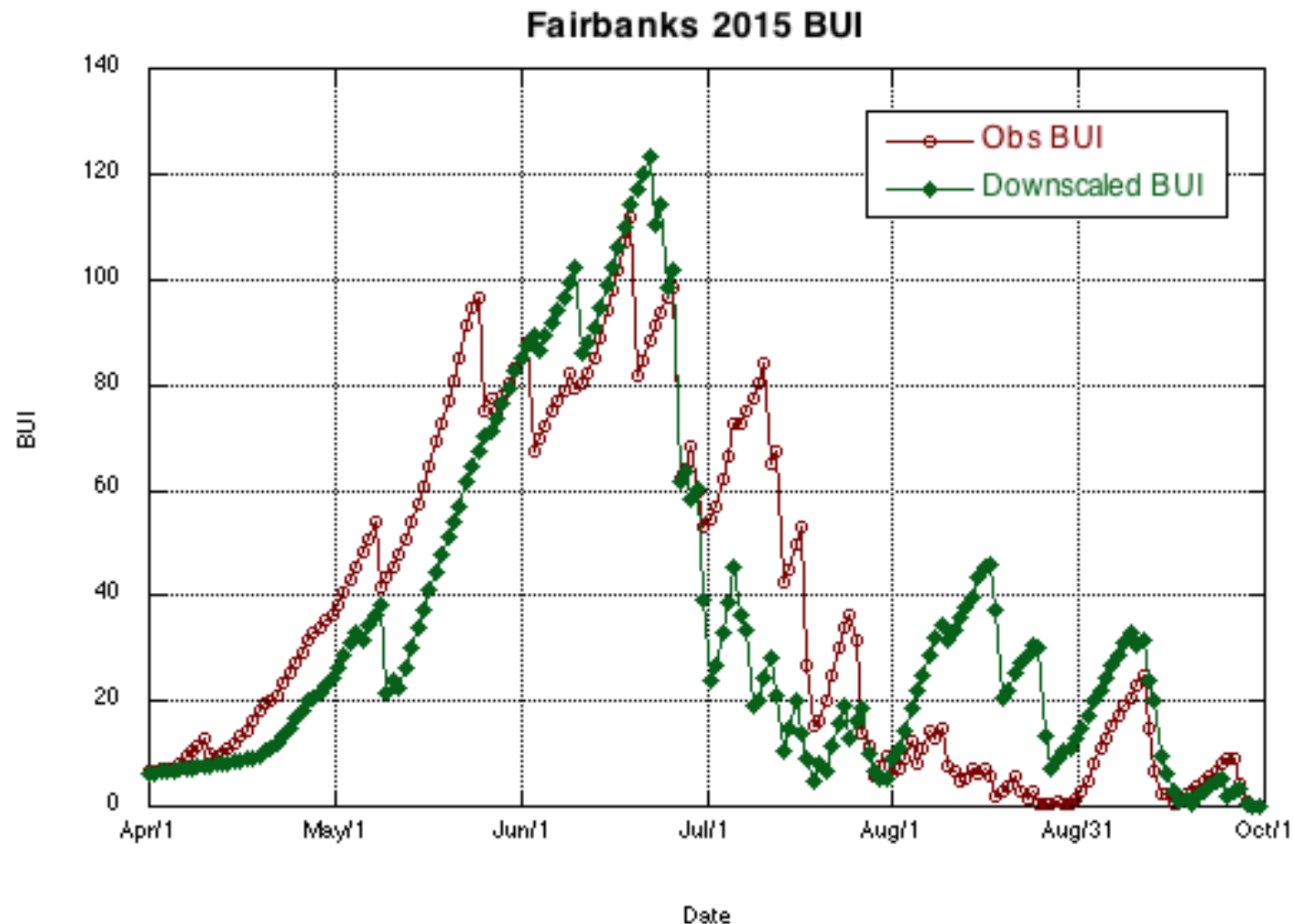
'Obs' larger & seasonal shift compared to CFSv2 BUI

Legend: Climo 82-16 (dashed black line); ERA climo 79-15 (solid blue line). Y-axis: Average BUI (0 to 30). X-axis: Apr/1 to Oct/1.
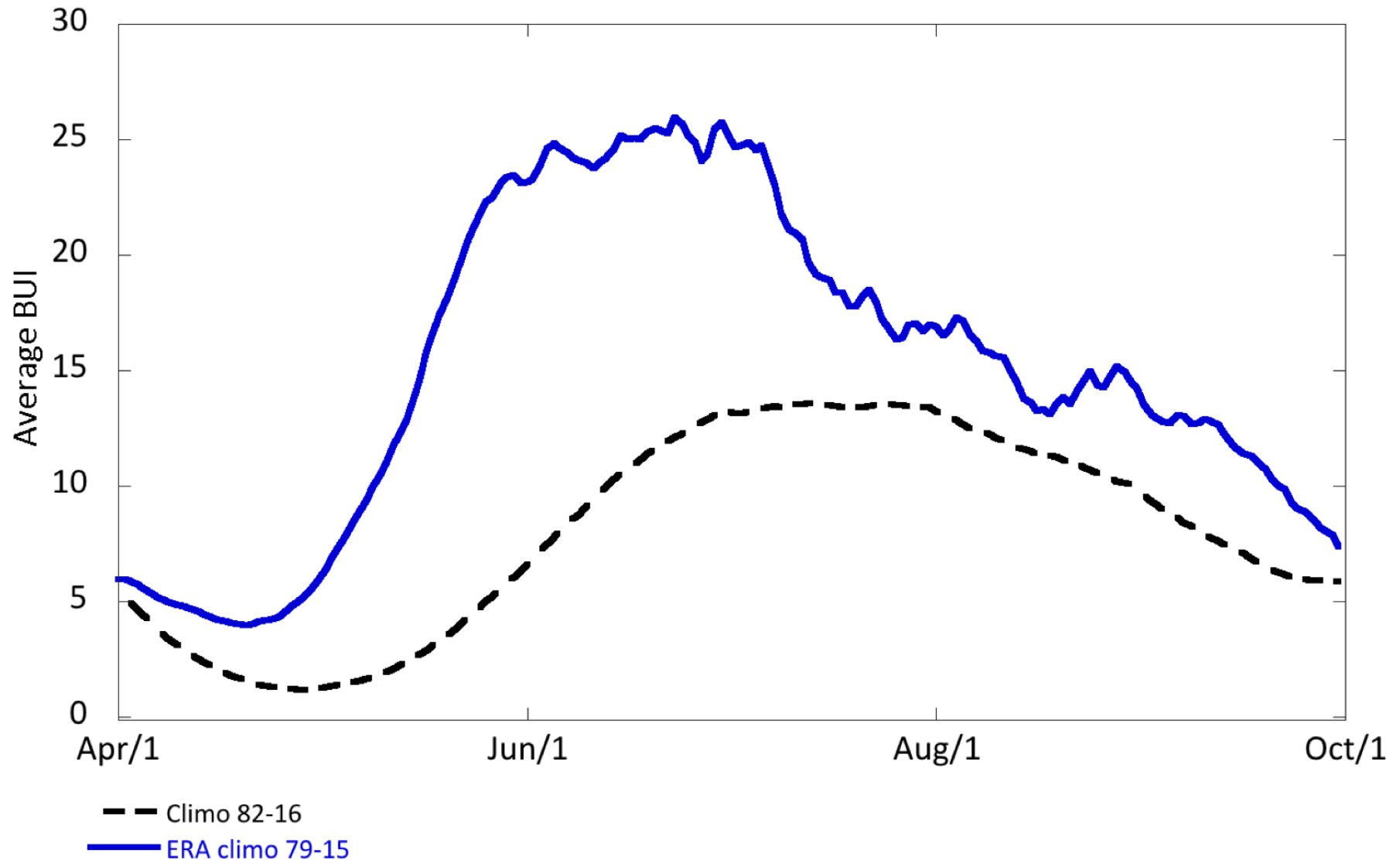
CFSv2 BUI for Interior Alaska for record

A. Sampath

Climatological 2-m Temperature
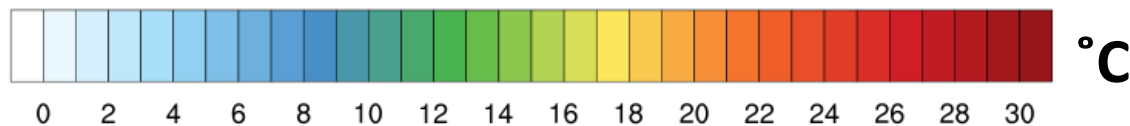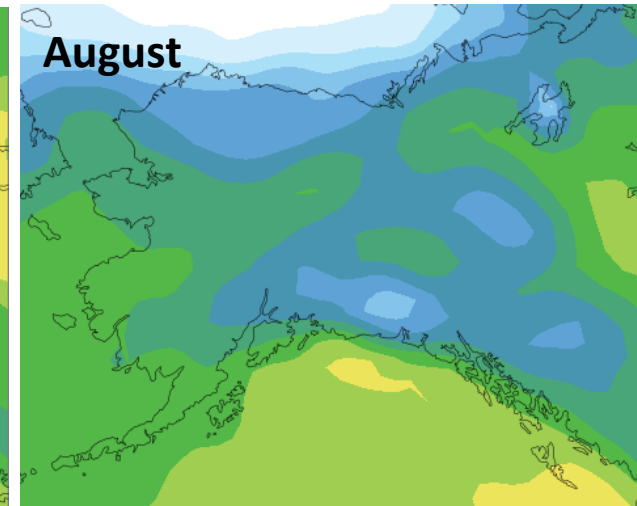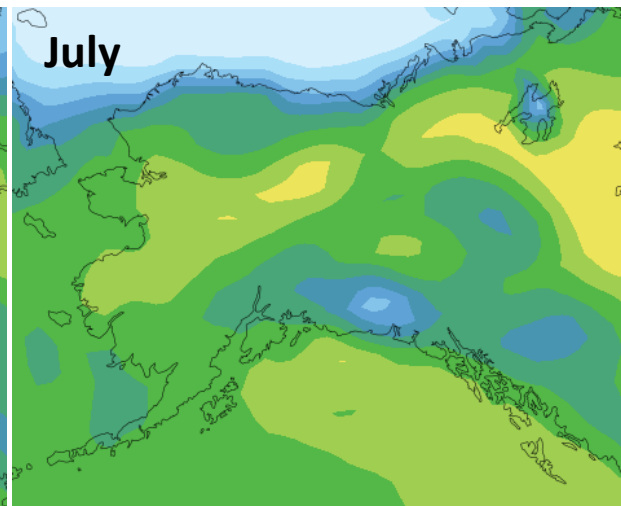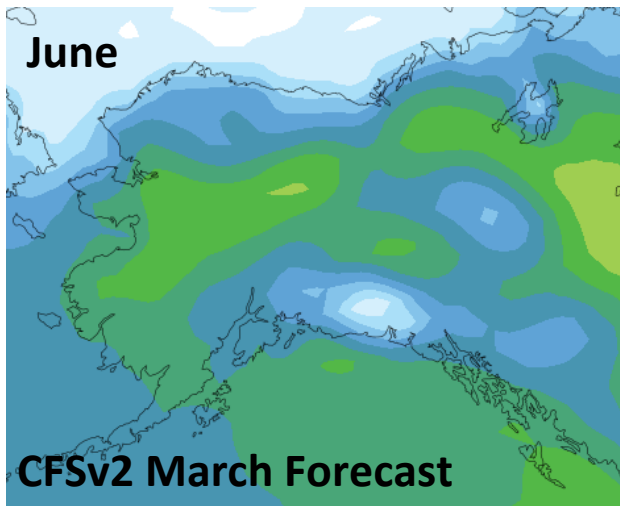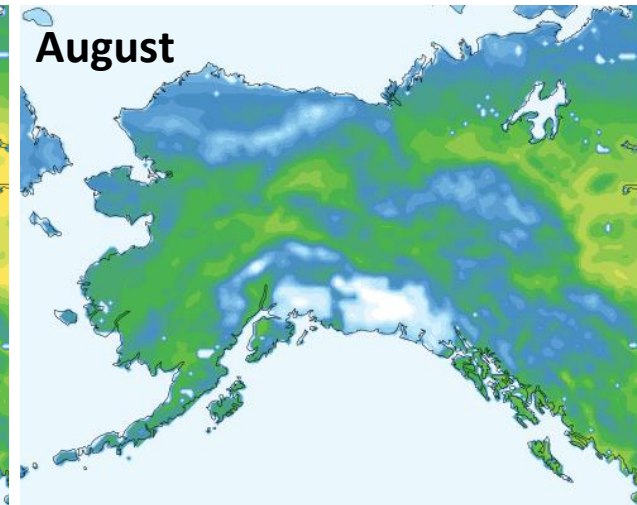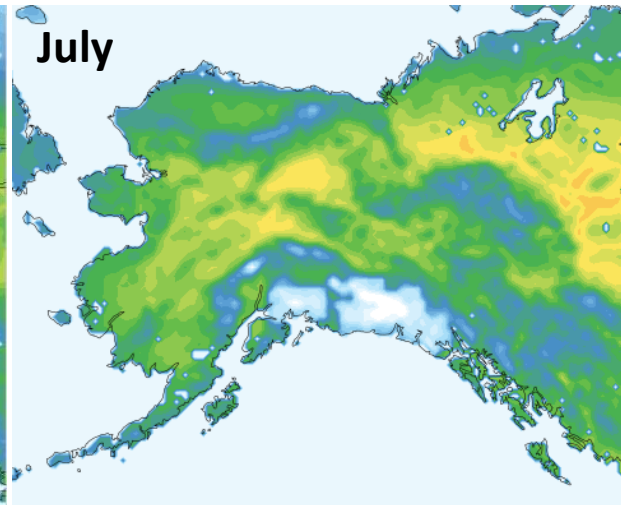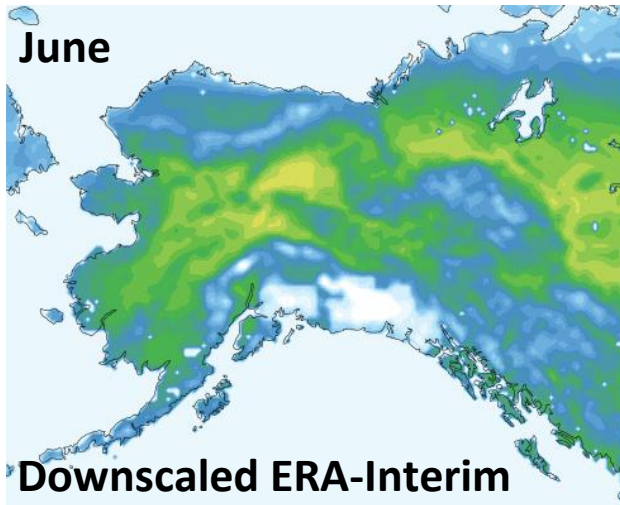
Climatological Precipitation

June   July   August

Downscaled ERA-Interim

June   July   August

CFSv2 March Forecast

mm/month

0   20   40   60   80   100   120   140   160   180   200
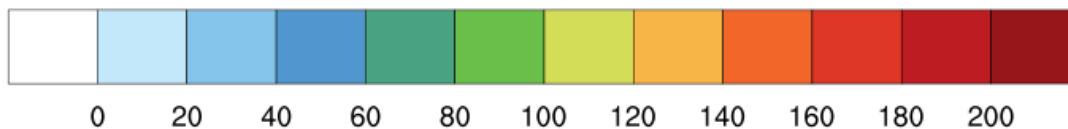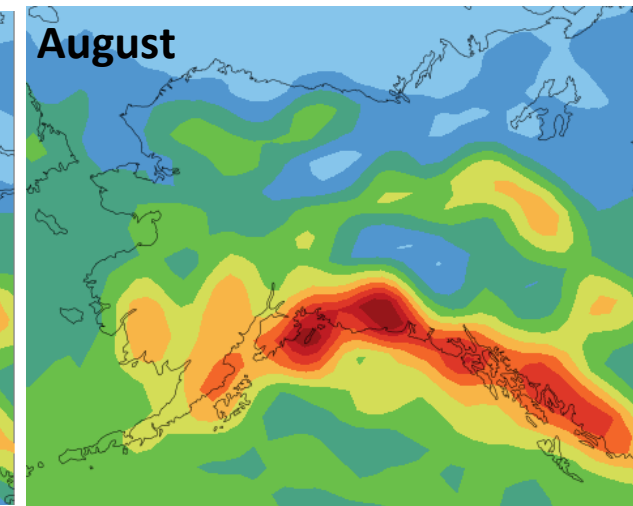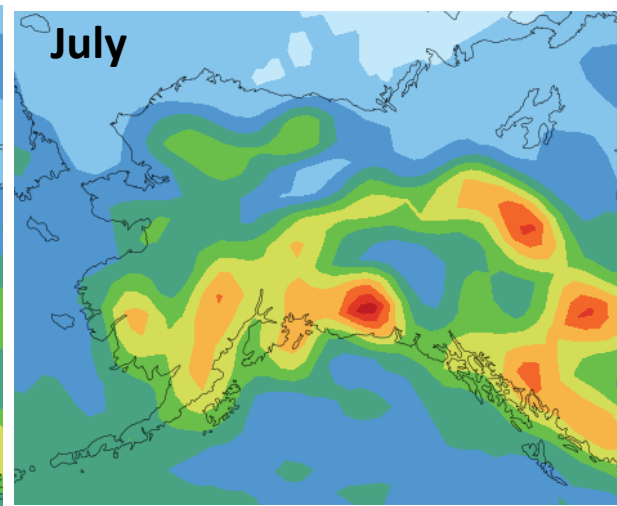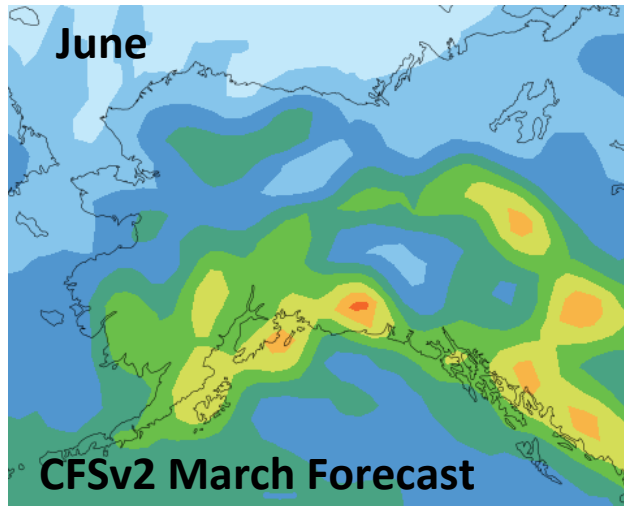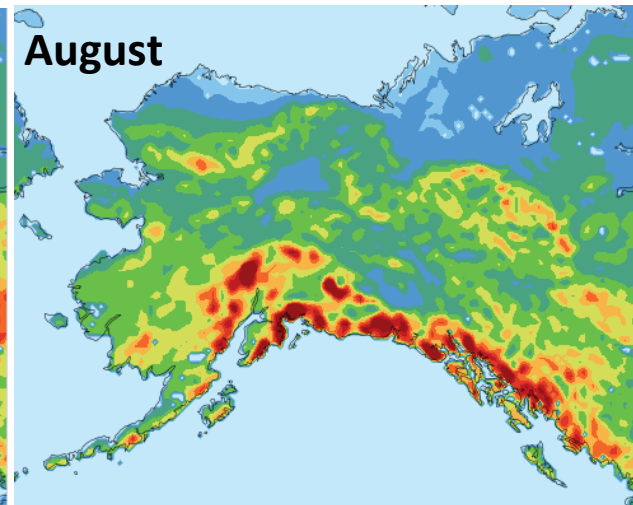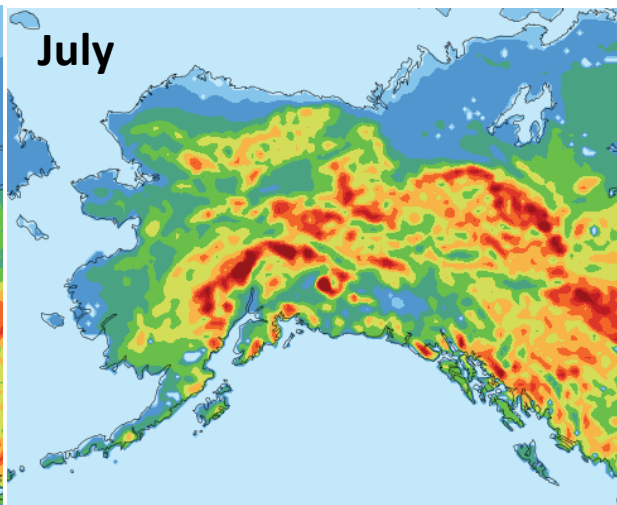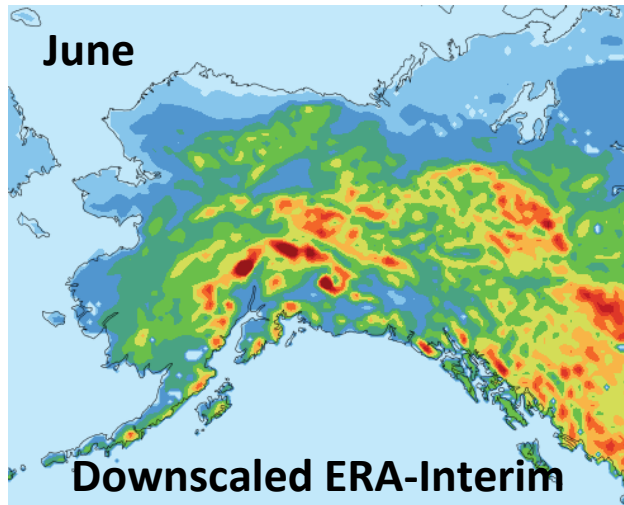
Climatological First Snow-Free Day
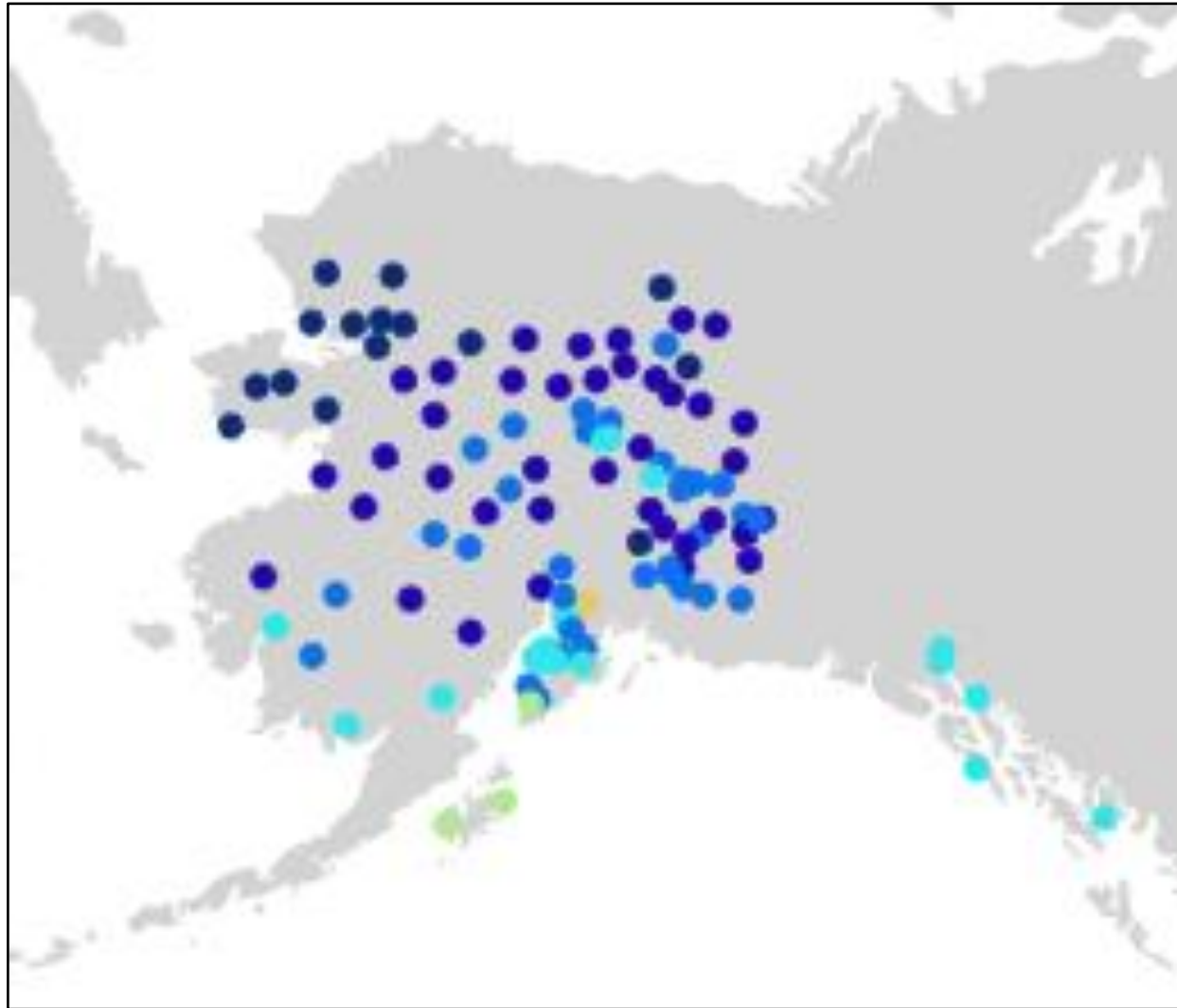
M. BuKader & R. Ziel

Use station data for correcting 'Obs' and then correcting forecasts.

2017 Fire Season in Alaska, small acreage burned
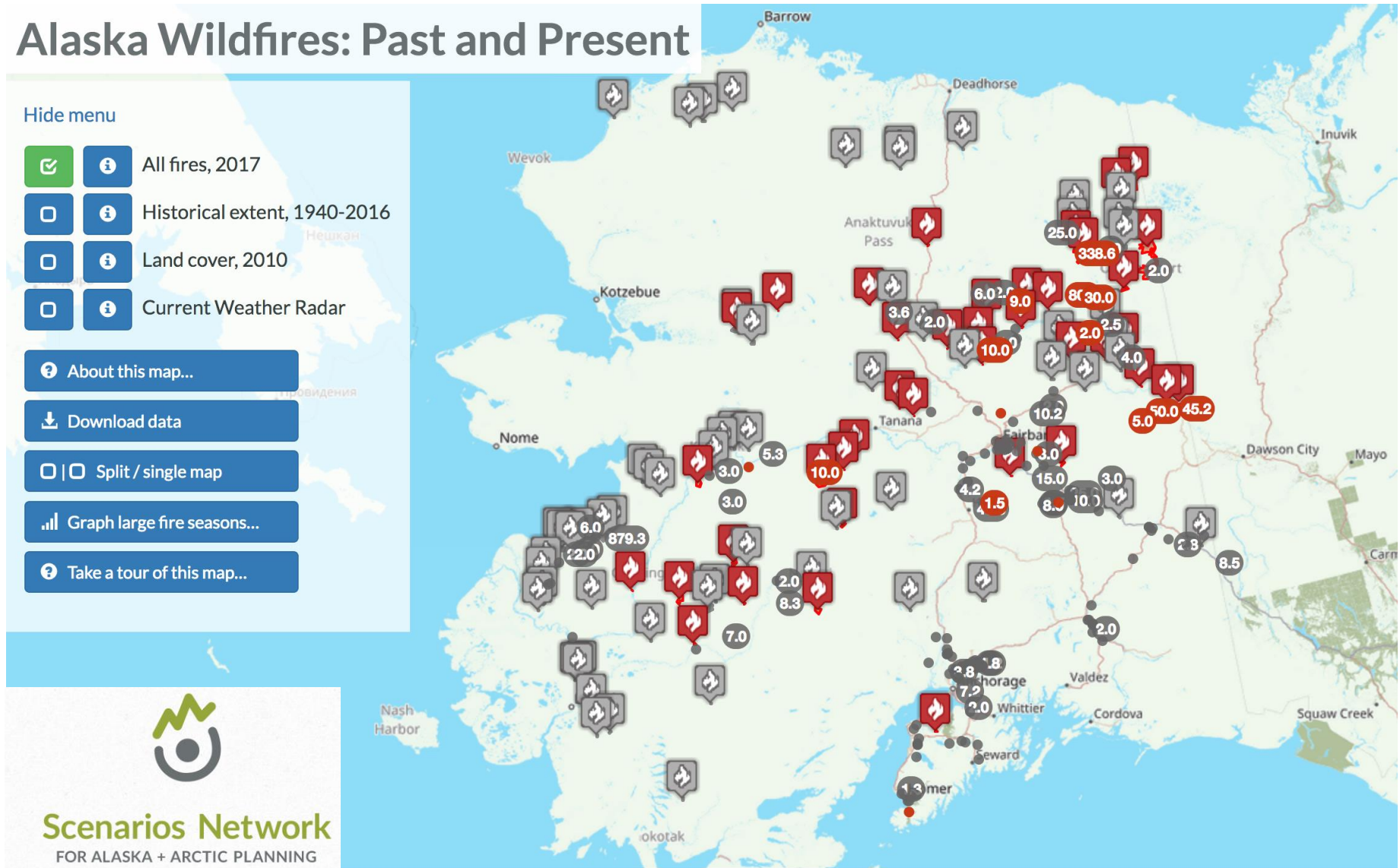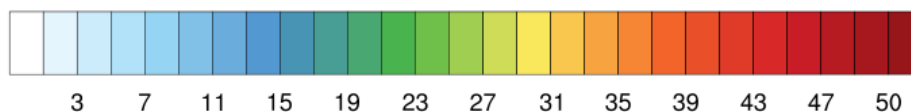
2017 March Forecast Average Interior BUI
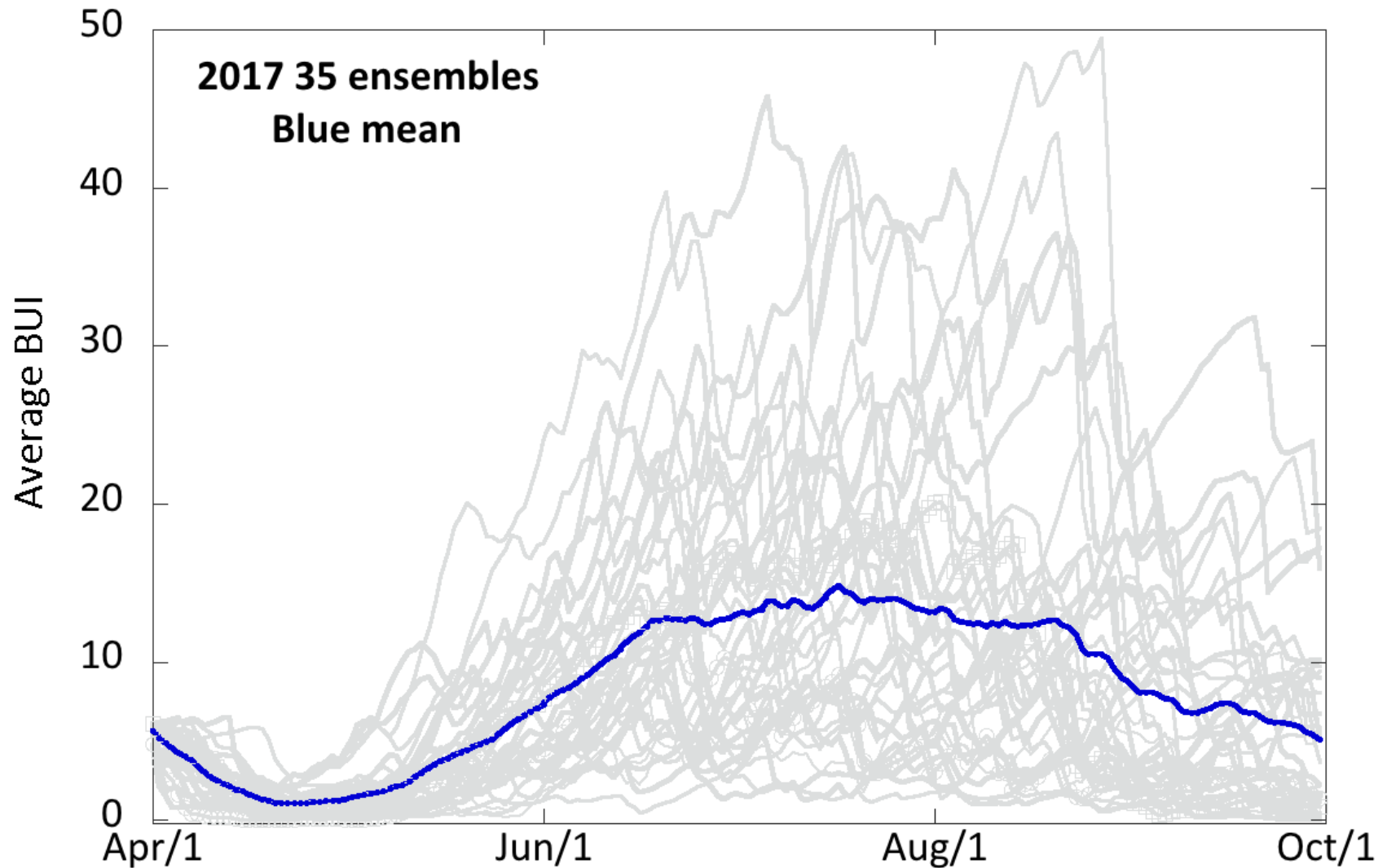
Buildup Index & Anomaly 2017
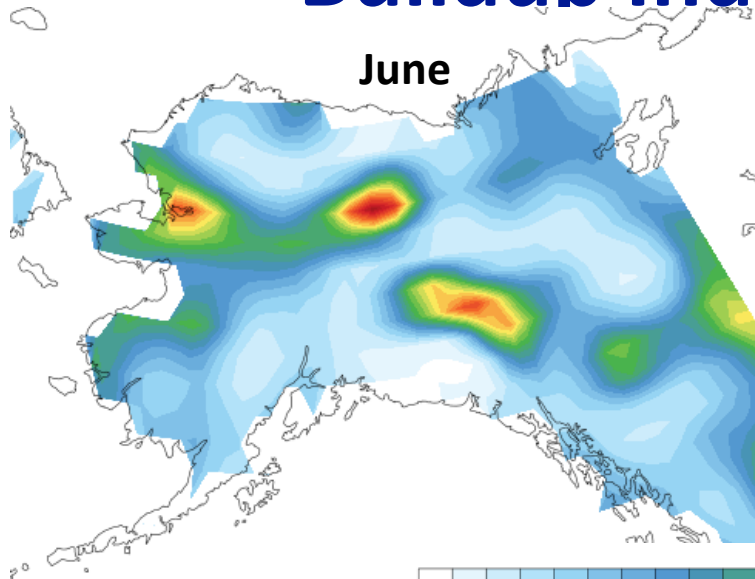
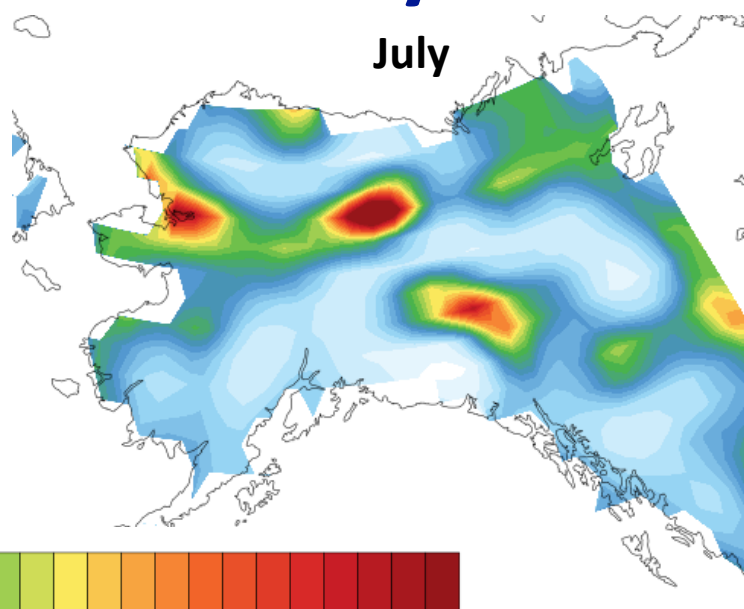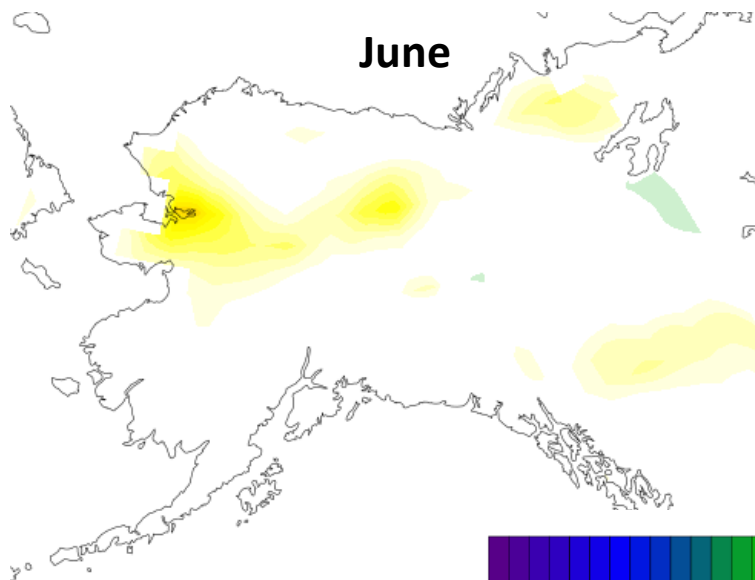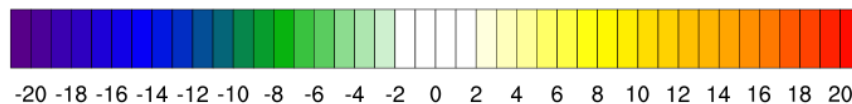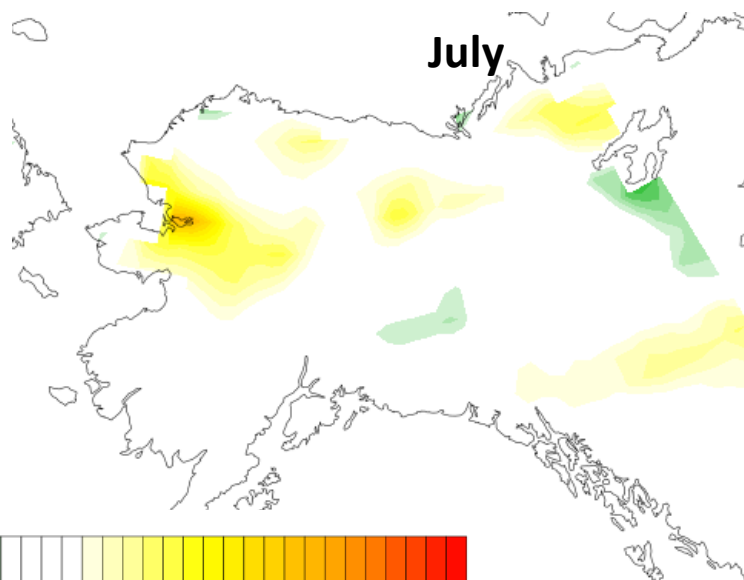# Lightning strike map from last half of July 2017
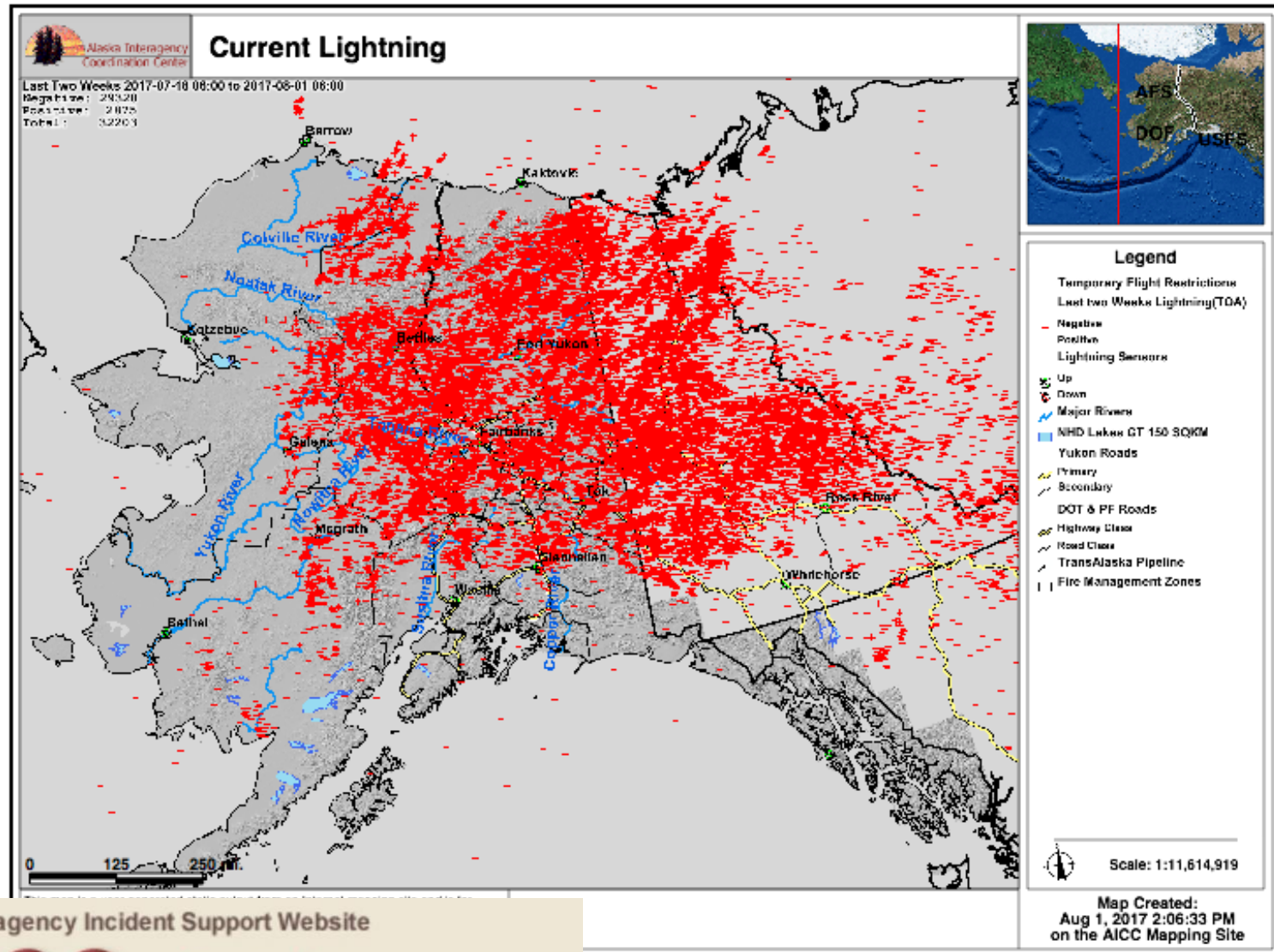
Lightning observations & 'Obs' convective precip

Lightning Sensors
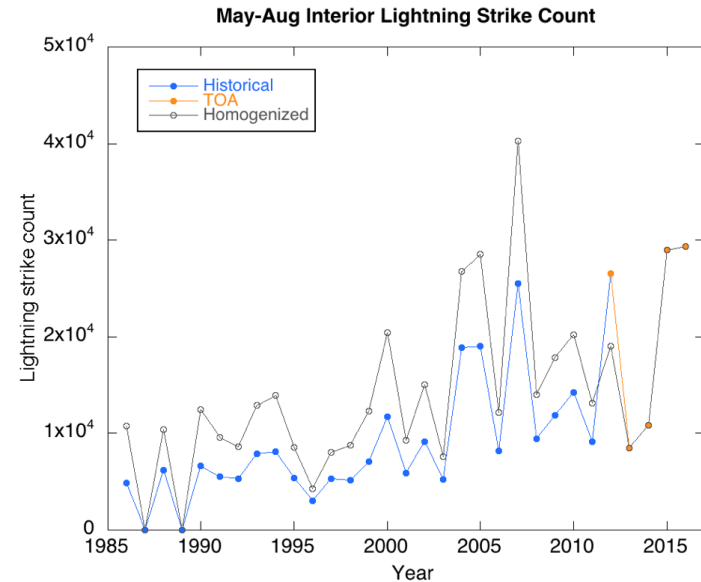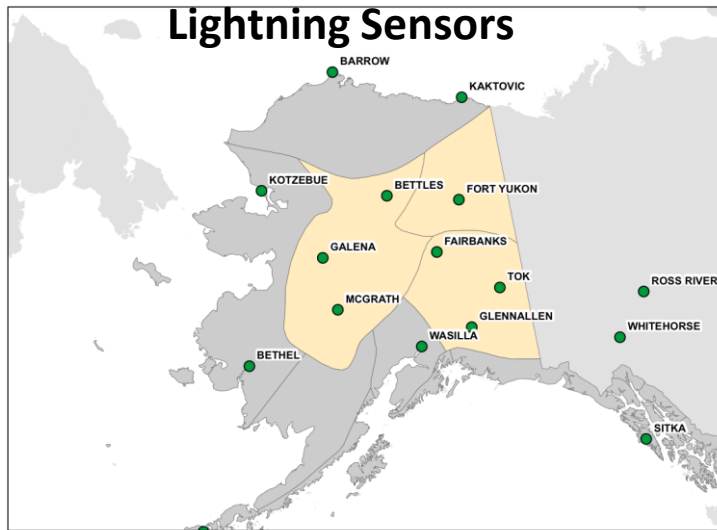
Can we use seasonal forecasts to anticipate the probability of lightning?
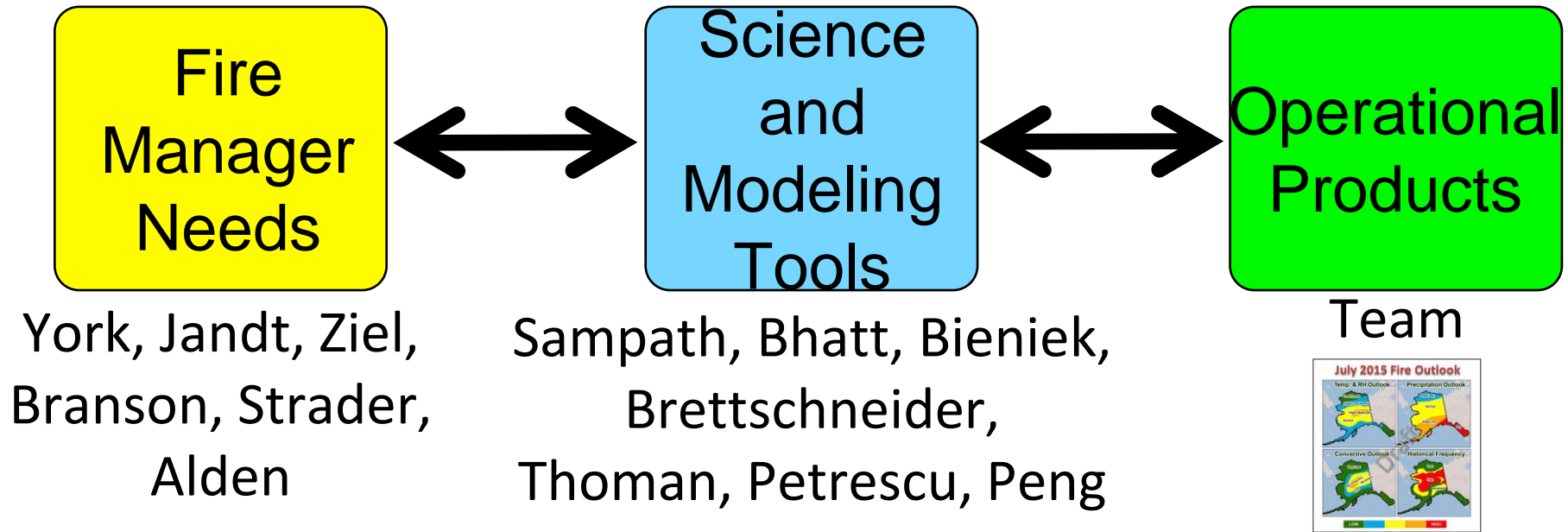**- through convective precipitation & SOMs**

Peter Bieniek

May-Aug Interior Lightning Strike Count

May-Aug Interior Lightning & Conv Precip

Corr = 0.53
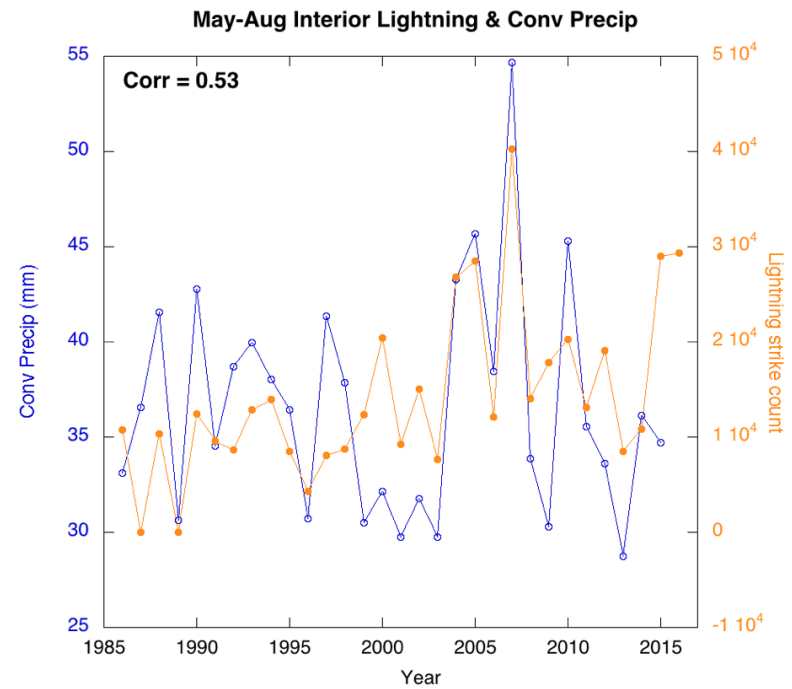
Take Home Message

- Bias correction needed for Indices to be useful to fire mangers (Quantile mapping).
- Multidisciplinary team needed to co-produce useful products.

Fire Manager Needs ⟷ Science and Modeling Tools ⟷ Operational Products

York, Jandt, Ziel, Branson, Strader, Alden

Sampath, Bhatt, Bieniek, Brettschneider, Thoman, Petrescu, Peng

Team

Thank you for your attention!

The boundary organization Alaska Fire Science Consortium is critical for this research!