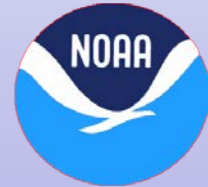


# Arctic Heat Waves: Towards Quantifying the Role of Atmospheric Dynamics

R. S. Stone, C.J. Cox, and D. Stanitski



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D. Longenecker

**A. McComiskey**  
**B. Vasel**  
**T. Uttal**

Cox et al., Drivers and environmental responses to the changing annual snow cycle of northern Alaska, *BAMS* 2017

# Pacific Arctic

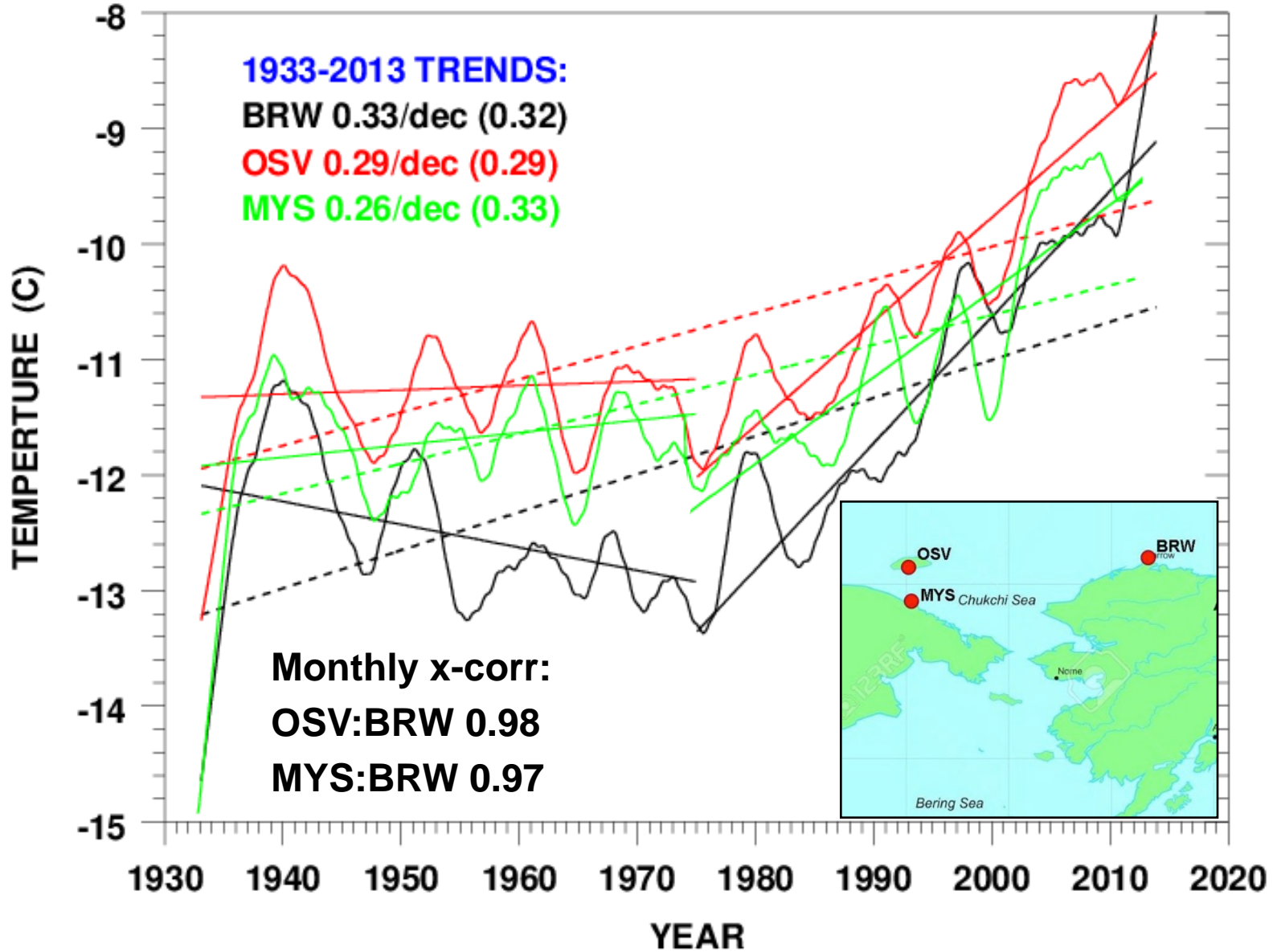
**BRW**



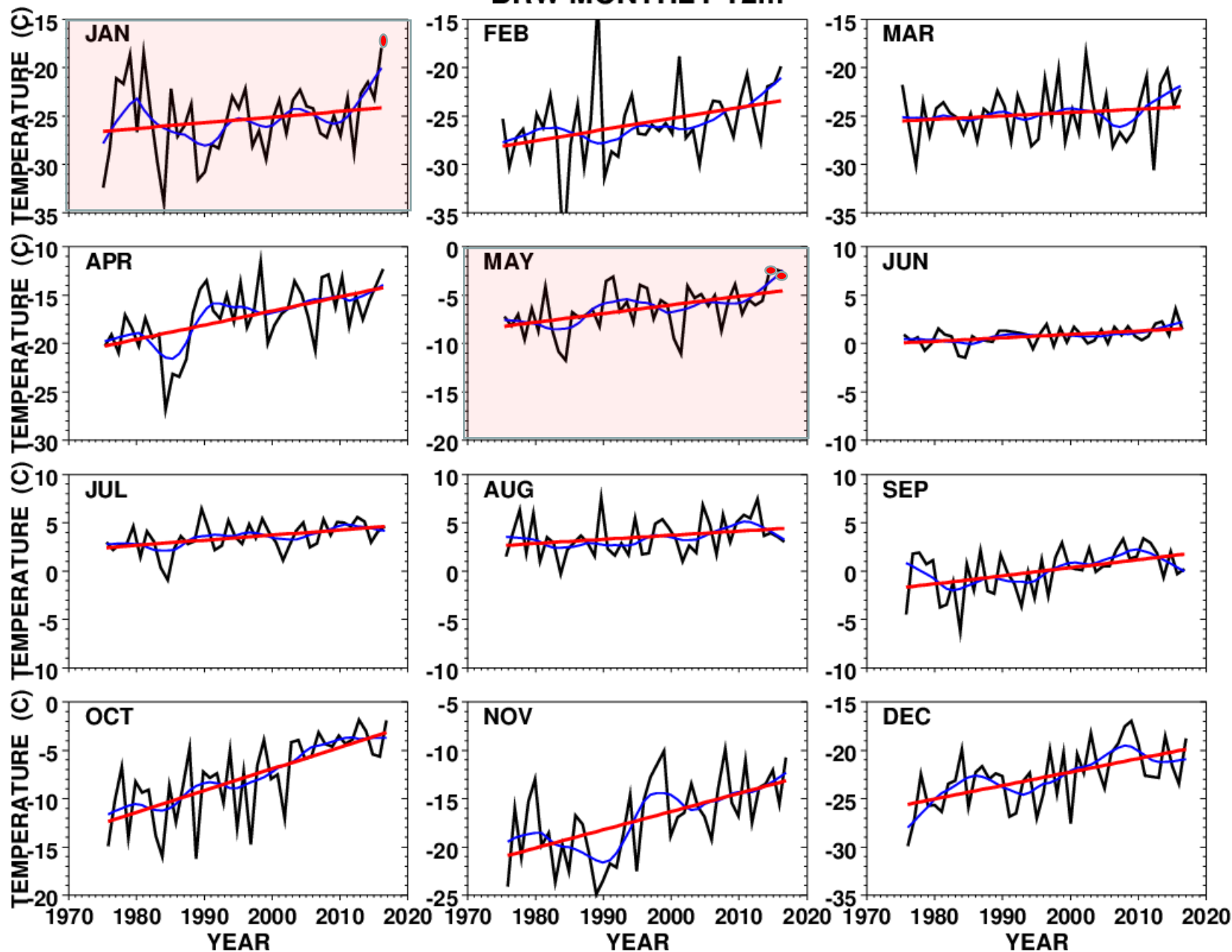
US Dept of State Geographer  
© 2016 Google  
Image Landsat / Copernicus  
Data SIG, NOAA, U.S. Navy, NGA, GEBCO

Google Earth

# SMOOTHED ANNUAL TEMPERATURES



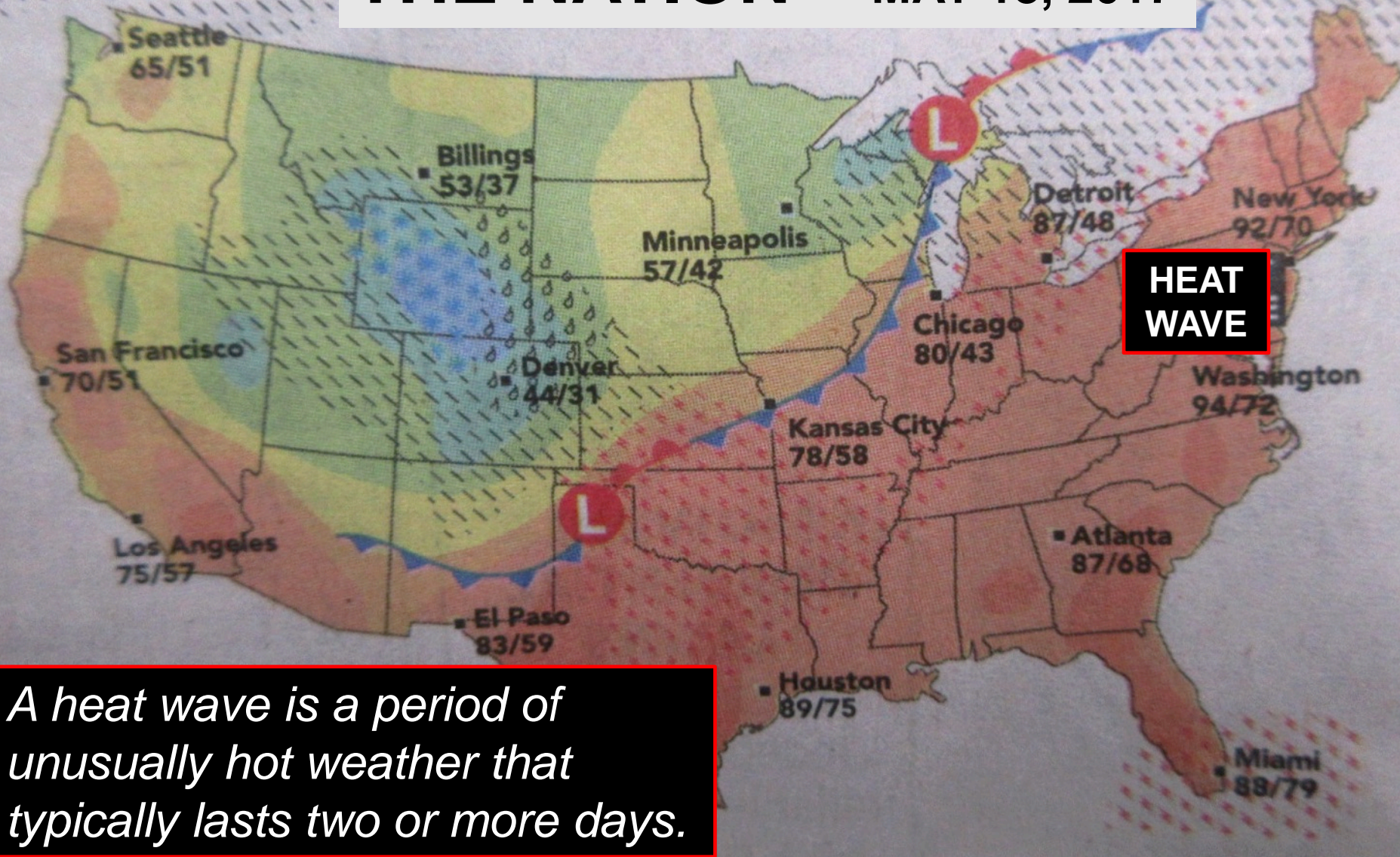
# BRW MONTHLY T2m





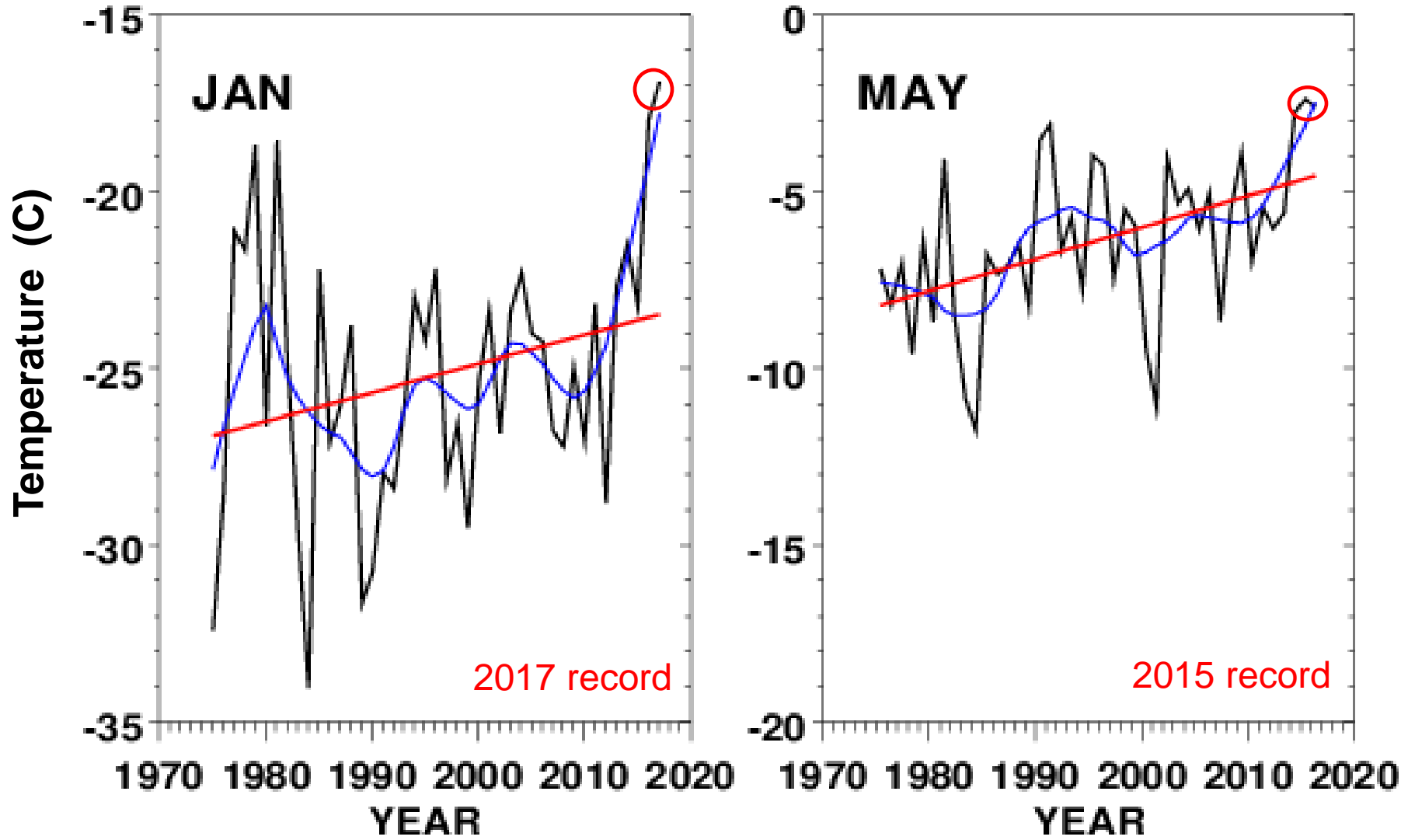
# THE NATION

MAY 18, 2017



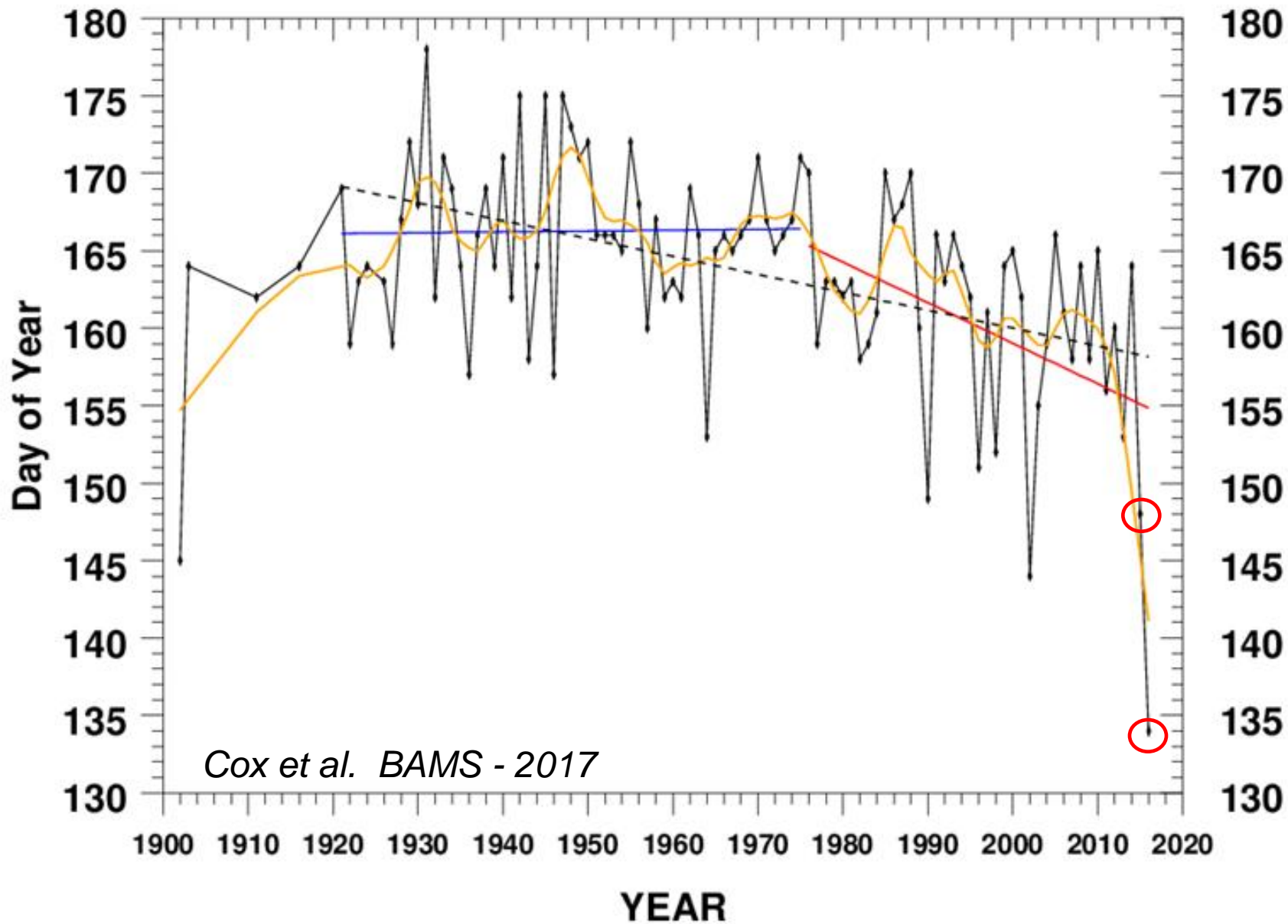
*A heat wave is a period of unusually hot weather that typically lasts two or more days.*

## BRW Heat Waves



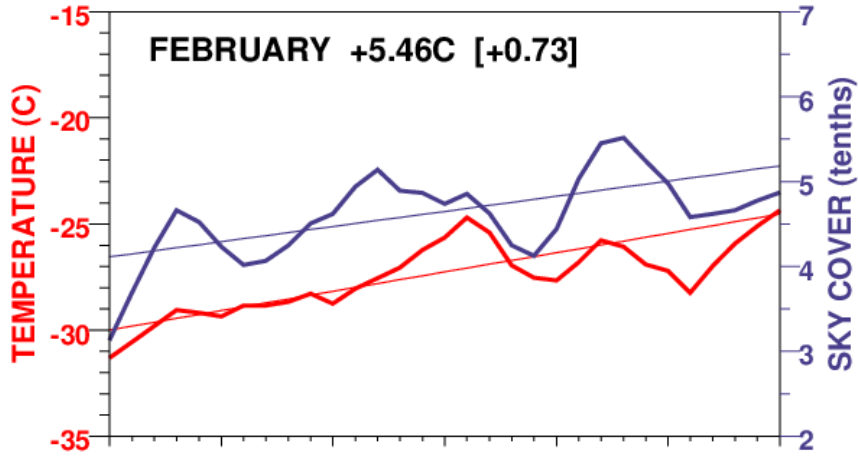
In this context, a heat wave is a period of anomalously warm temperatures lasting from weeks to months

# HISTORIC BARROW SNOWMELT RECORD

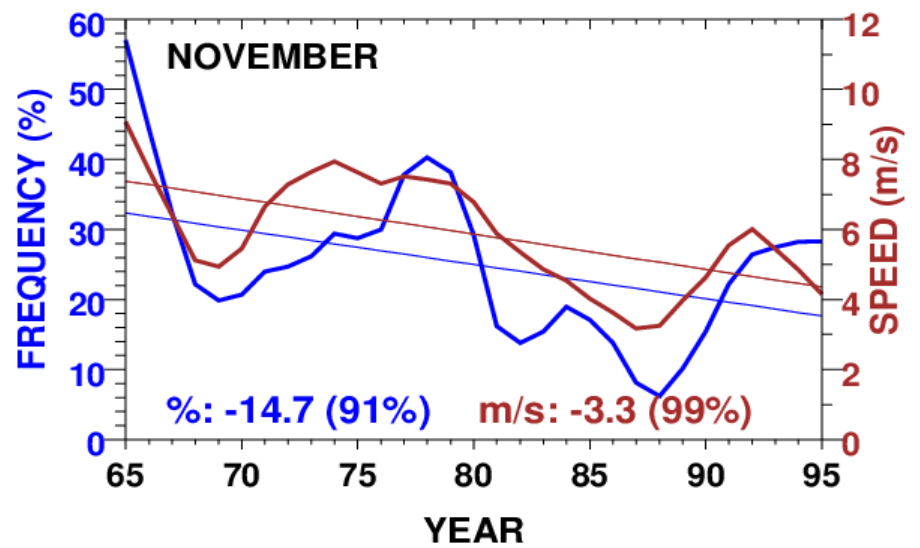
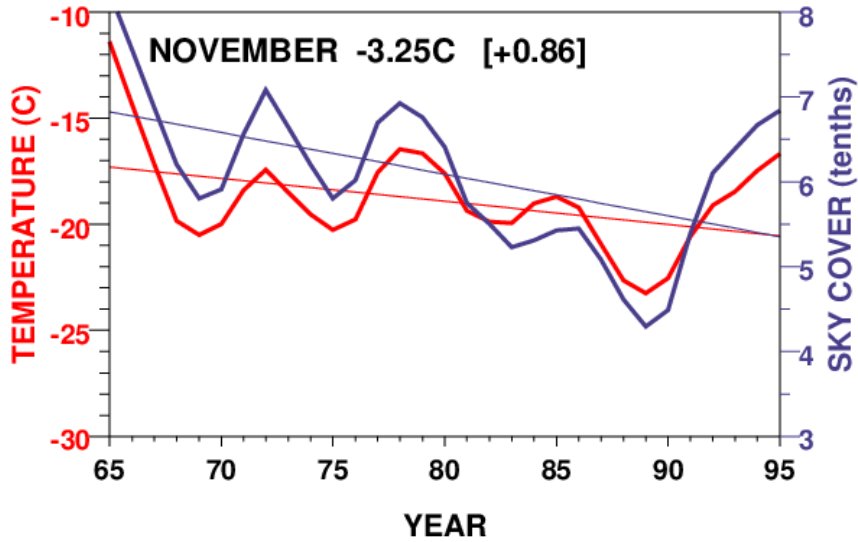
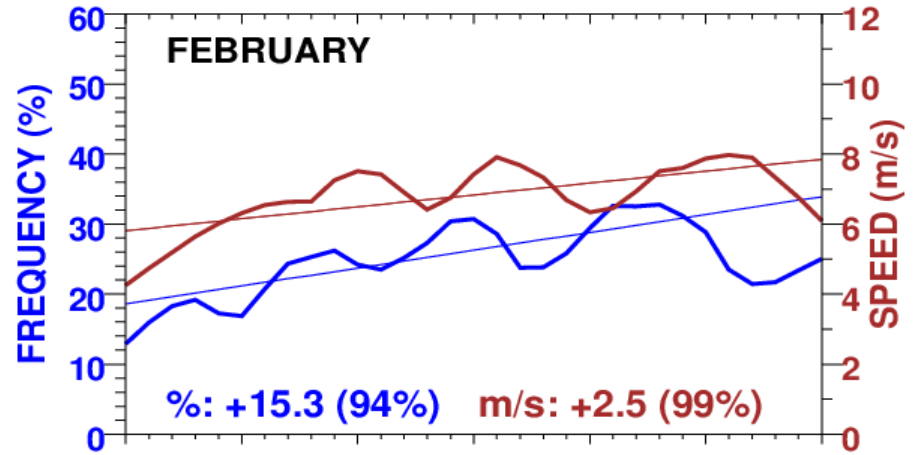




## BARROW, ALASKA - NWS



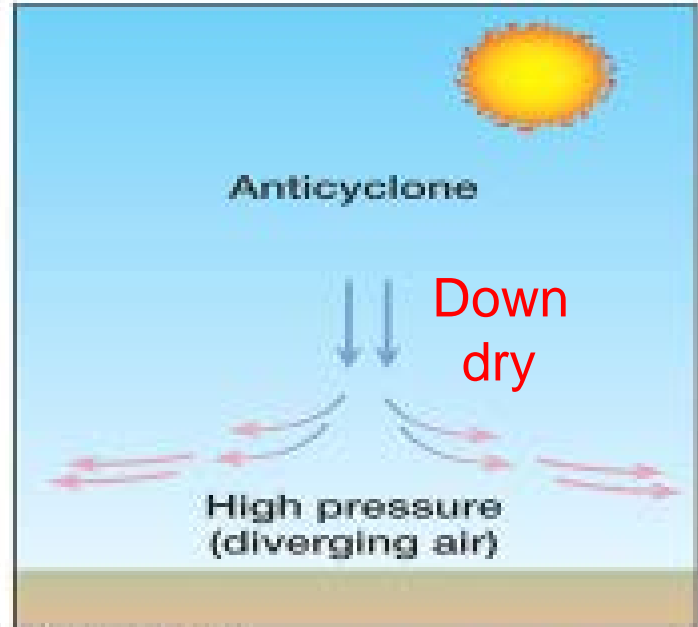
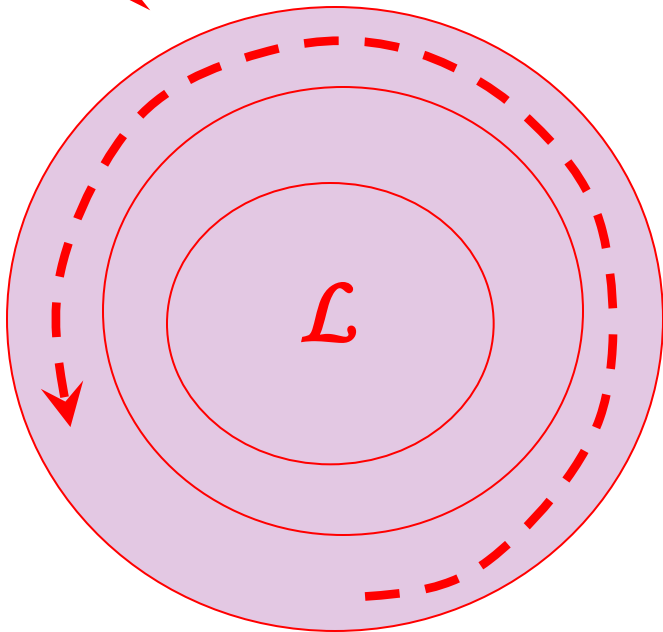
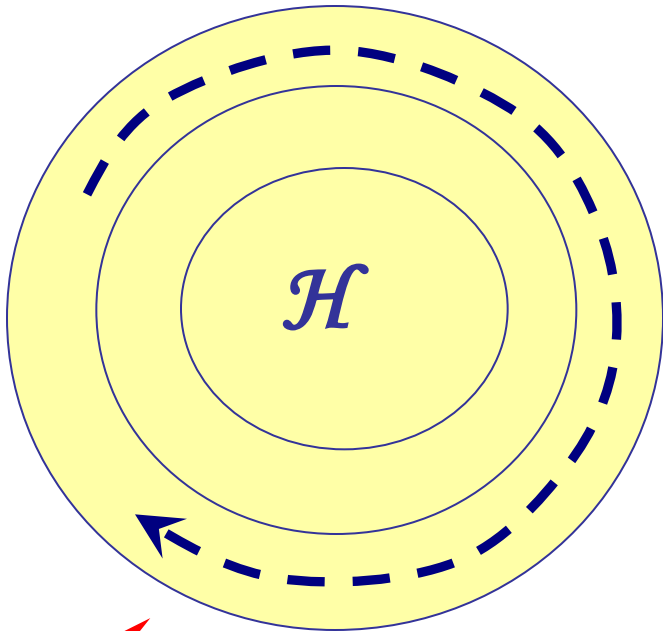
## BARROW, AK (850mb SW WINDS)



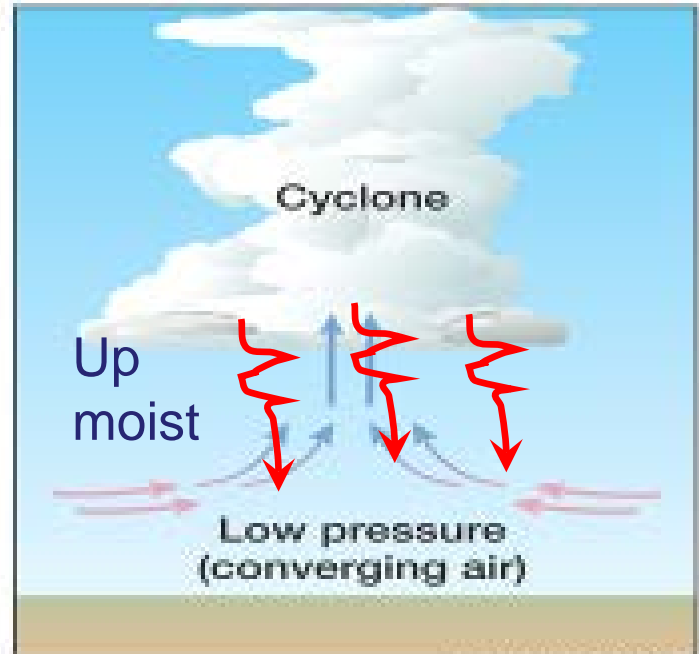
- Temperature varies with sky cover

- Changes in circulation implicated



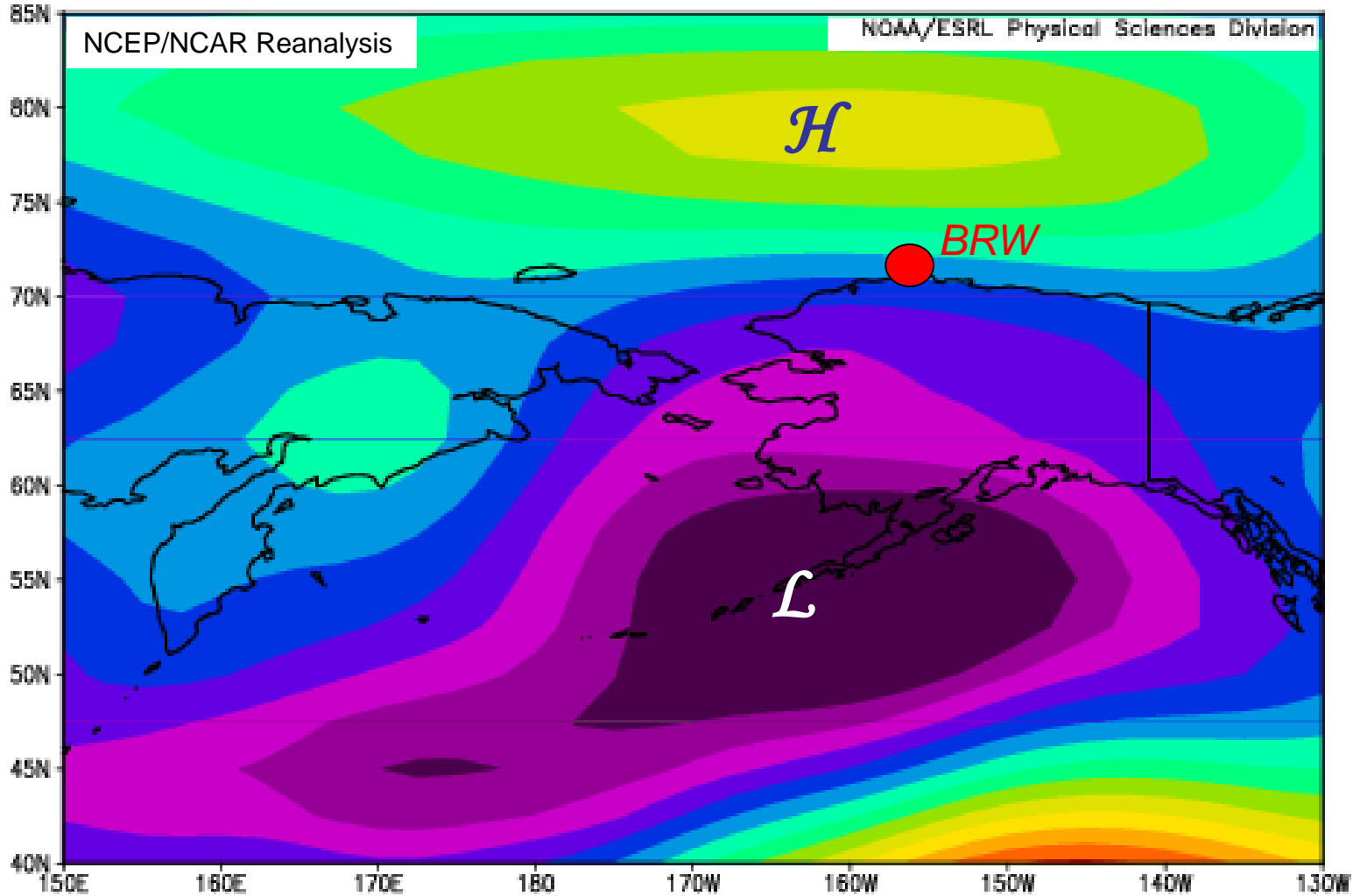


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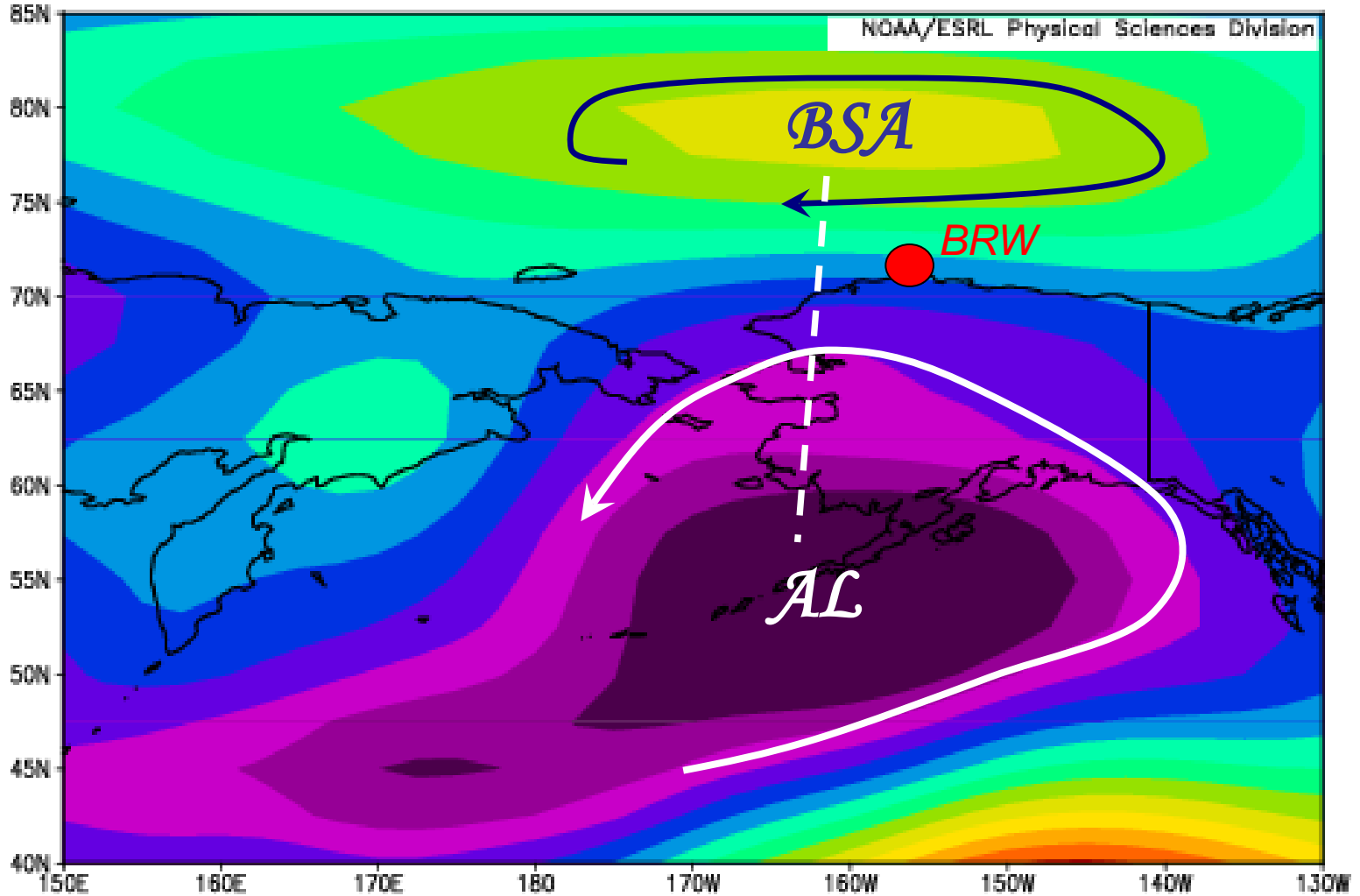
# 850 mb Geopotential Height (m)



May 2010



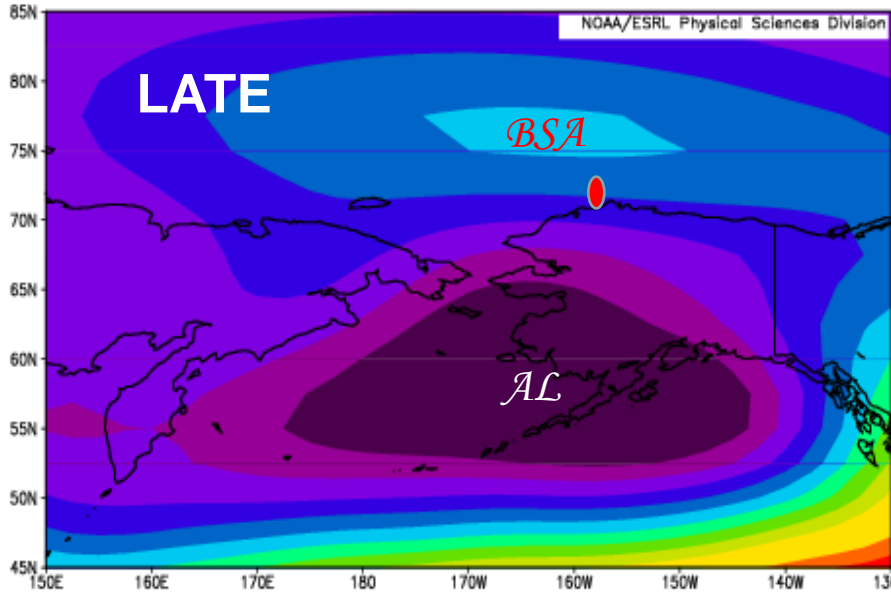
# 850 mb Geopotential Height (m)



May 2010

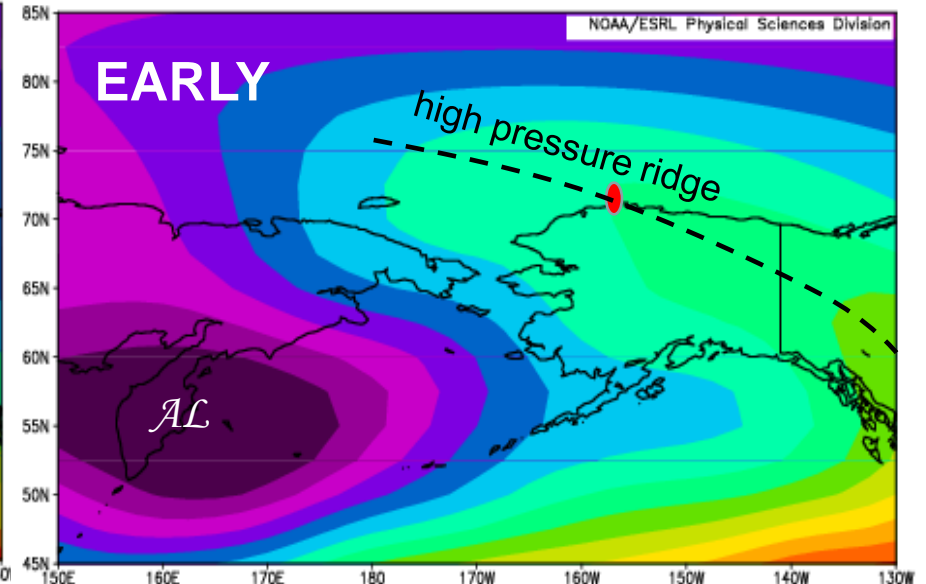


Mar/Apr/May 1985,1986,1987,1988 composite

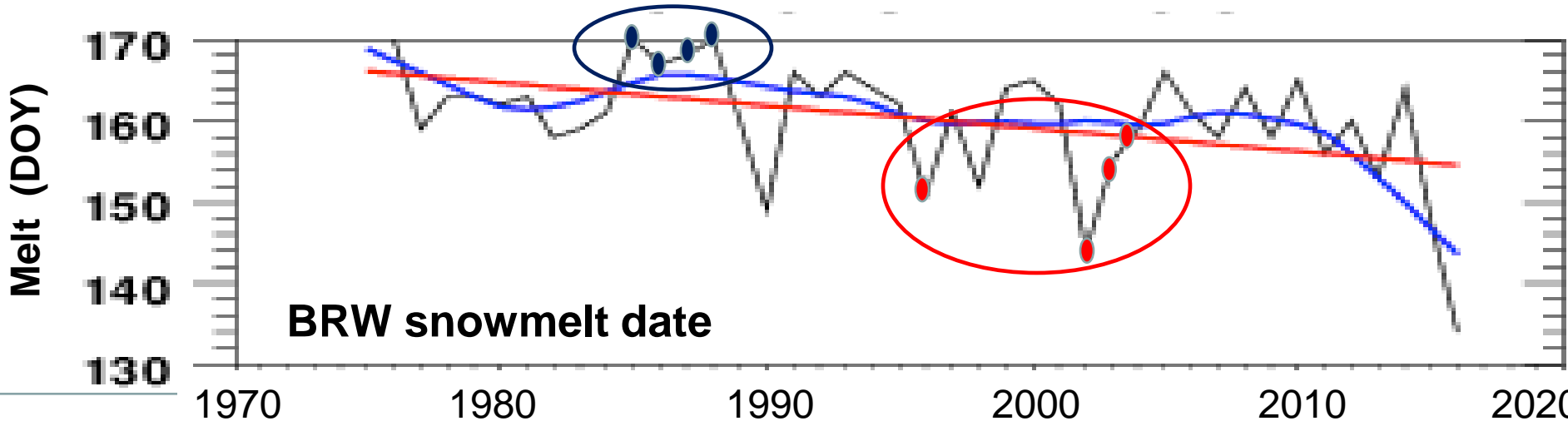
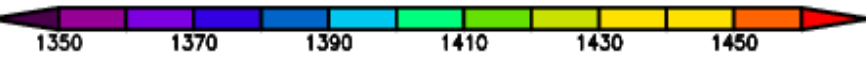


850 mb Geopotential height (m)

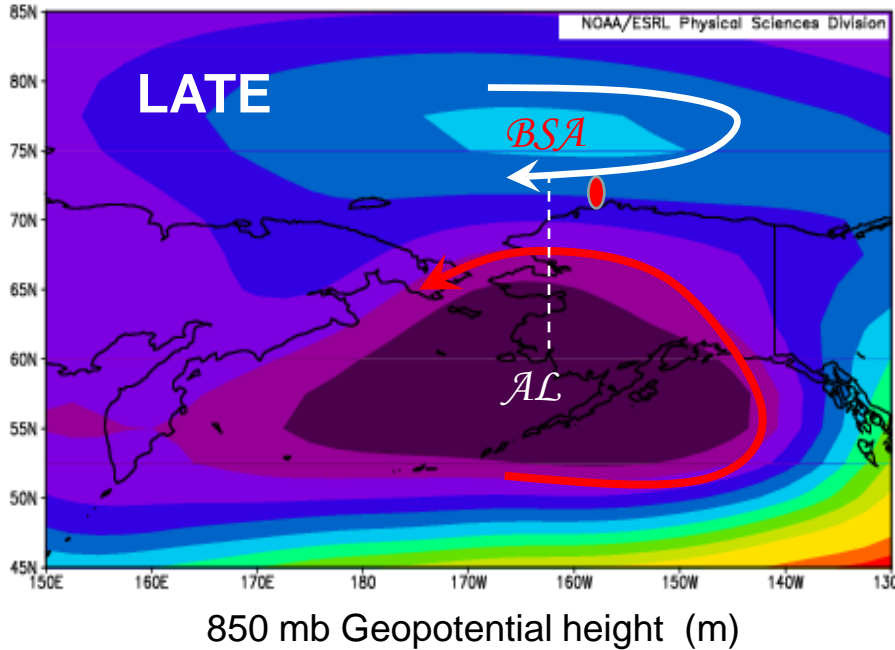
Mar/Apr/May 1996,2002,2003,2004 composite



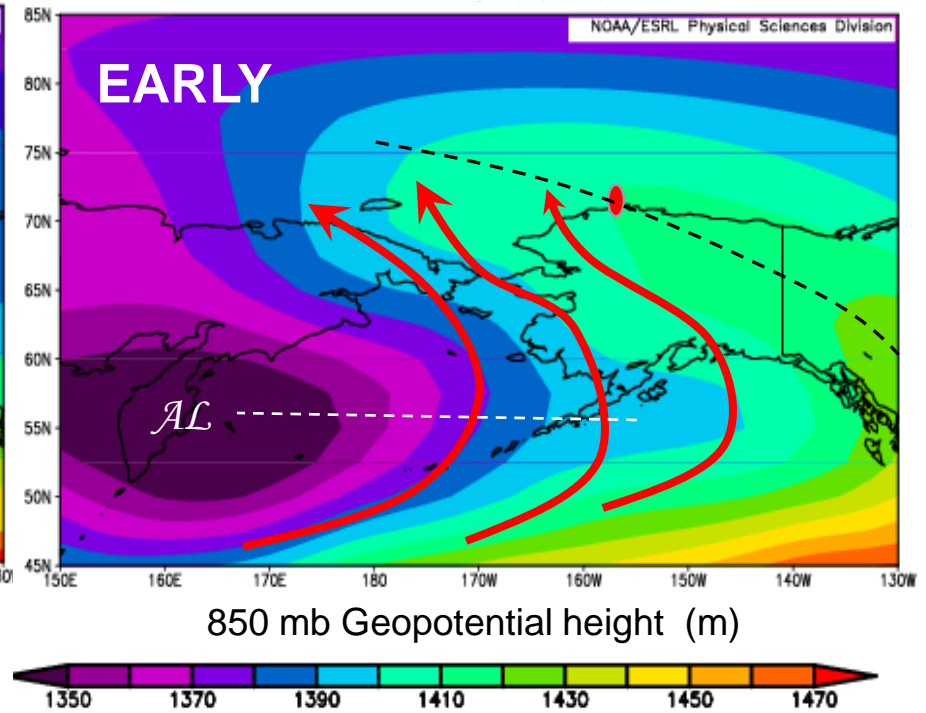
850 mb Geopotential height (m)



Mar/Apr/May 1985,1986,1987,1988 composite



Mar/Apr/May 1996,2002,2003,2004 composite

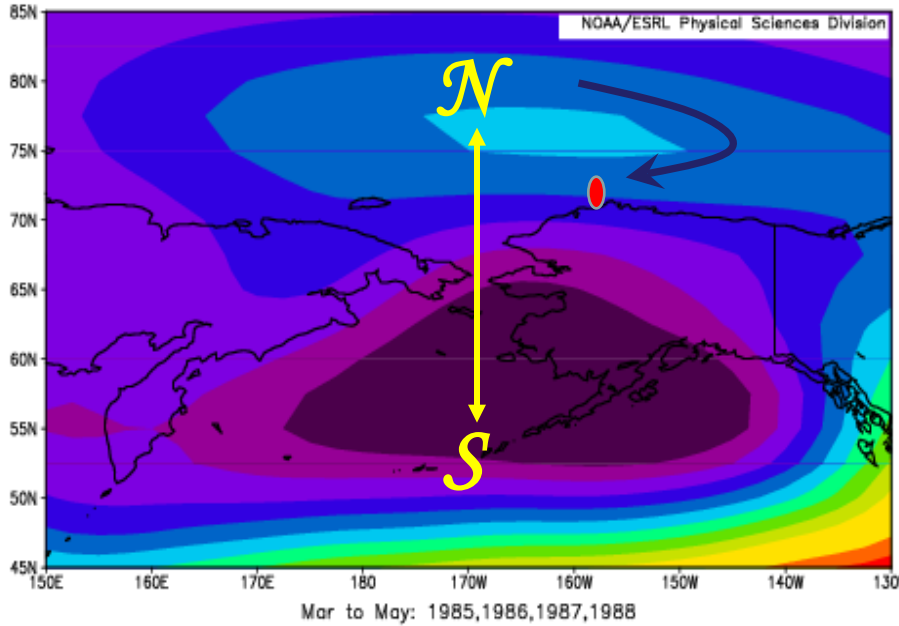


- BSA blocks southerly flow; N-S dipole established
- BRW experiences cold, dry prevailing winds

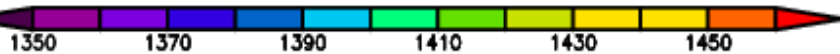
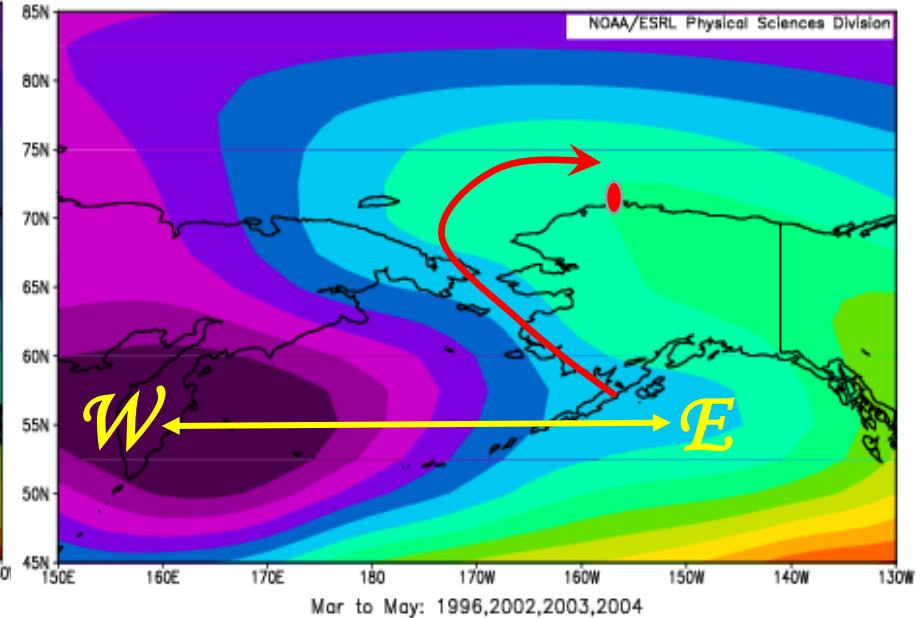
- AL shifts west, forming E-W pressure gradient
- Warm, moist air is advected into the Pacific Arctic



NCEP/NCAR Reanalysis  
850mb Geopotential Height (m) Composite Mean



NCEP/NCAR Reanalysis  
850mb Geopotential Height (m) Composite Mean



- Define N-S dipole

- Define E-W pressure gradient

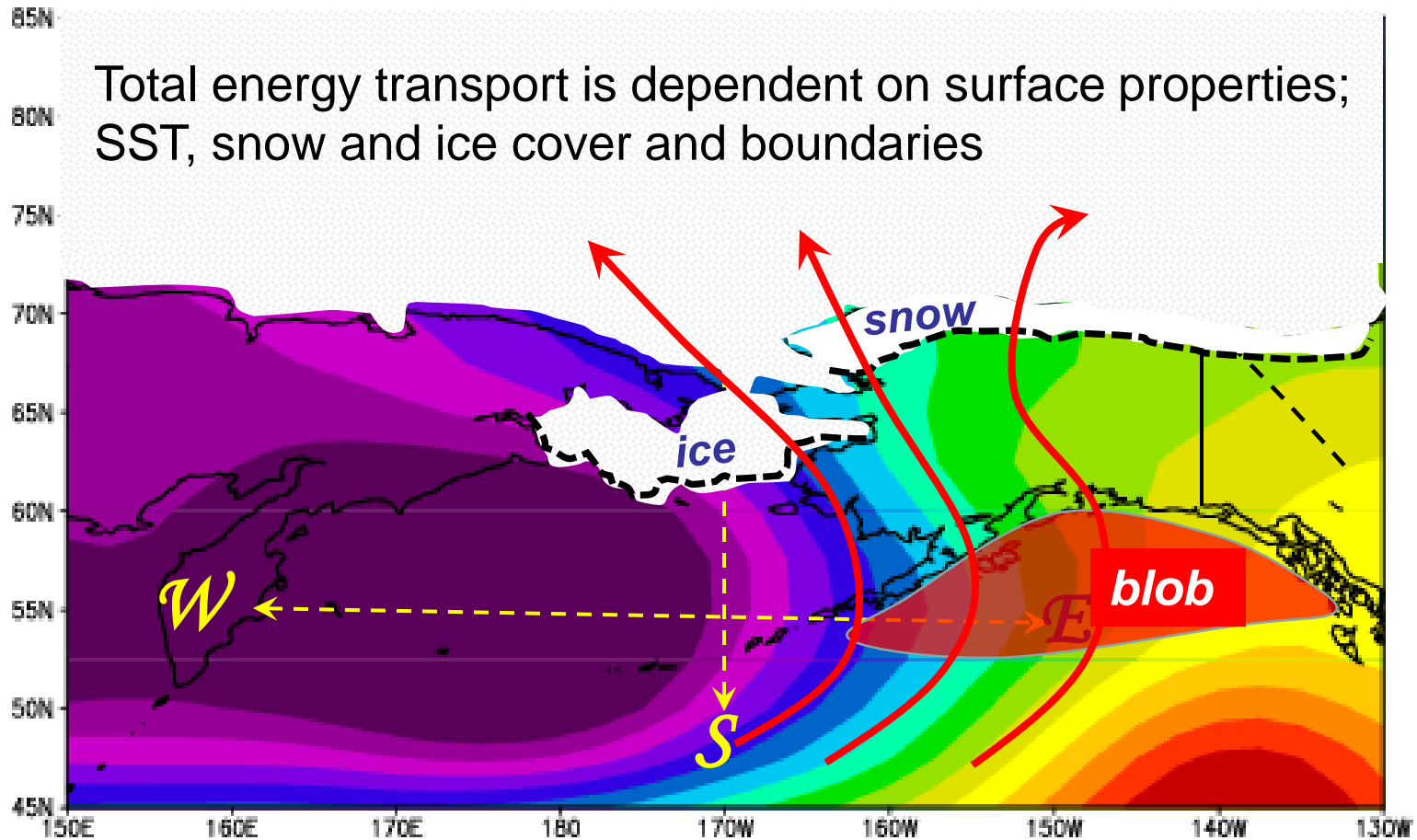
Compute four-point composite index:  $ALBSA = (E-W) - (N-S)$

- values are associated with BSA blocking

+ values favor northward advection of warm air

NCEP/NCAR Reanalysis  
850mb Geopotential Height (m) Composite Mean

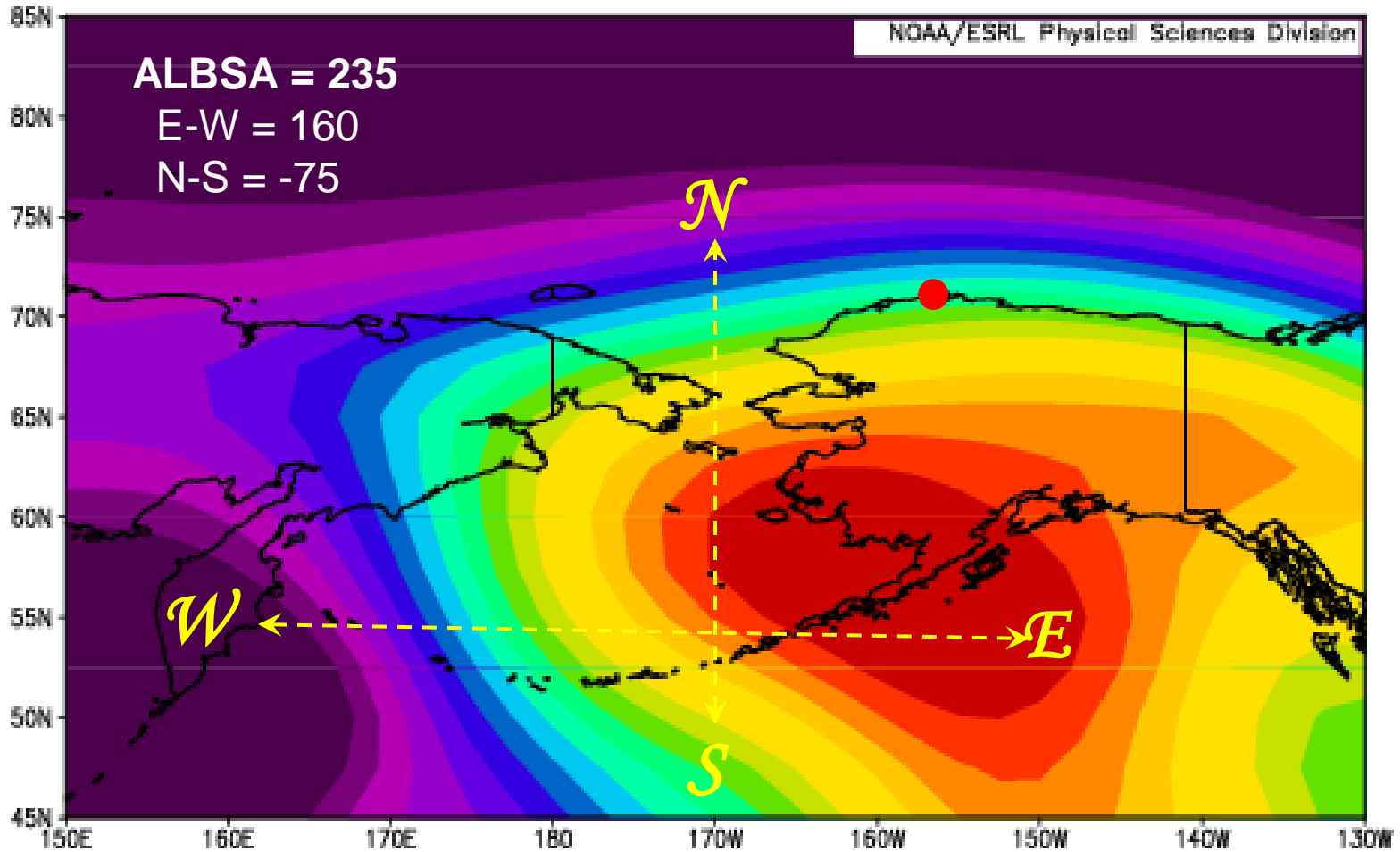
Total energy transport is dependent on surface properties;  
SST, snow and ice cover and boundaries



May 2015 and 2016



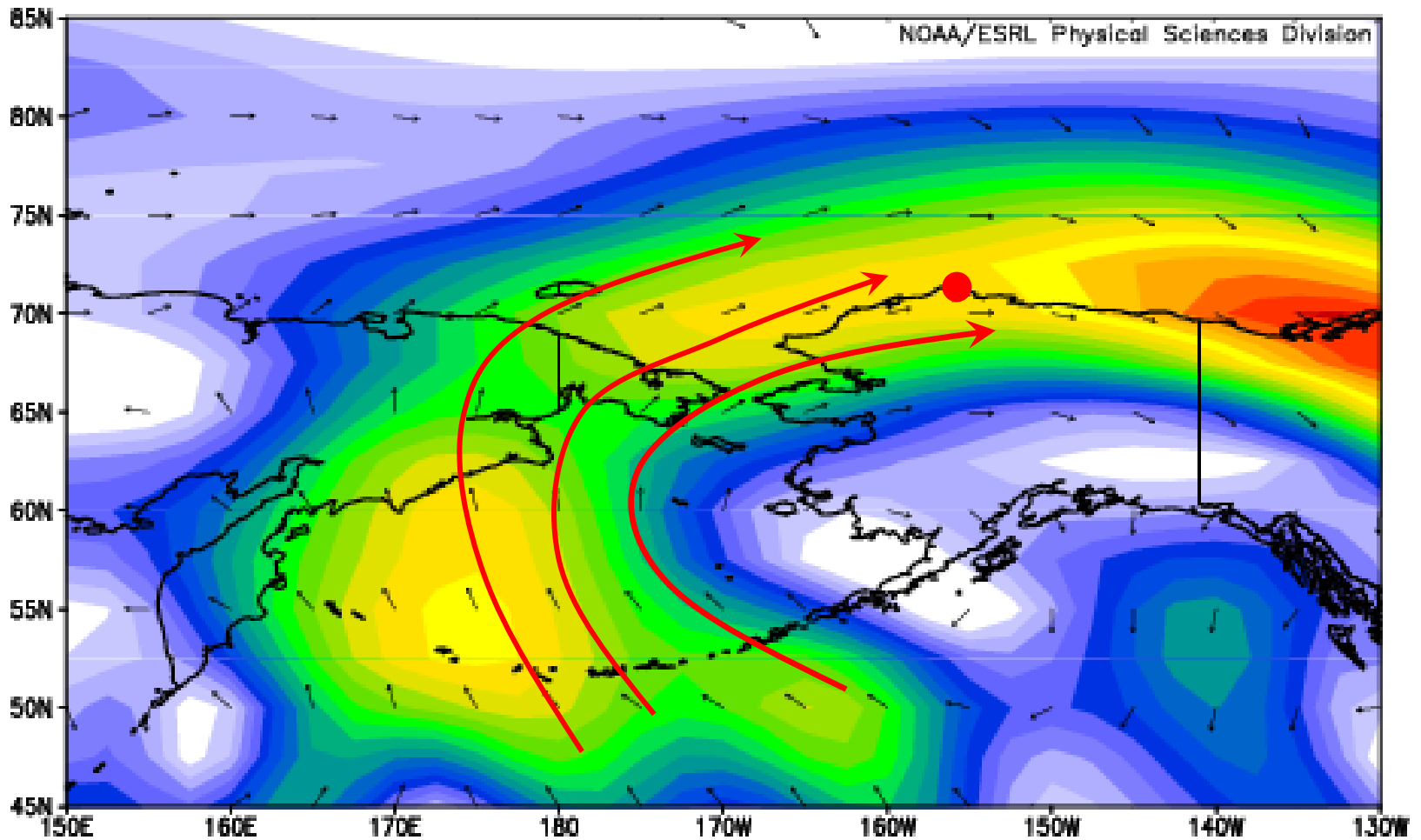
1- 14 January 2017



850 mb geopotential height (m)



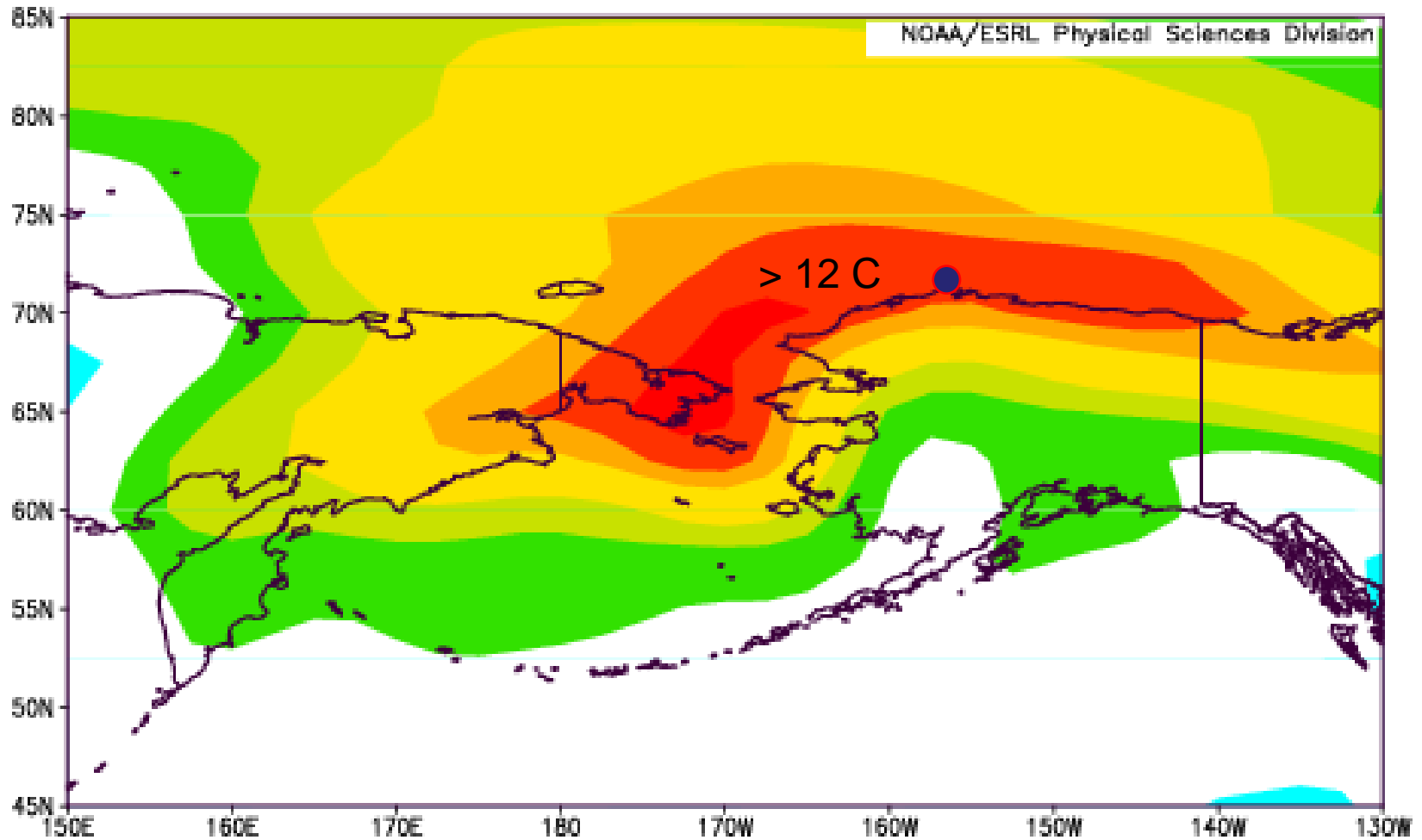
1- 14 January 2017



850 mb vector wind field (m/s)



# 1- 14 January 2017 Heat Wave

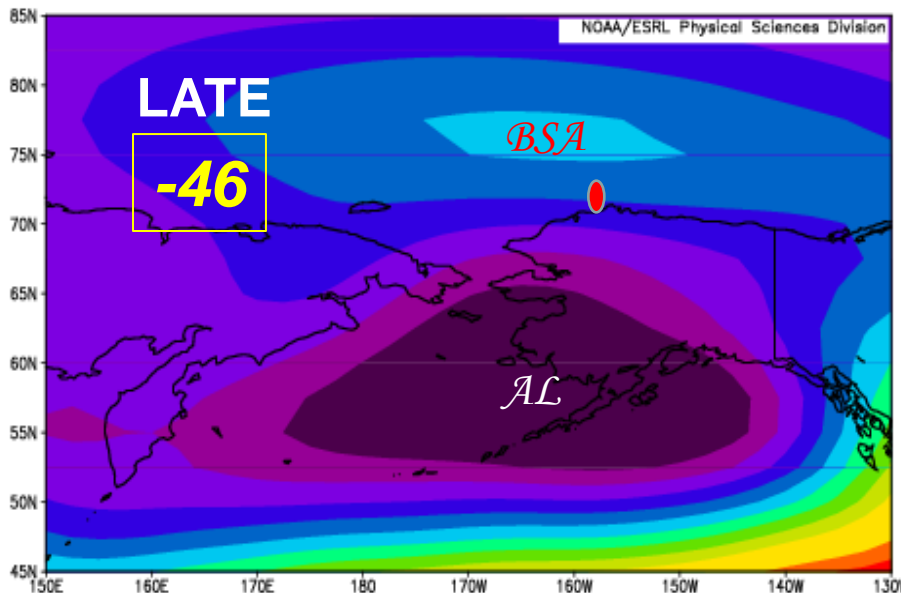


**Surface Temperature Anomaly (C)** 1981-2010 climatology



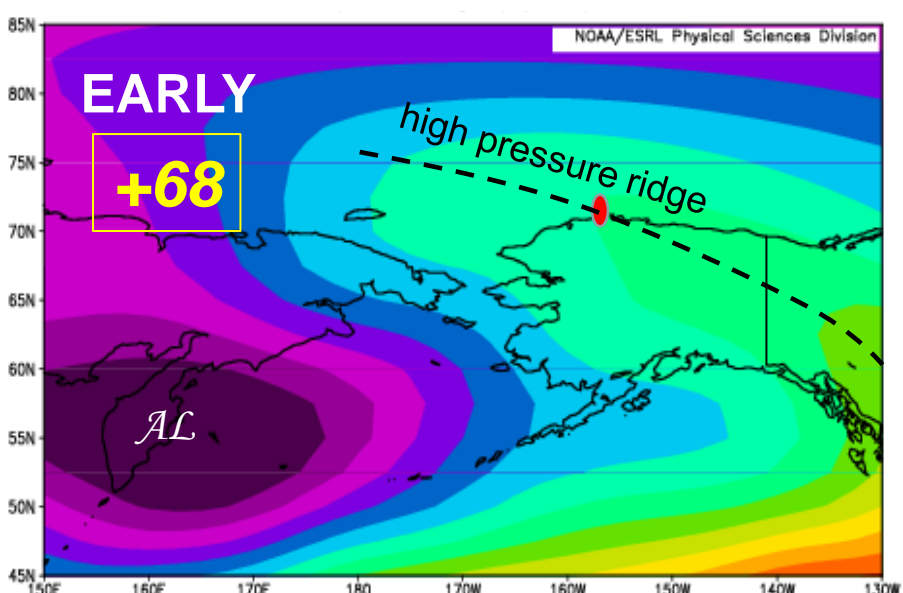


Mar/Apr/May 1985,1986,1987,1988 composite

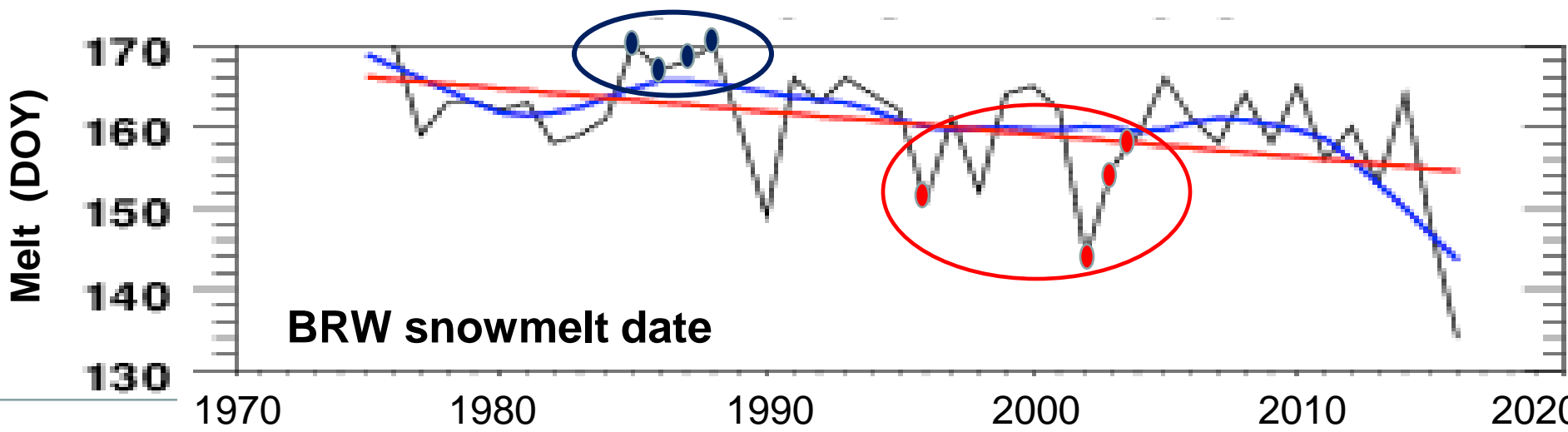
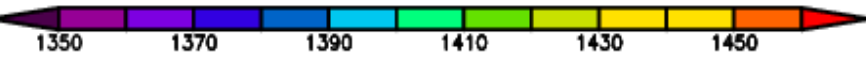


850 mb Geopotential height (m)

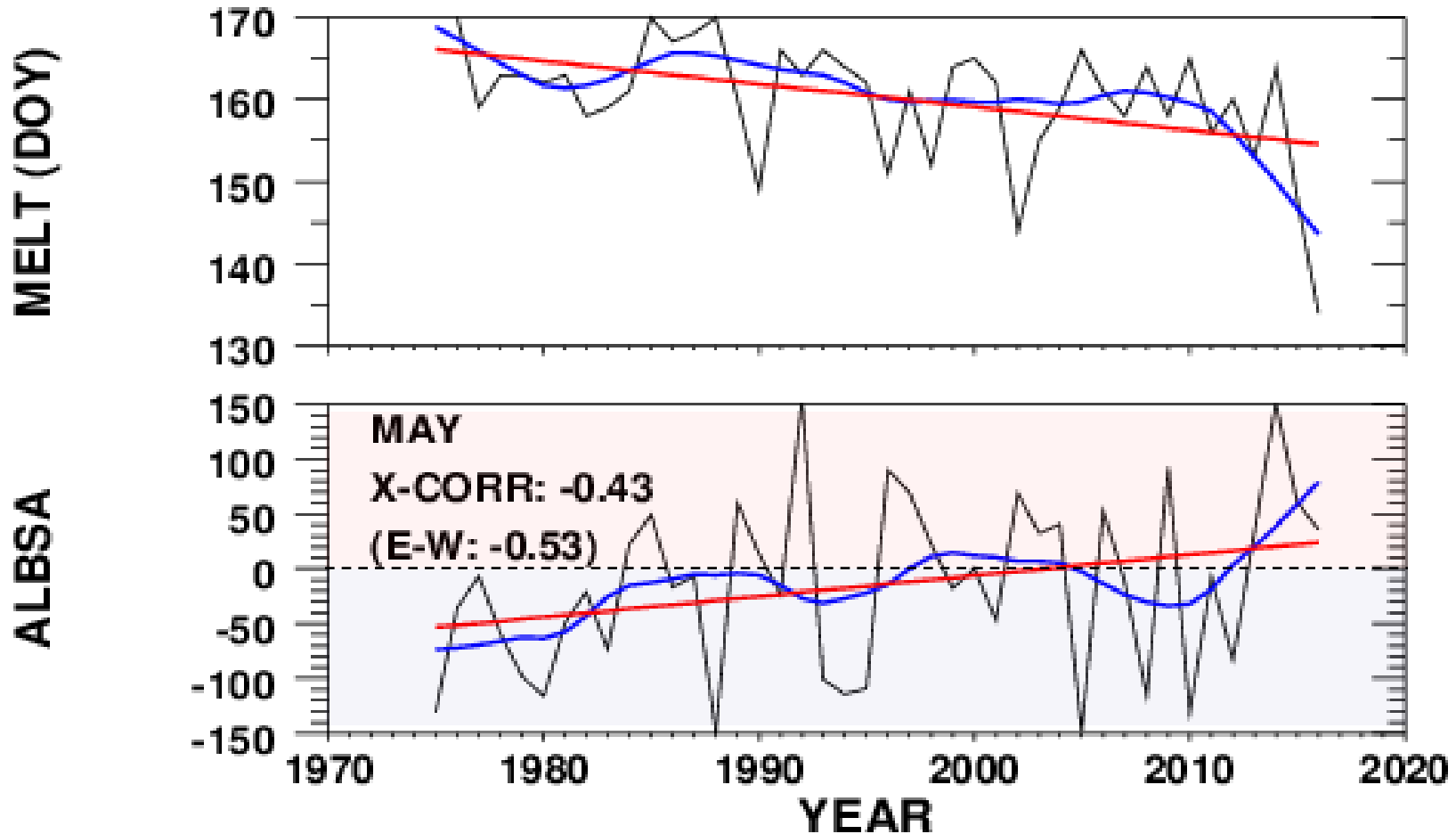
Mar/Apr/May 1996,2002,2003,2004 composite



850 mb Geopotential height (m)



## ALBSA INFLUENCE ON TIMING OF BRW MELT



### Future applications:

- Analyze ALBSA and components; evaluate variations and trends
- Correlate with other metrics; quantify role of atmospheric dynamics
- Develop empirically-based climate model for regional forecasting

*Thank You*



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