

# AT THE EDGE OF THE WIDE WATER: SOUTHEAST ALASKA CLIMATE AND PACIFIC OCEAN VARIABILITY

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Climate Change in Southeast Alaska, Apr 13,  
2016

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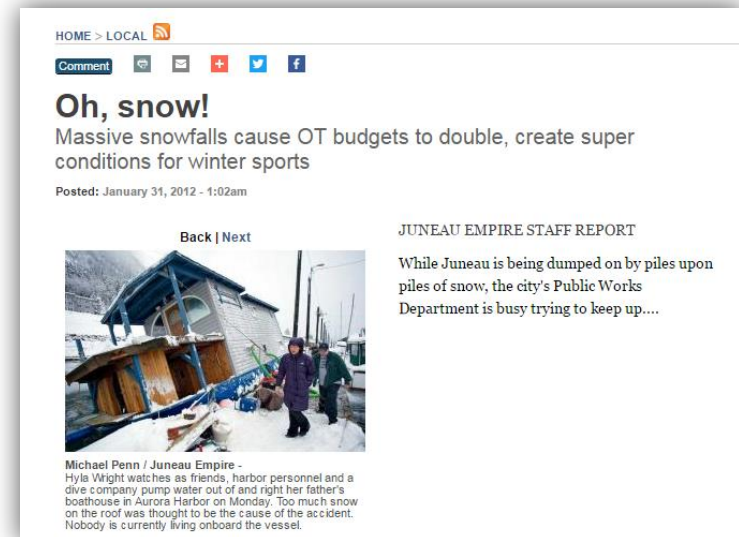
Aatlein Gunalchéesh Auk Kwáan



# The Wide Water Matters to Southeast

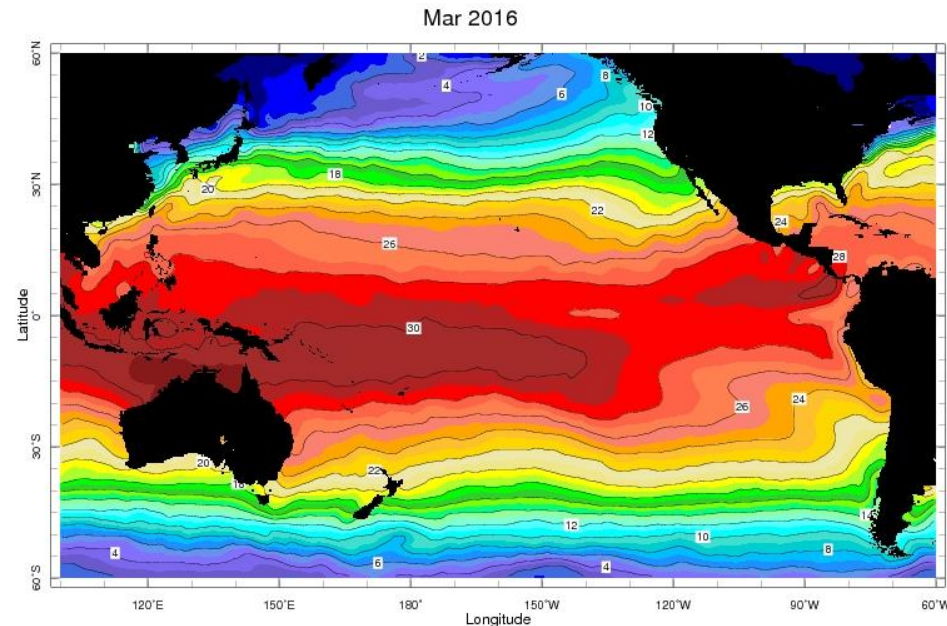
From the day to day weather to century scale climate, Southeast is heavily influenced by what's happening across the Pacific Basin

- Ex- Hurricane Oho (2015)
- “The Blob” 2014-15
- El Niño/La Niña
- Pacific D



# Today's Agenda

- The Pacific Ocean: driver of our climate
- Small variations in Sea Surface Temperatures influence weather and climate in Southeast (and globally)
- Large scale (and distance) variations most pronounced in winter, so today will be about winter, including (gasp) snow



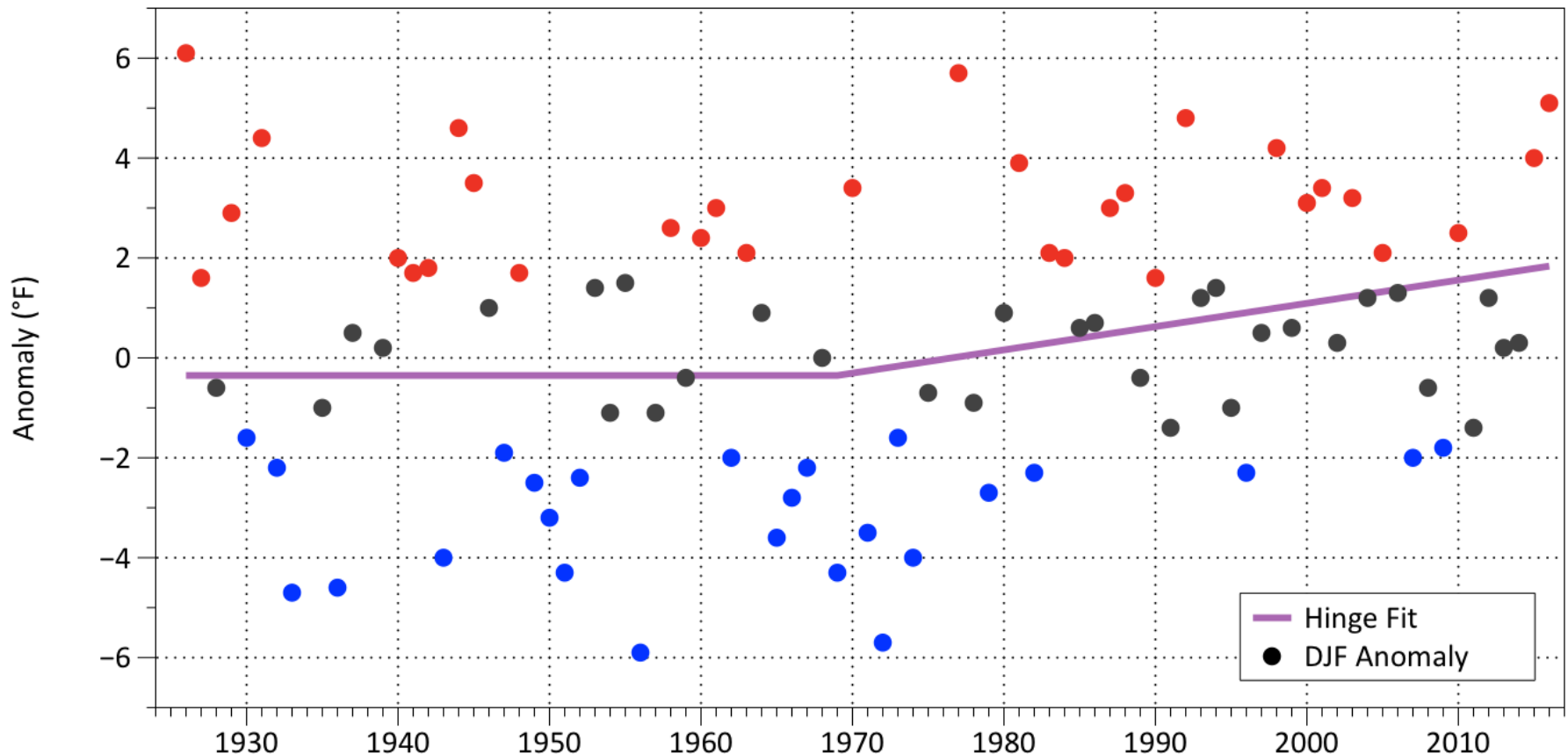
# Pacific Ocean Based Climate Drivers

Climate Variability: Quasi-regular ocean-atmosphere patterns on the few year to few decade timescales

- El Niño-Southern Oscillation (ENSO)
  - Quasi-regular variation in equatorial Pacific SSTs that impacts global circulations: two flavors El Niño, La Niña
    - Two to seven year cycle
    - Primary driver of annual global climate variability
- Pacific Decadal Oscillation (PDO)
  - Pattern of North Pacific SSTs
  - NOT independent of ENSO
  - 15 to 30 year cycle but highly variable
- North Pacific Mode (NPM, aka “the Blob”)
  - Active Research

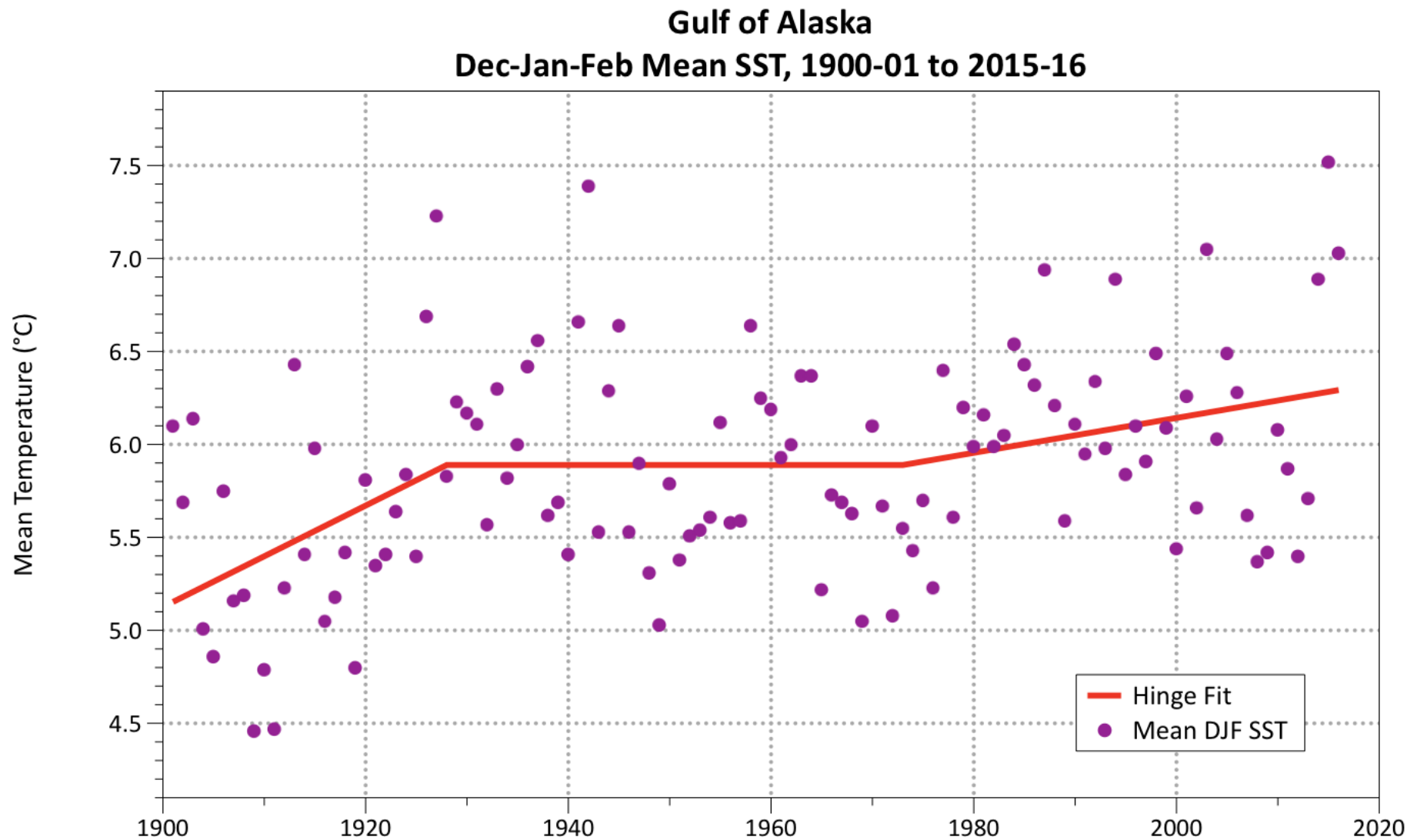
# Southeast winters: not what they

Central Southeast Alaska  
Dec-Jan-Feb Temperatures, 1925-26 to 2015-16



Alaska Climate Division 11, Anomaly from 1925-2000 Mean

# Gulf of Alaska is warming

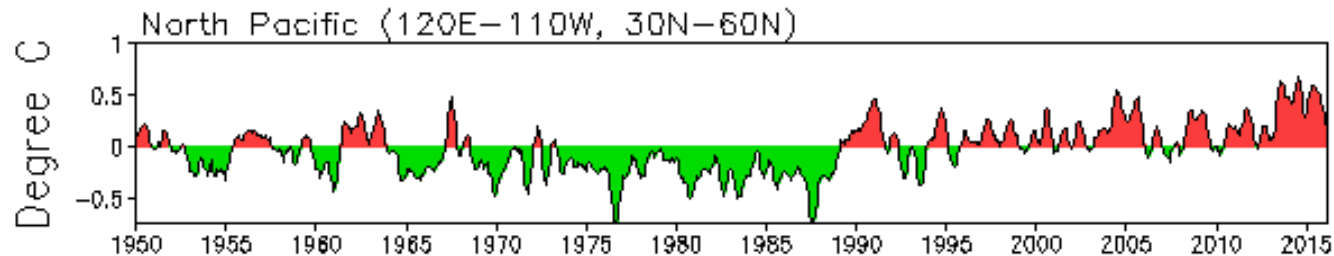


Source: NOAA/ERSSTv4

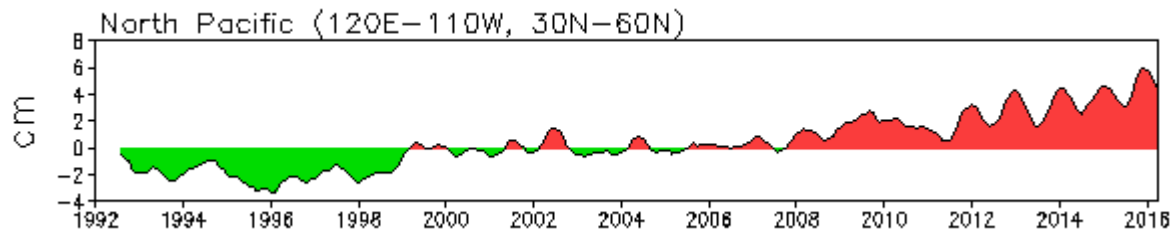


# Heat Content of the North Pacific is increasing

North Pacific SST anomaly, ERSSTv3b, 1981-2010 climo

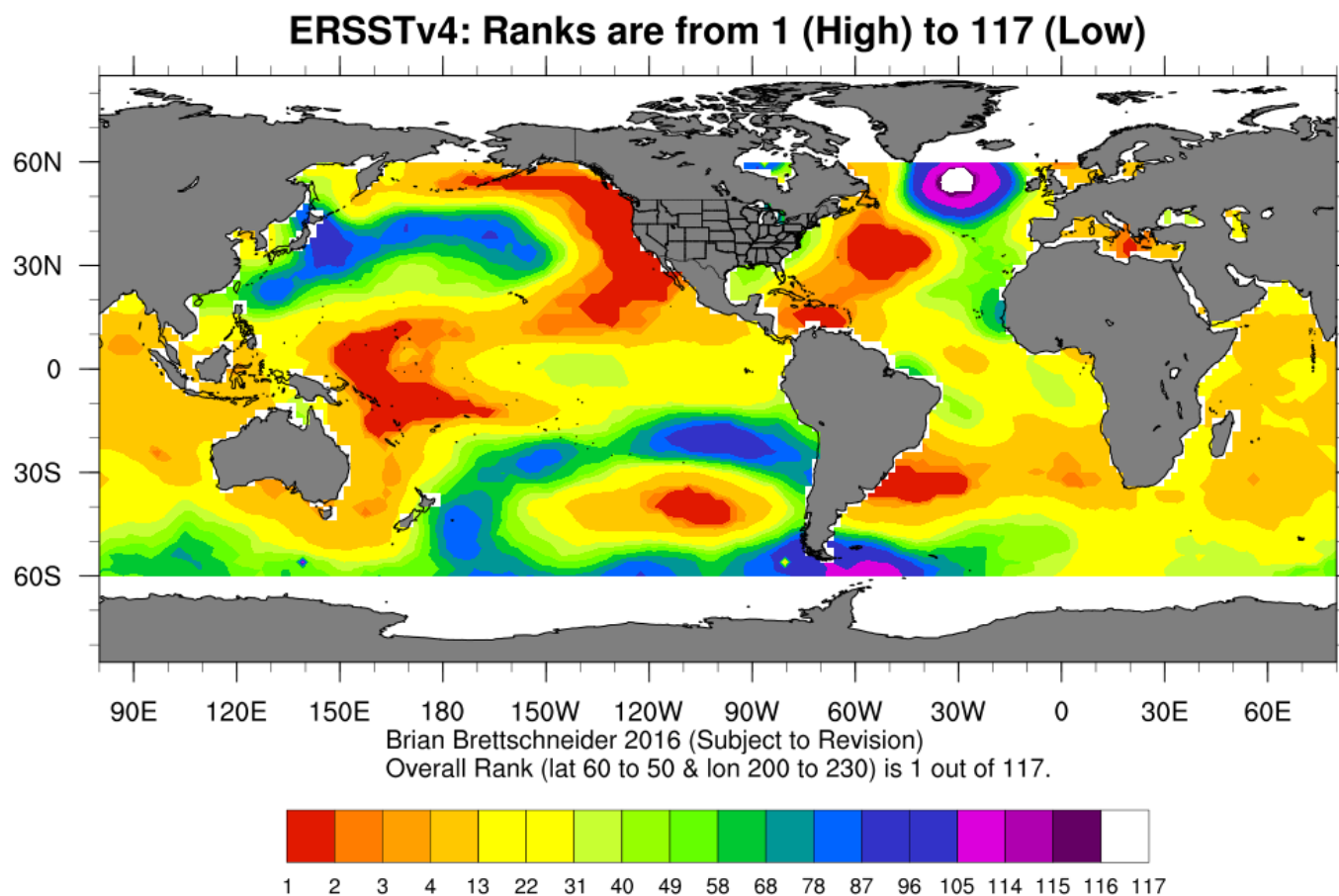


North Pacific SH anomaly, 1993-2013 climo



Source: NOAA/Climate Prediction Center

# Dec-Feb SST ranks for 2014-15 (1900-2016)



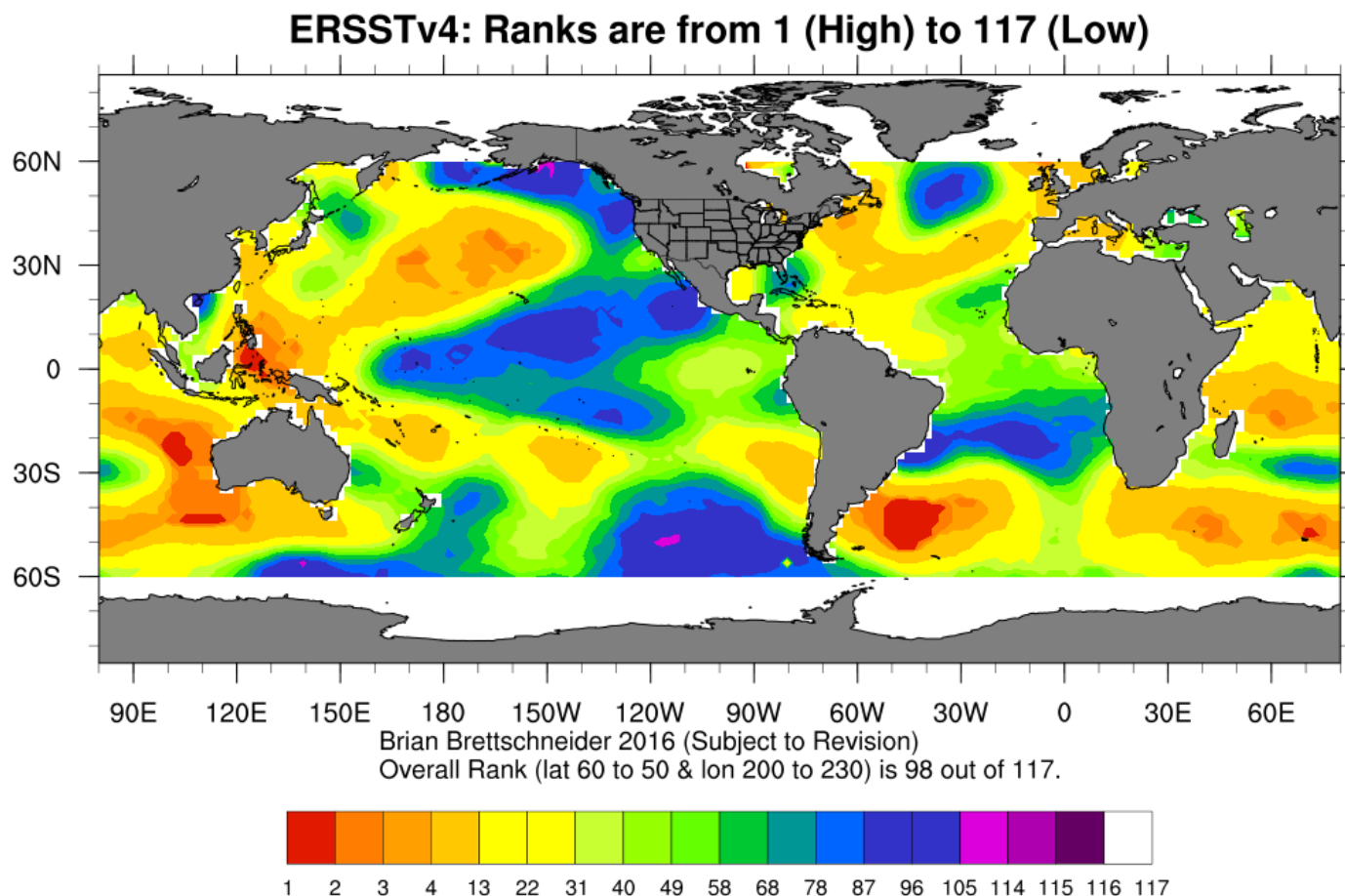
Rank for Dec 2014 - Feb 2015

Compared to All Dec-Feb  
Time Periods Since 1900

Source: NOAA/ERSL



# Dec-Feb SST ranks for 2011-12 (1900-2016)

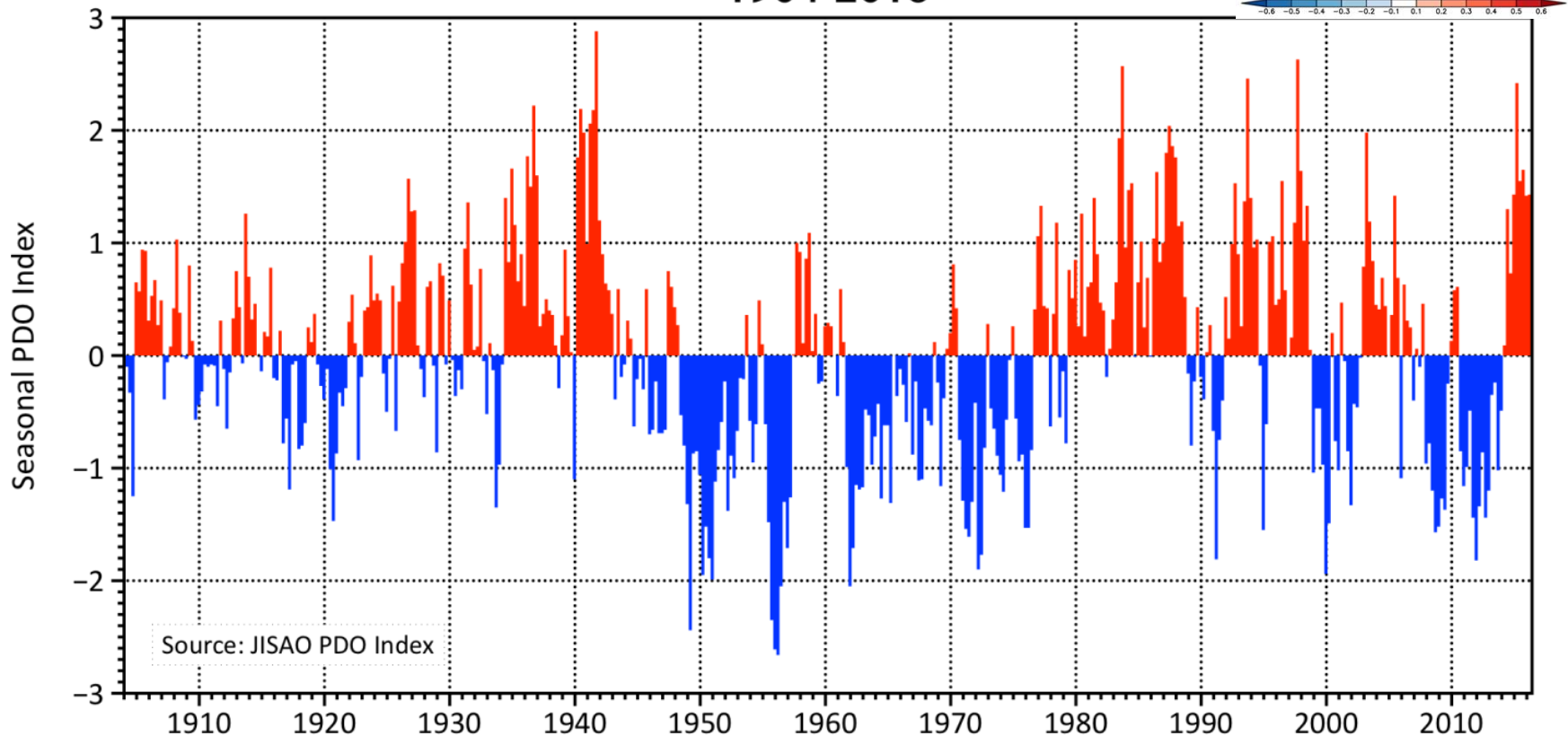


Rank for Dec 2011 - Feb 2012  
Compared to All Dec-Feb  
Time Periods Since 1900

Source: NOAA/ERSL

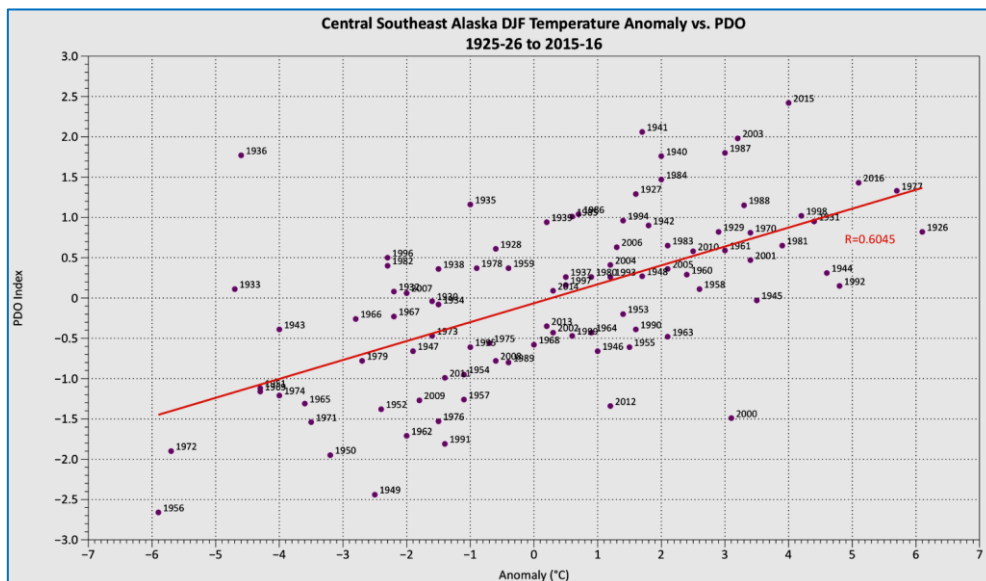
# A century of Pacific Decadal Oscillation

## Pacific Decadal Oscillation Index 3-Month Non-Overlapping Seasons 1904-2016

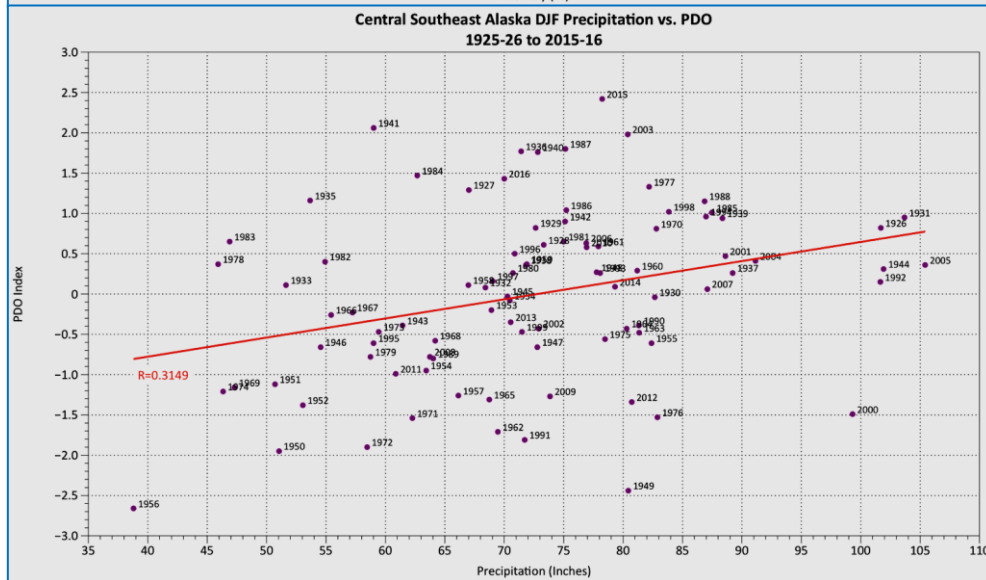


# PDO and Central Southeast Alaska

Temperature:  
decent linkage

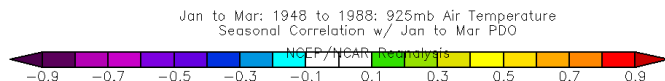
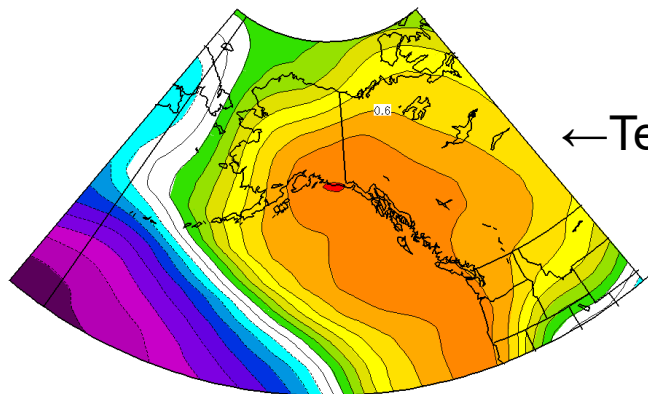


Precipitation:  
modest linkage



# PDO then and now: Late winter correlation

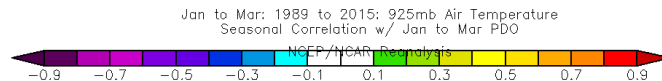
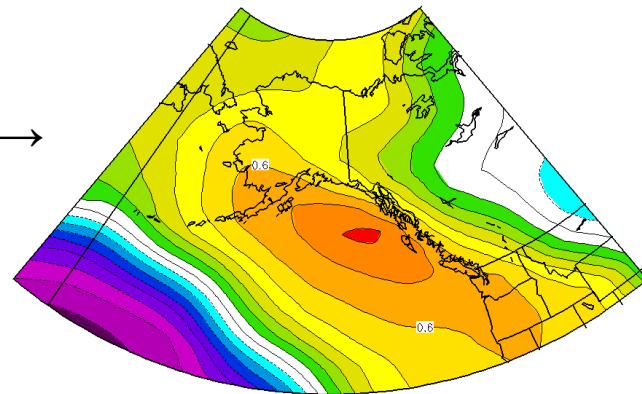
1948-88



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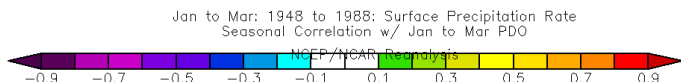
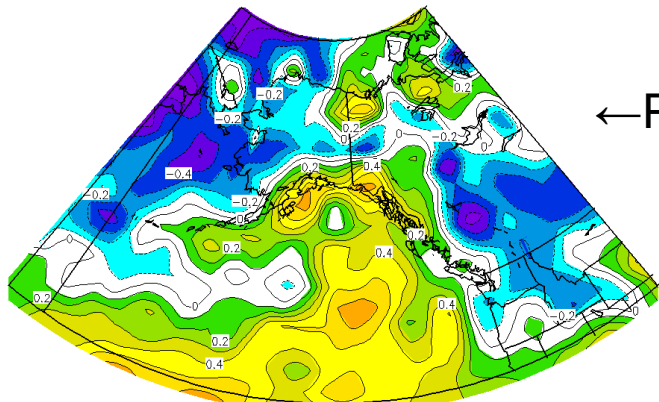
←Temps→

1989-2015

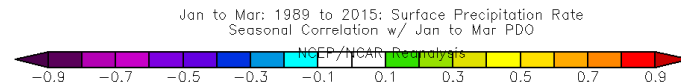
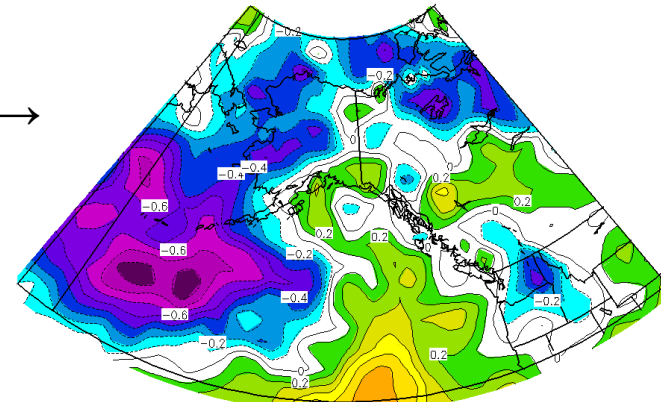


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←Precip→



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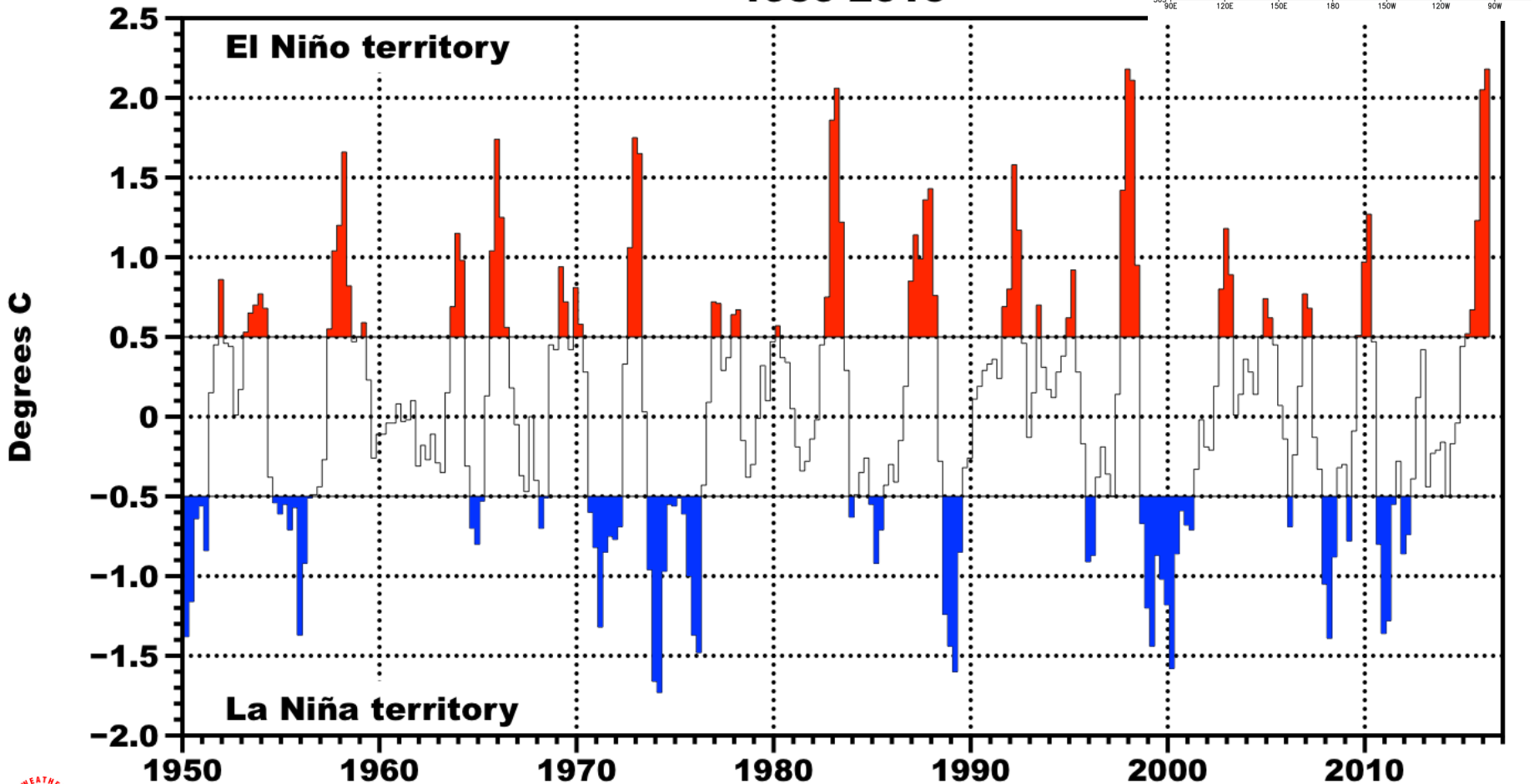


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# ENSO through the years

## Oceanic Niño Index 1950-2016

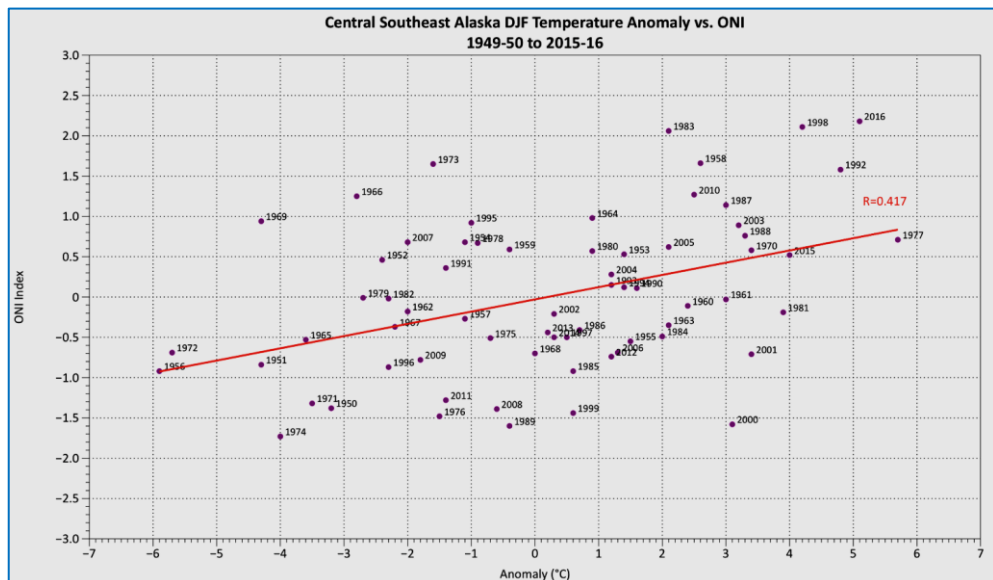


Source: NOAA/Climate Prediction Center

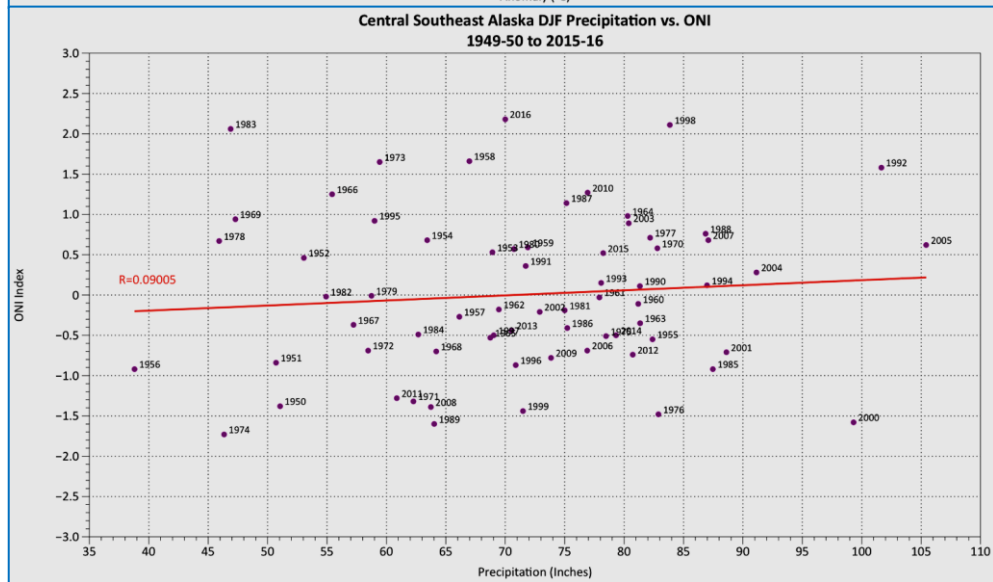


# ENSO and Central Southeast Alaska

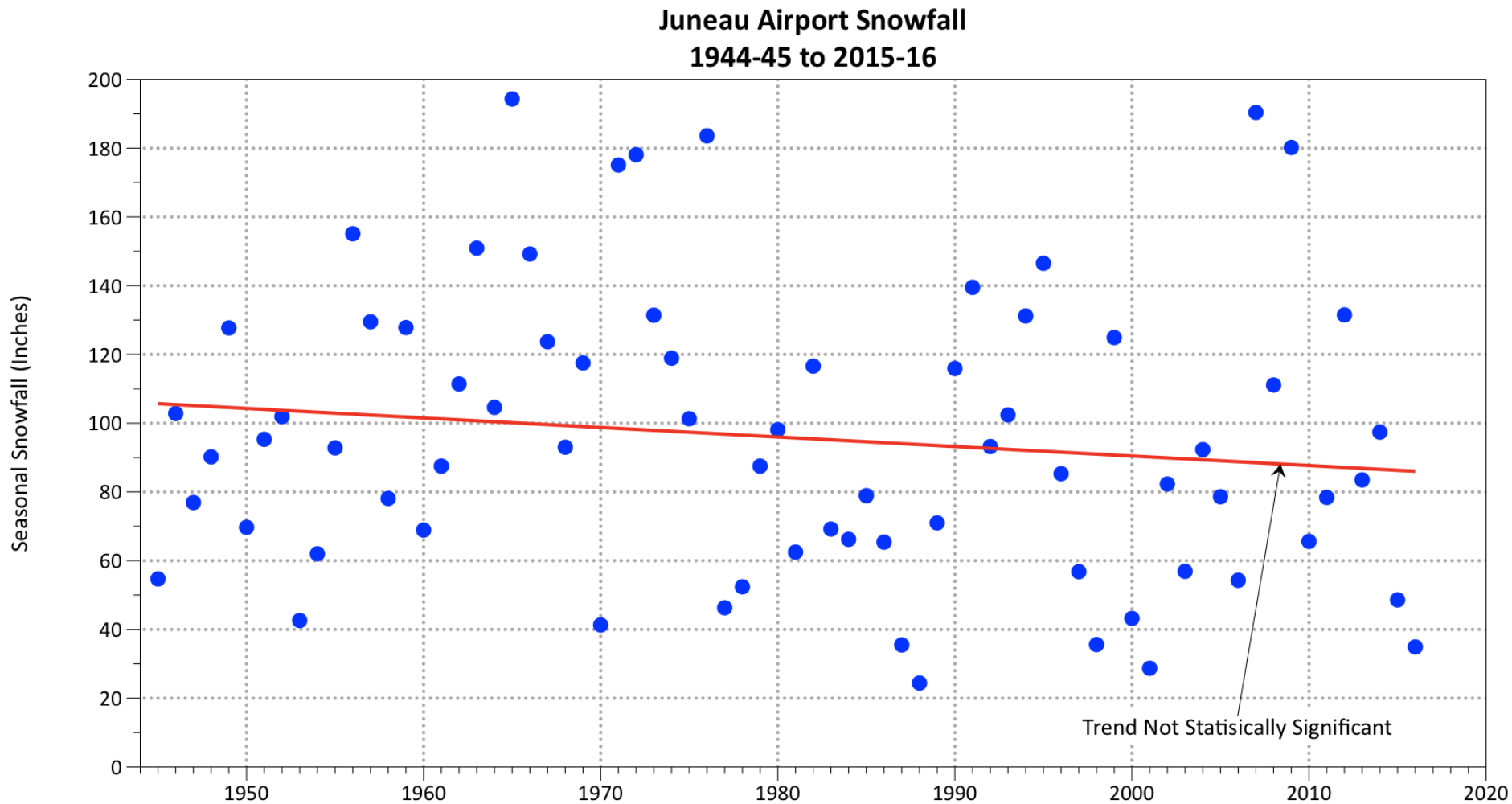
Temperature:  
modest linkage



Precipitation:  
no helpful  
linkage



# Juneau Airport snowfall: it's complicated

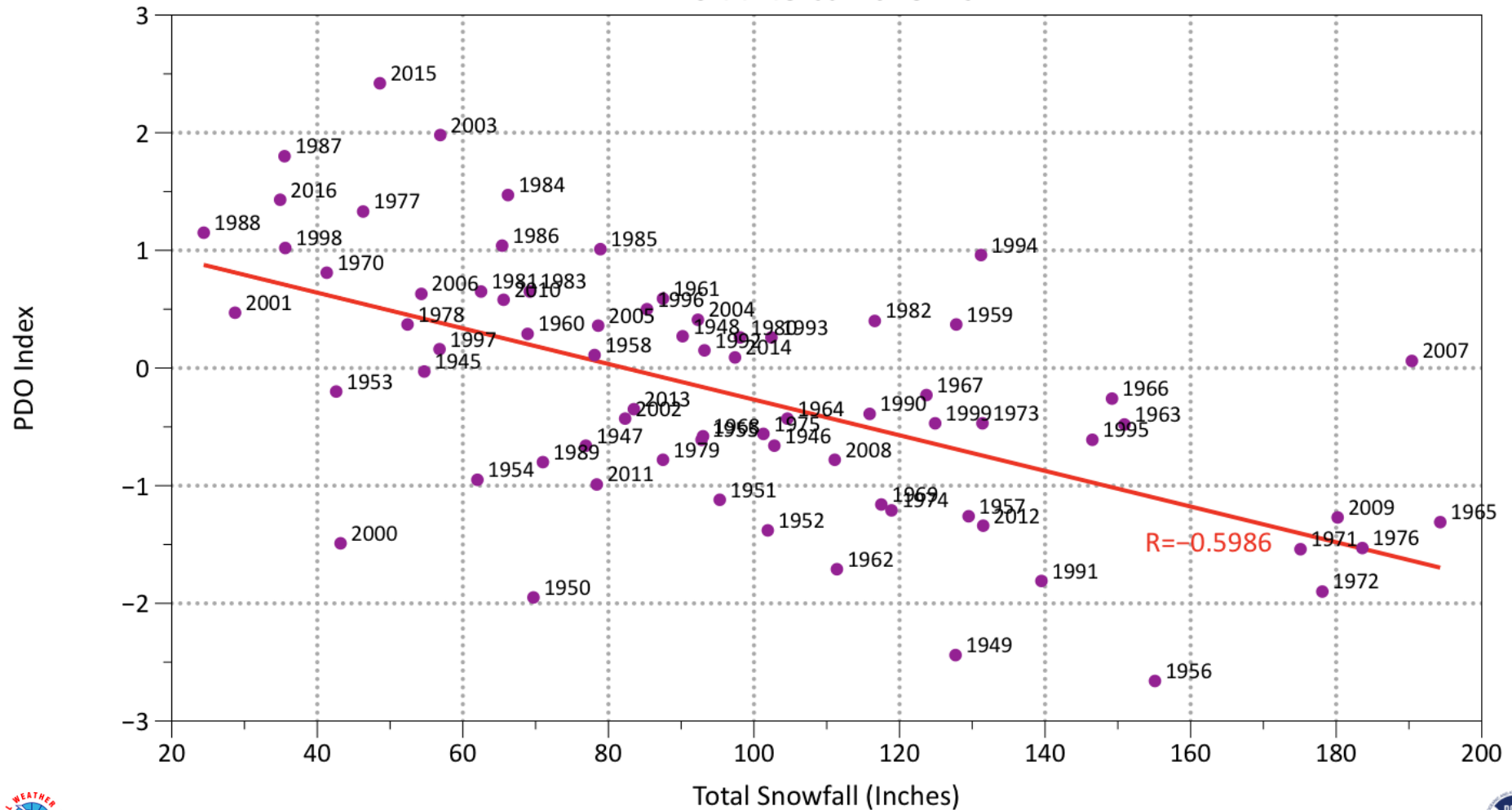


Source: NOAA/National Centers for Environmental Information



# Juneau Snowfall vs. PDO

Juneau Seasonal Snowfall vs. DJF PDO  
1944-45 to 2015-16

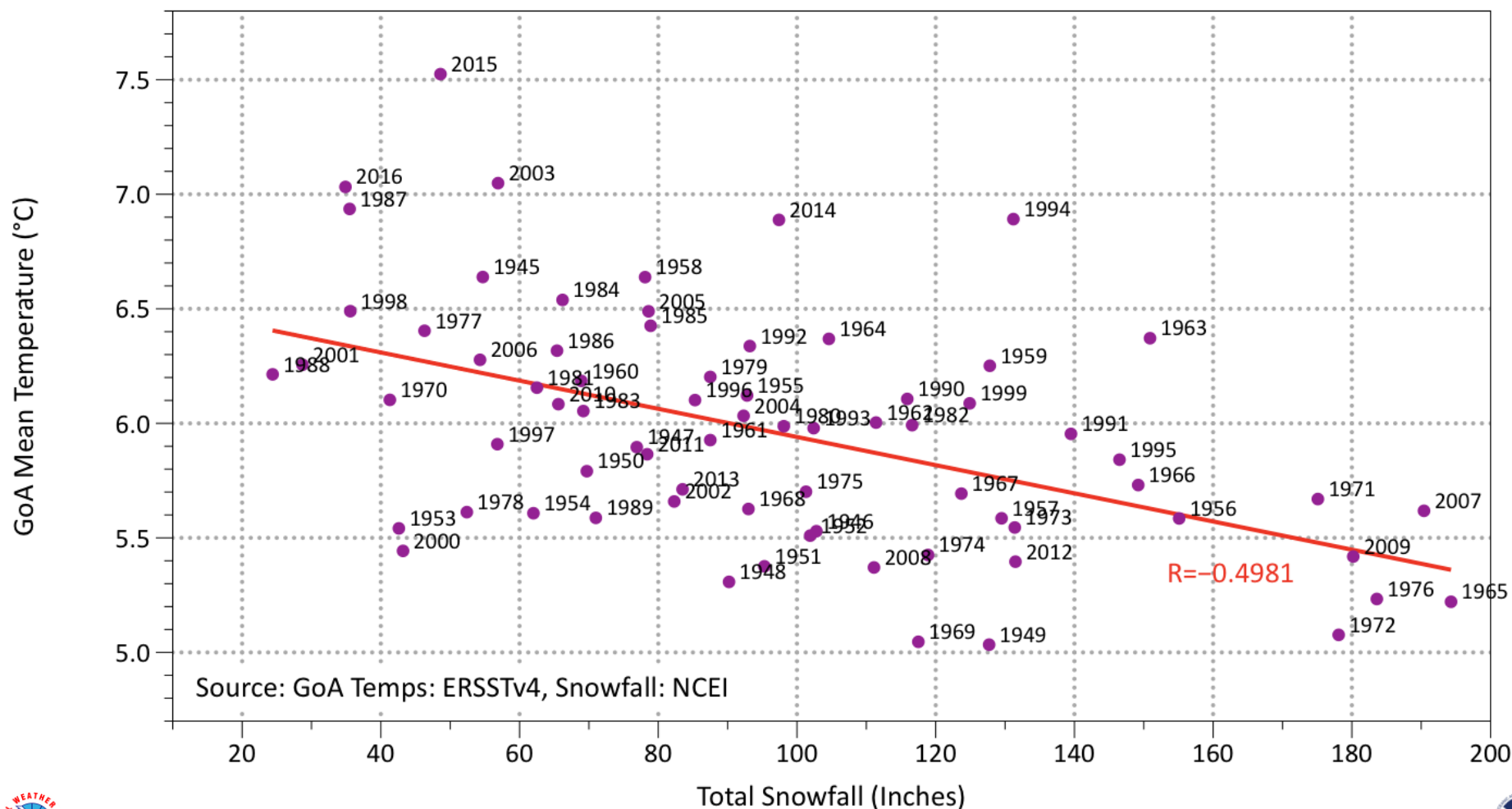




# Juneau Aprt Snowfall vs. Gulf of Alaska

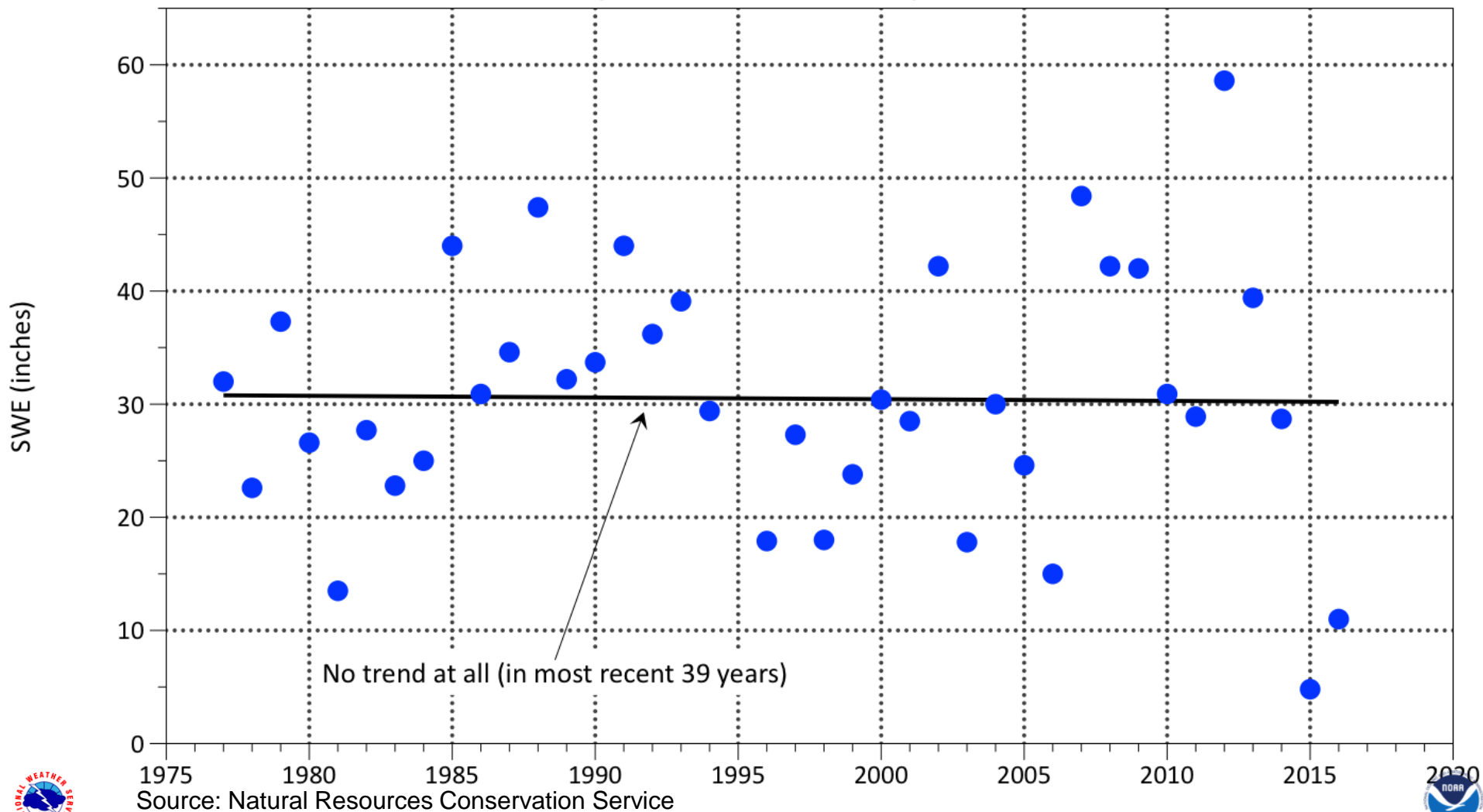
Temp

Juneau Seasonal Snowfall vs. DJF Gulf of Alaska Mean Temps  
1944-45 to 2015-16



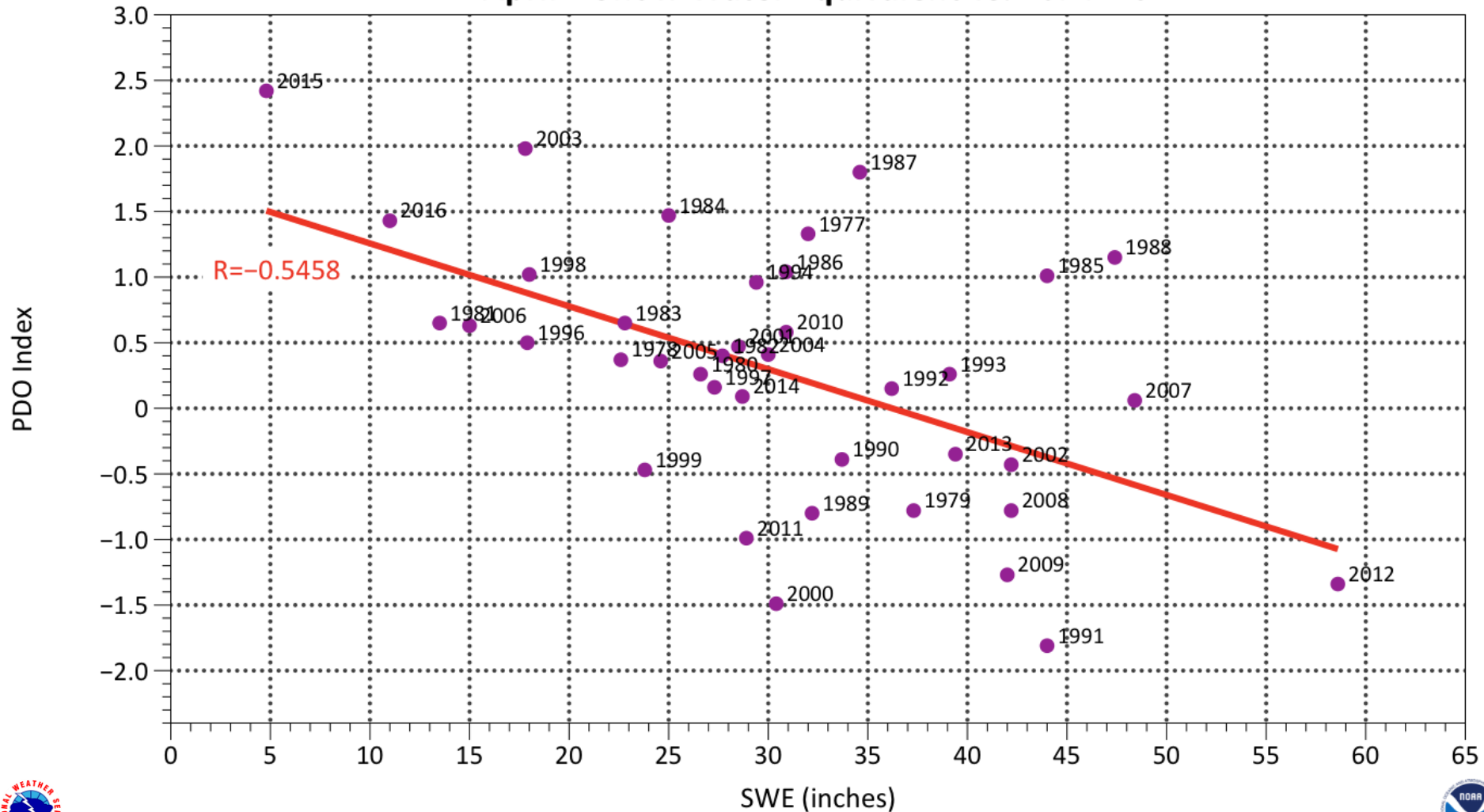
# Snow at Elevation: No Trend since late 70s

Cropley Lake (1650' MSL, Douglas Island)  
April 1 Snow Water Equivalent



# Snow Water Equivalent and PDO

Cropley Lake (1650' MSL, Douglas Island)  
April 1 Snow Water Equivalent vs. DJF PDO



# Summary

- Southeast Alaska climate is strongly modulated by what's happening in the wider Pacific Ocean
- North Pacific more important, but not unrelated to the tropical Pacific
- All this variability occurs in a warming world (i.e. on top of the long term trend)

# Thanks Very Much!

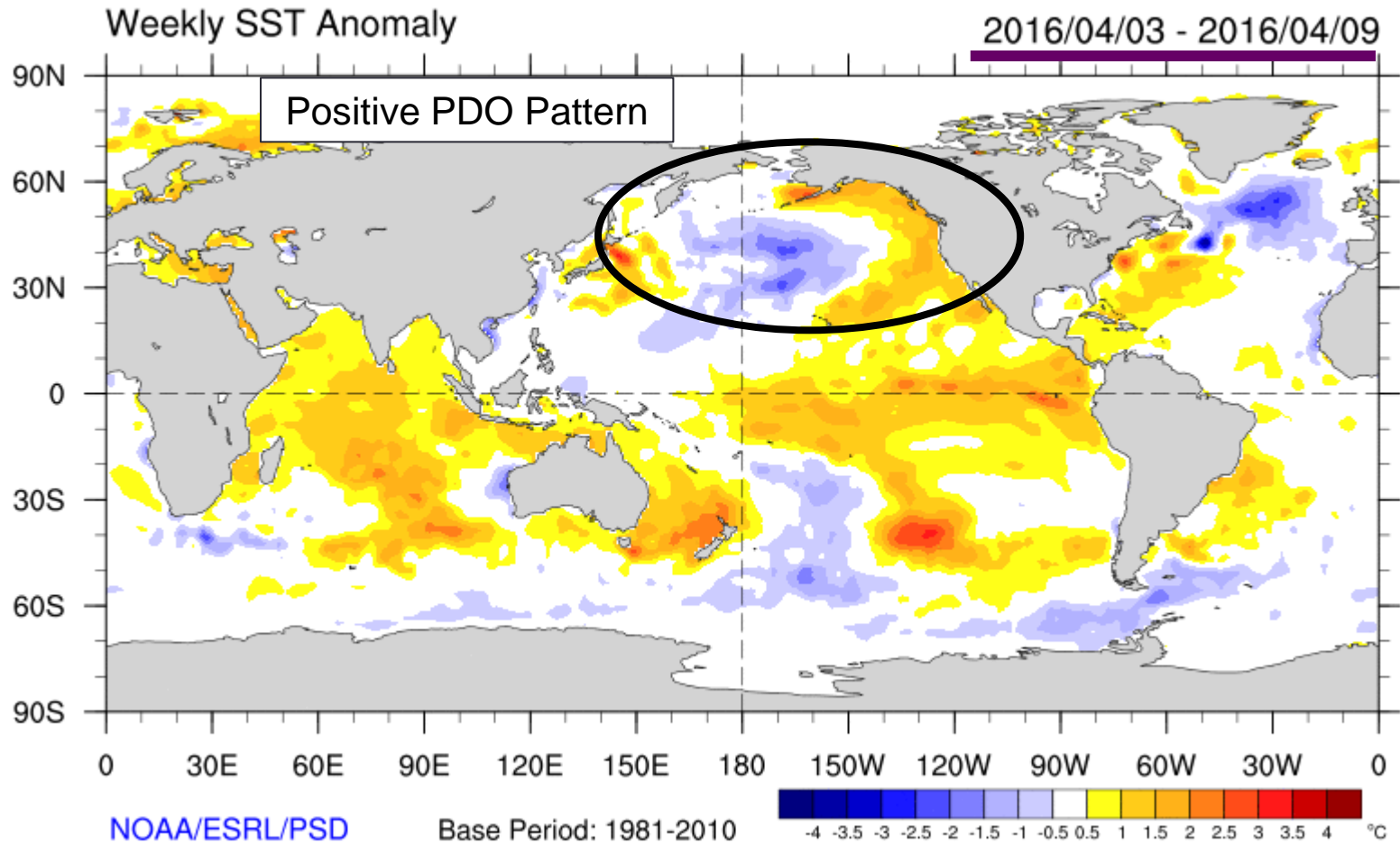
- Jeremy Littell
- Julianne Thompson
- Debbie Hart



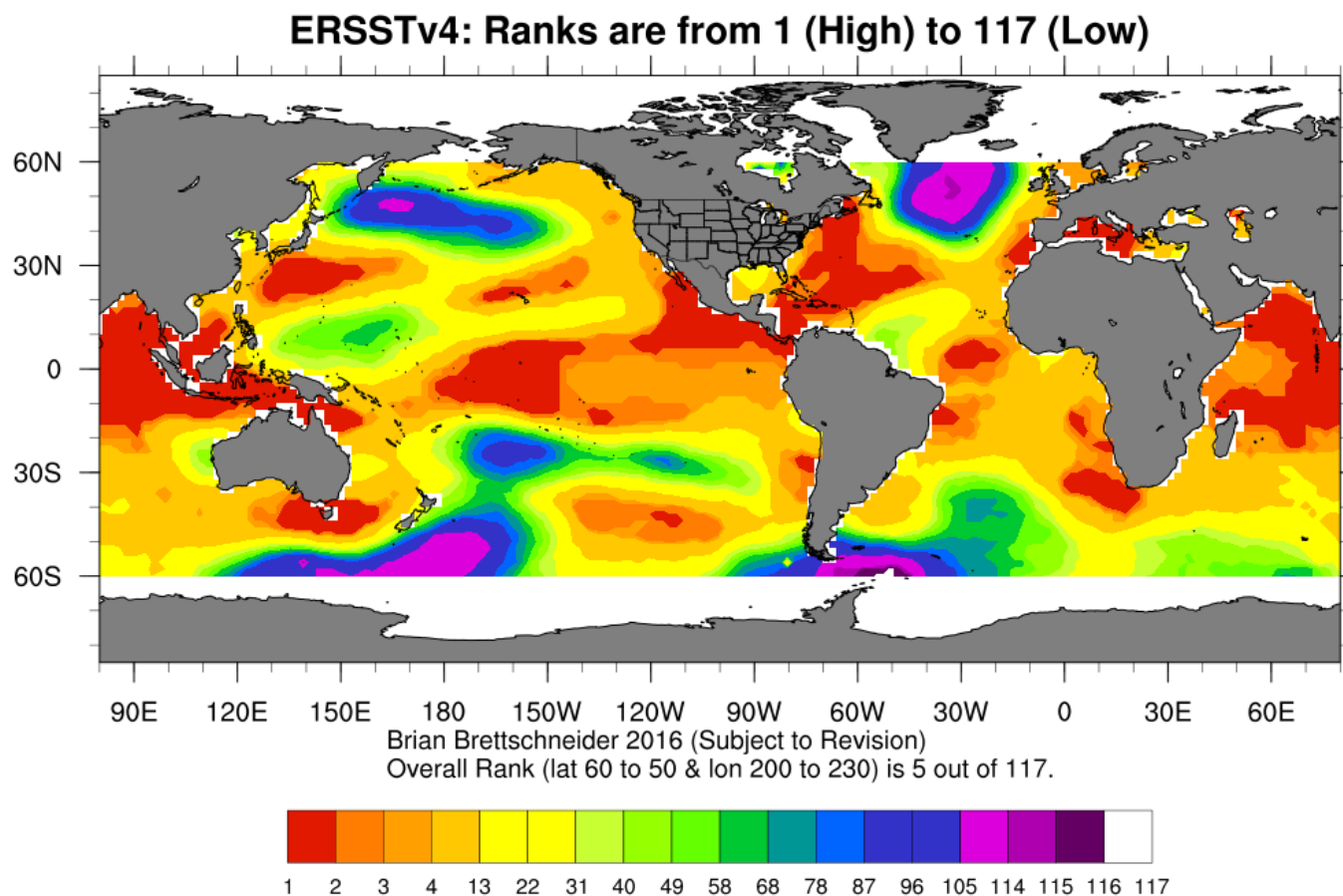
# Supplemental Slides



# Global SST Anomalies Today



# 2015-16 SST ranks



Rank for Dec 2015 - Feb 2016  
Compared to All Dec-Feb  
Time Periods Since 1900