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# THE WARM PACIFIC ANOMALY - II: CAUSES AND SOME CANADIAN PERSPECTIVE

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AN INITIATIVE OF  **University  
of Victoria**

# **The Warm Pacific Anomaly (The Blob), A Summary on the Dynamics and Some Recent Canadian Observations**

**First, to acknowledge those who have helped form  
the foundation for our/my understanding:**

**Nick Bond, Howard Freeland, Meghan Cronin, Bill  
Crawford, Jack Barth, and many others.**

**Most things I say that are “correct”, they deserve  
credit for, the mistakes are all mine.**

## Outline – A Brief Overview

- 1) What, where, and how significant.
- 2) How and why did it form, and how and why it has evolved, at the surface and below.
- 3) Some recent (Dec 2015) observations:

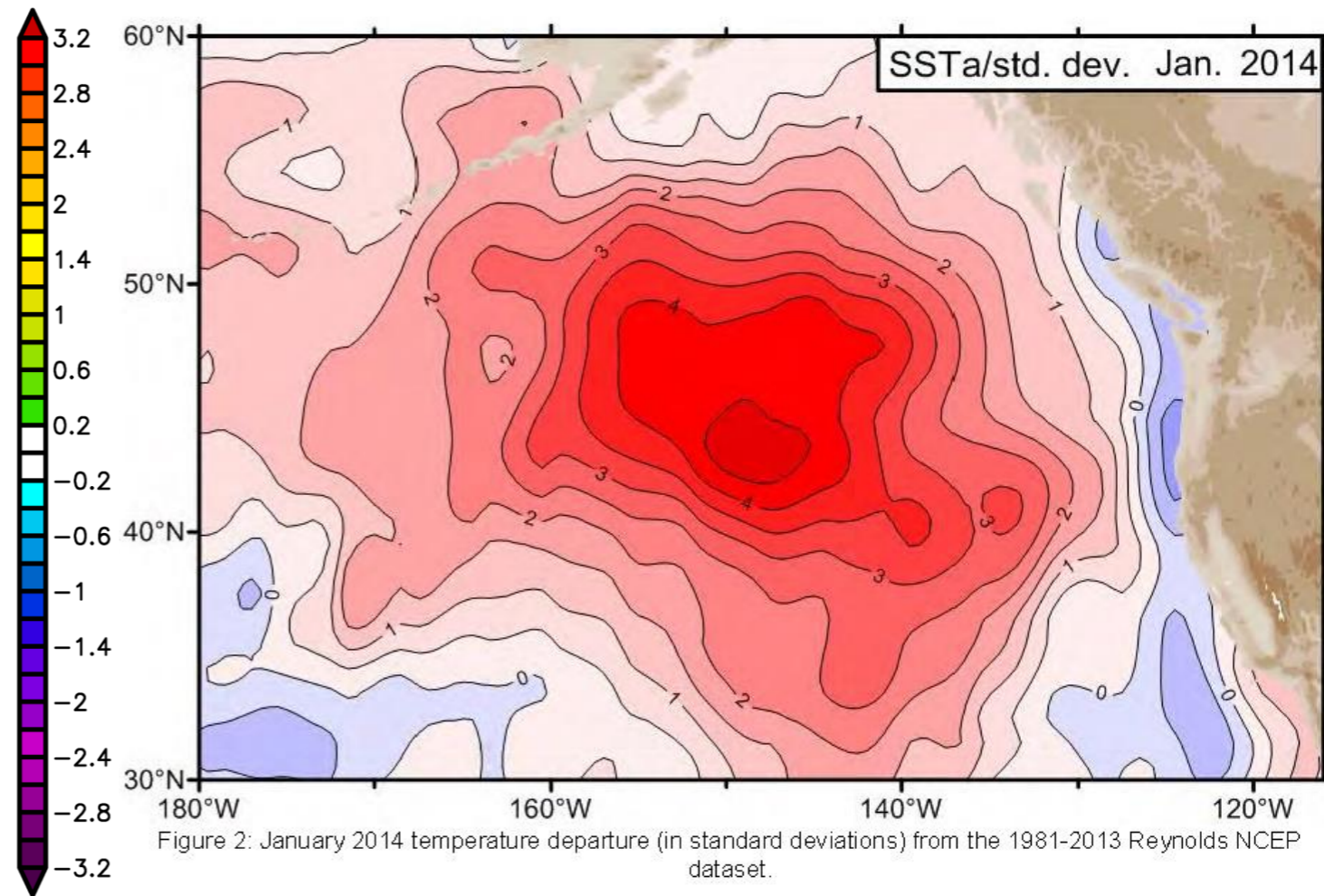
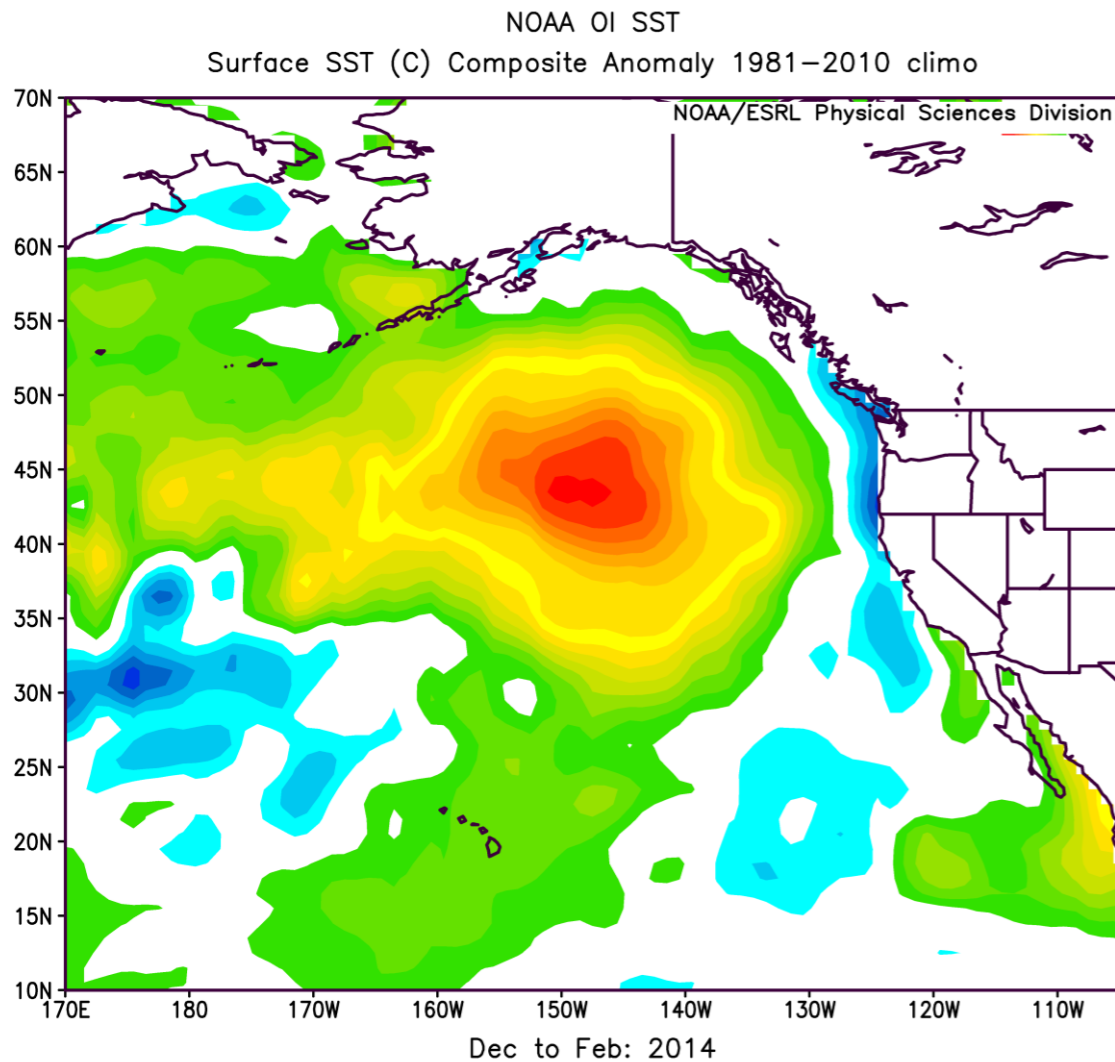
“I’m not dead...”

Heat at depth seems to be persisting, but

“Well, he will be soon, he’s very ill.”

# The Blob

What, Where, and How Significant:  
GOA surface warm anomaly, SSTa ~ 3°C, ~January 2014



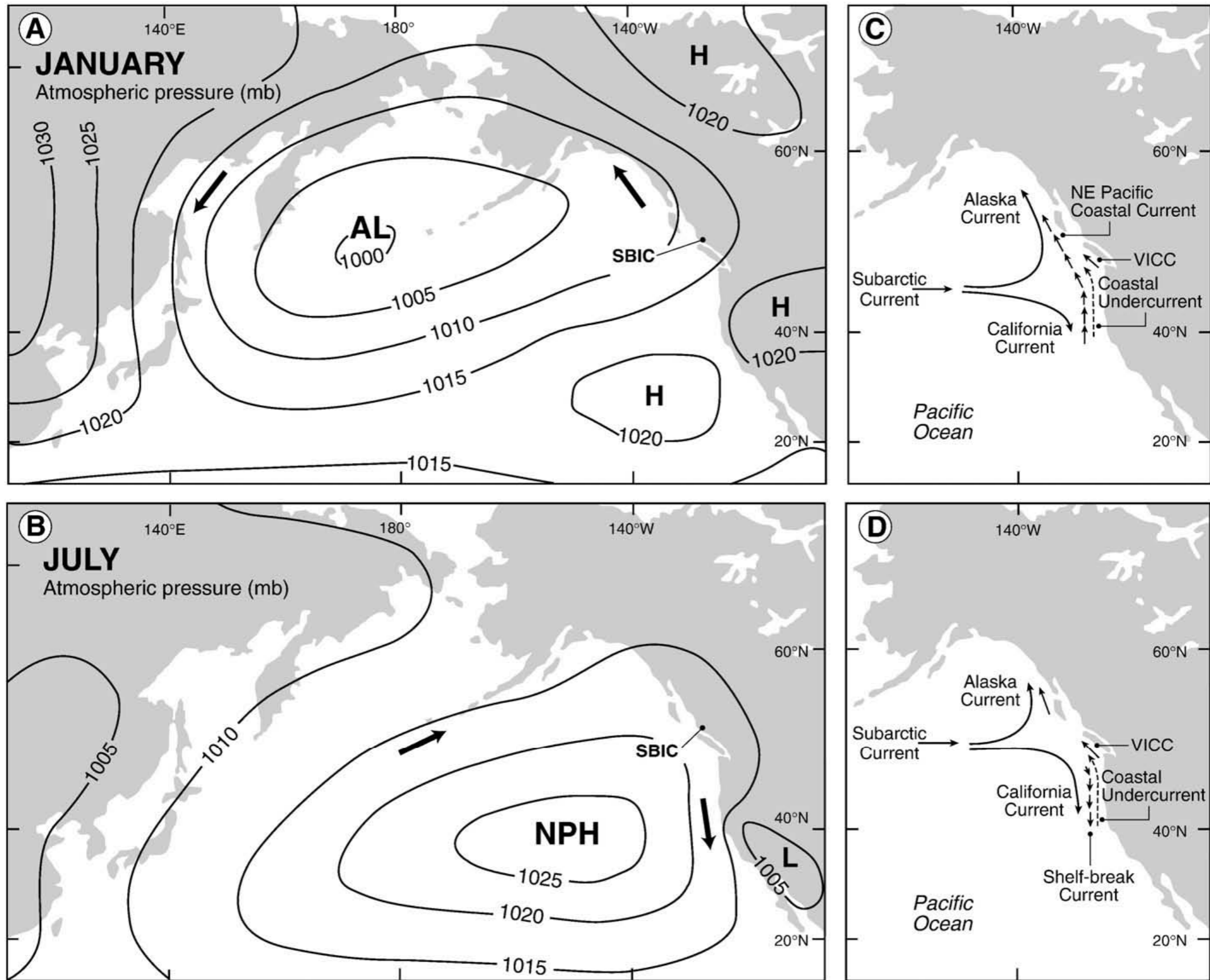
4 std.dev. above long-term mean!  
 “If” Gaussian: 1/15,000 or 1/1000yrs  
 Lasting more than a year: 1/10,000yrs  
 (<http://www.esrl.noaa.gov/psd/>)



# Atmospheric Forcing - Ocean Response

## How and Why Did It Form

- 1) Weak Aleutian Low (& shifted jet-stream) in 2013-2014
- 2) Weaker winds and storm activity in GOA (wind speed  $\frac{1}{2}u$ )
  - Reduced Ekman transport,  $\tau/f$  (wind stress  $\frac{1}{4}$ )
    - Reduced advection/transport from colder NW region
    - Reduced thinning/Ekman pumping of GOA surface layer
  - Reduced heat flux out of ocean into atmosphere
  - Reduced energy flux ( $\frac{1}{8}, u^3$ ) into surface ocean (mixing)
    - Reduced heat flux out of bottom of surface layer
    - Reduced nutrient flux into surface layer
- 3) Lack of cooling → warming: The Blob



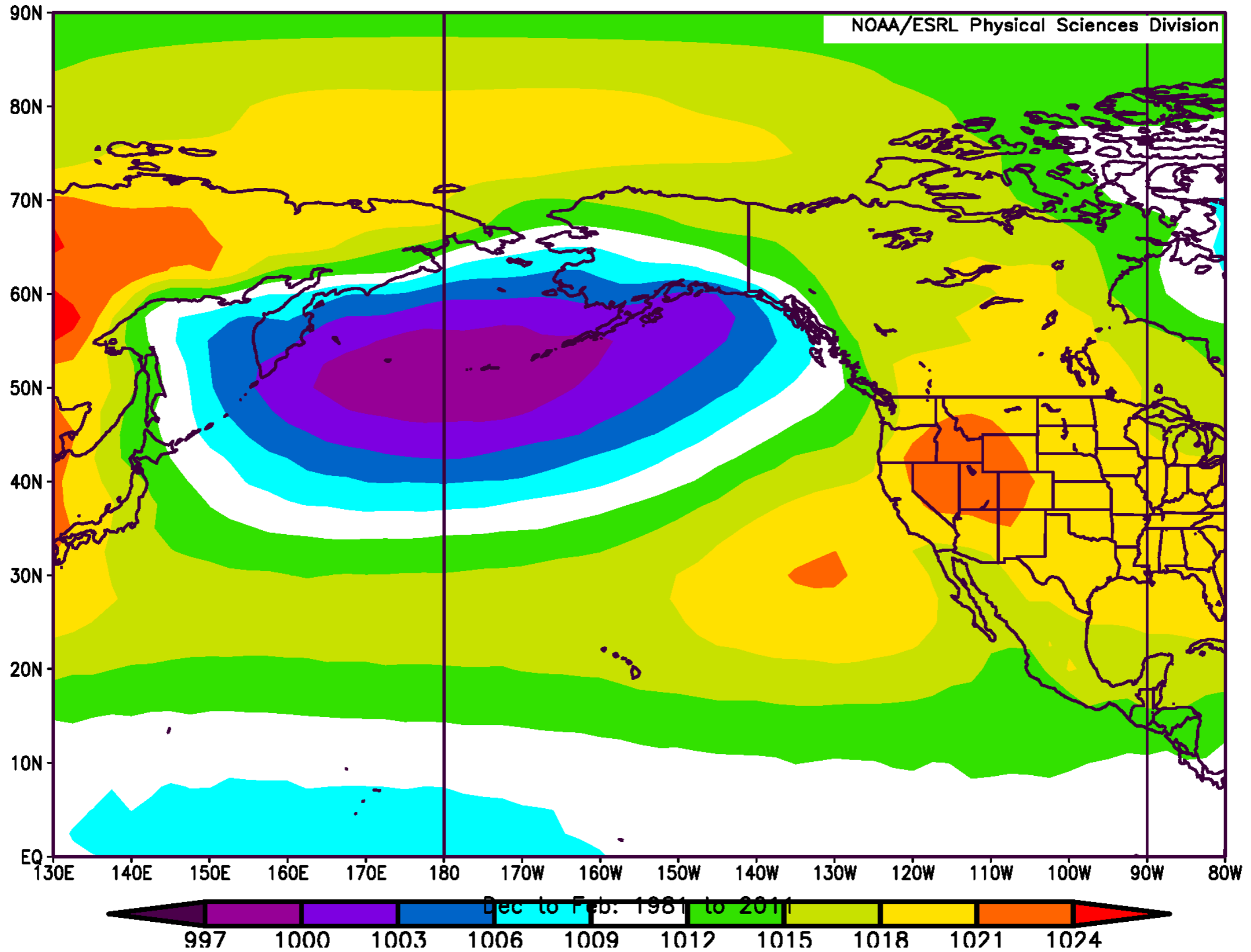
**Fig. 3.** Maps showing main ocean–atmosphere circulation features for the NE Pacific region in winter (A,C) and summer (B,D) months and the location of the Seymour–Belize Inlet Complex (SBIC) (after Favorite et al., 1976). In summer, northerly North Pacific High (NPH) winds generate the southward Shelf-Break Current at the surface and consequent offshore Ekman transport induces upwelling. During winter, southerly winds generate a northward drift producing the NE Pacific Coastal Current and consequent onshore Ekman transport. This causes an accumulation of low density, less saline water on the surface, thus restricting the upwelling of deep water. The Vancouver Island Coastal Current (VICC) and Coastal Undercurrent are permanent features although they vary in strength seasonally.

# Typical/Mean SLP Dec-Feb, Aleutian Low

NCEP/NCAR Reanalysis Sea Level Pressure  
Sea Level Pressure (mb) Composite Mean

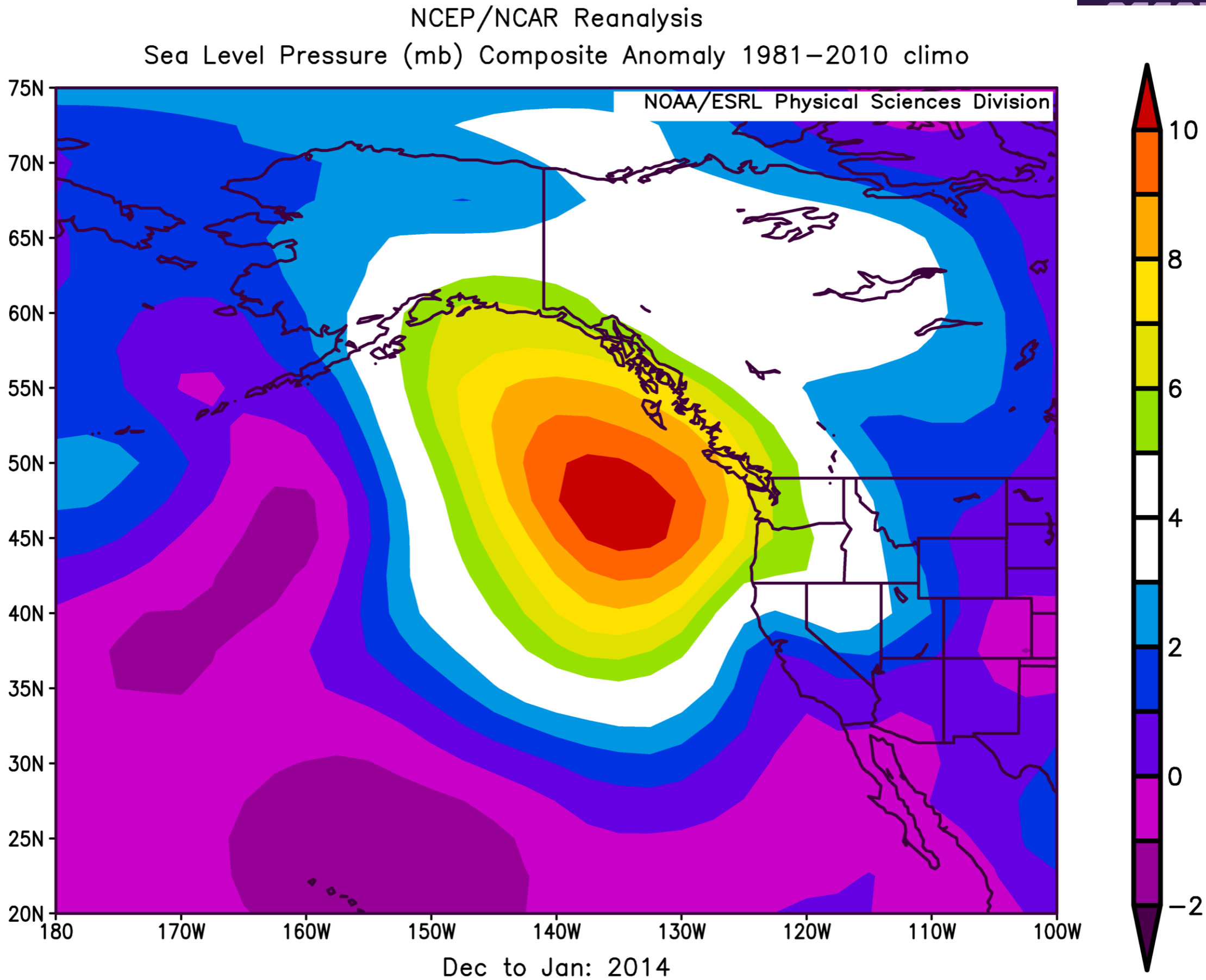
NOAA/ESRL Physical Sciences Division

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# SLPa for Dec 2013 – Jan 2014

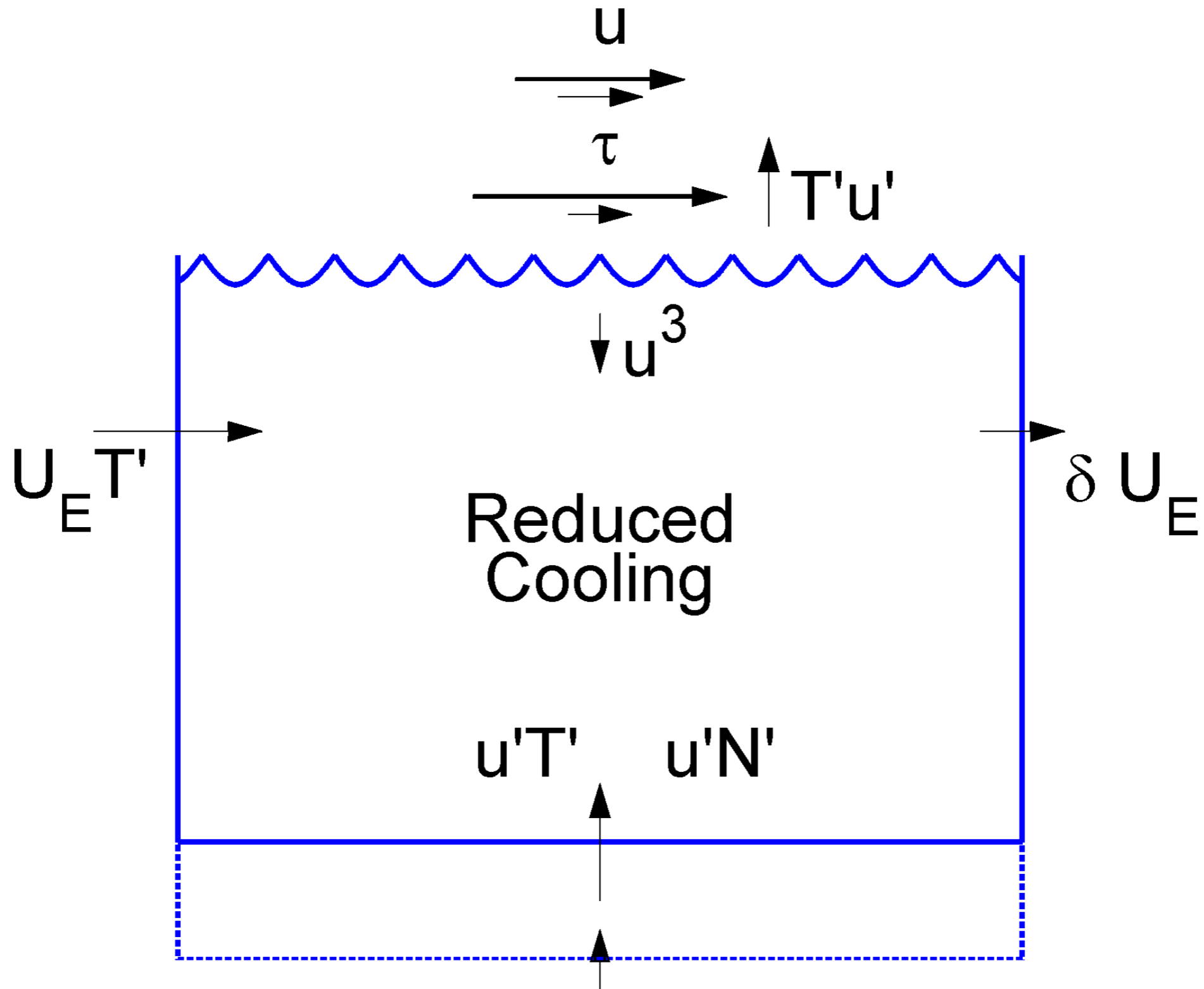
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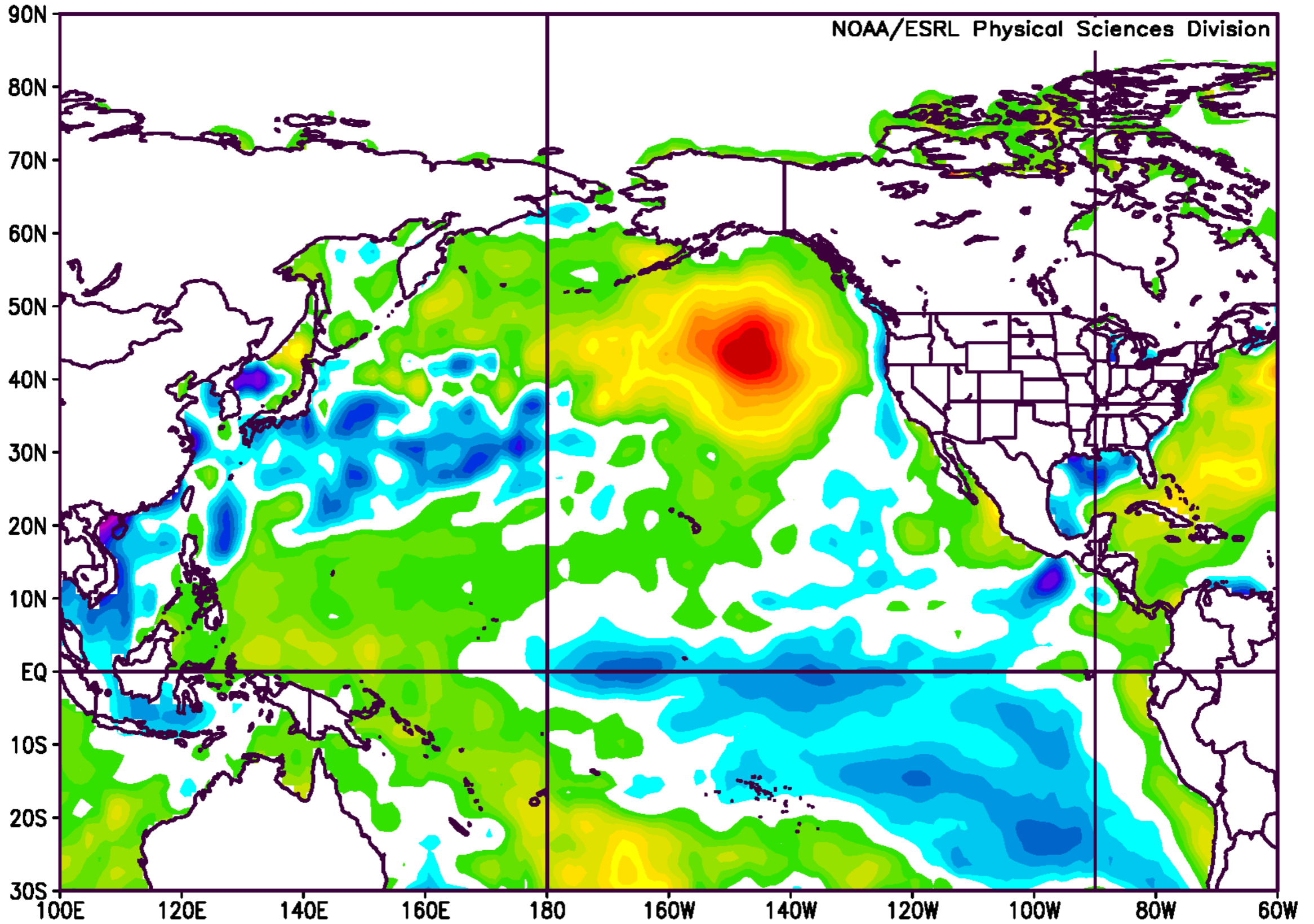


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SPACE

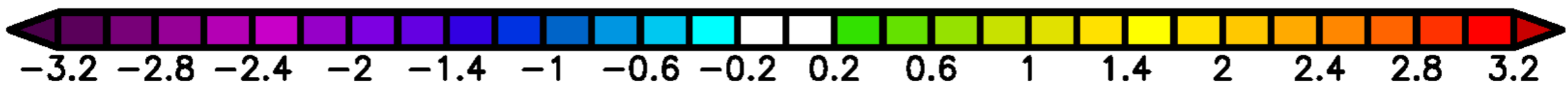
University  
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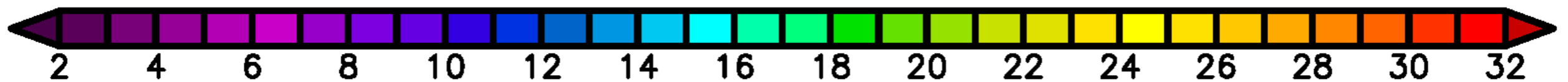
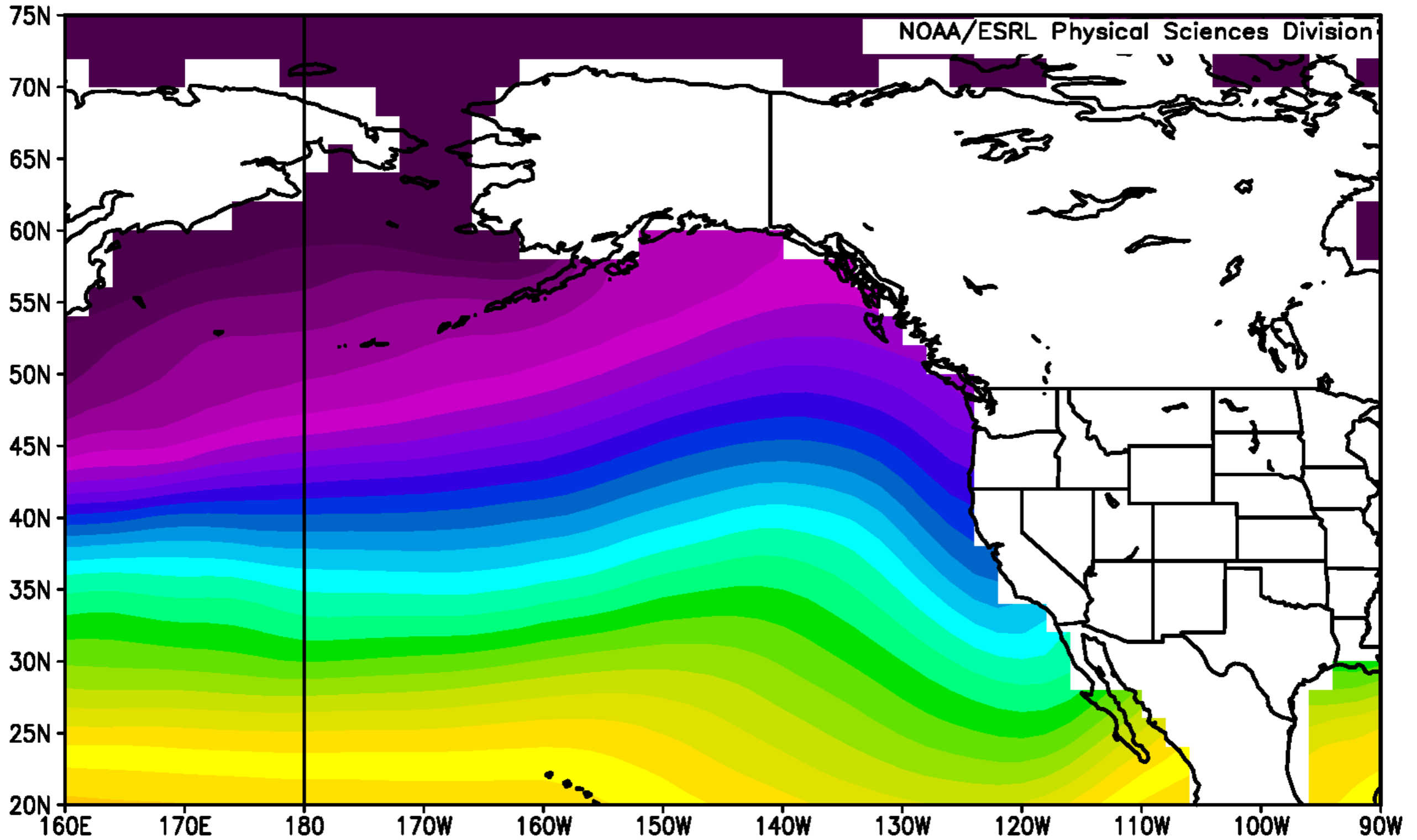




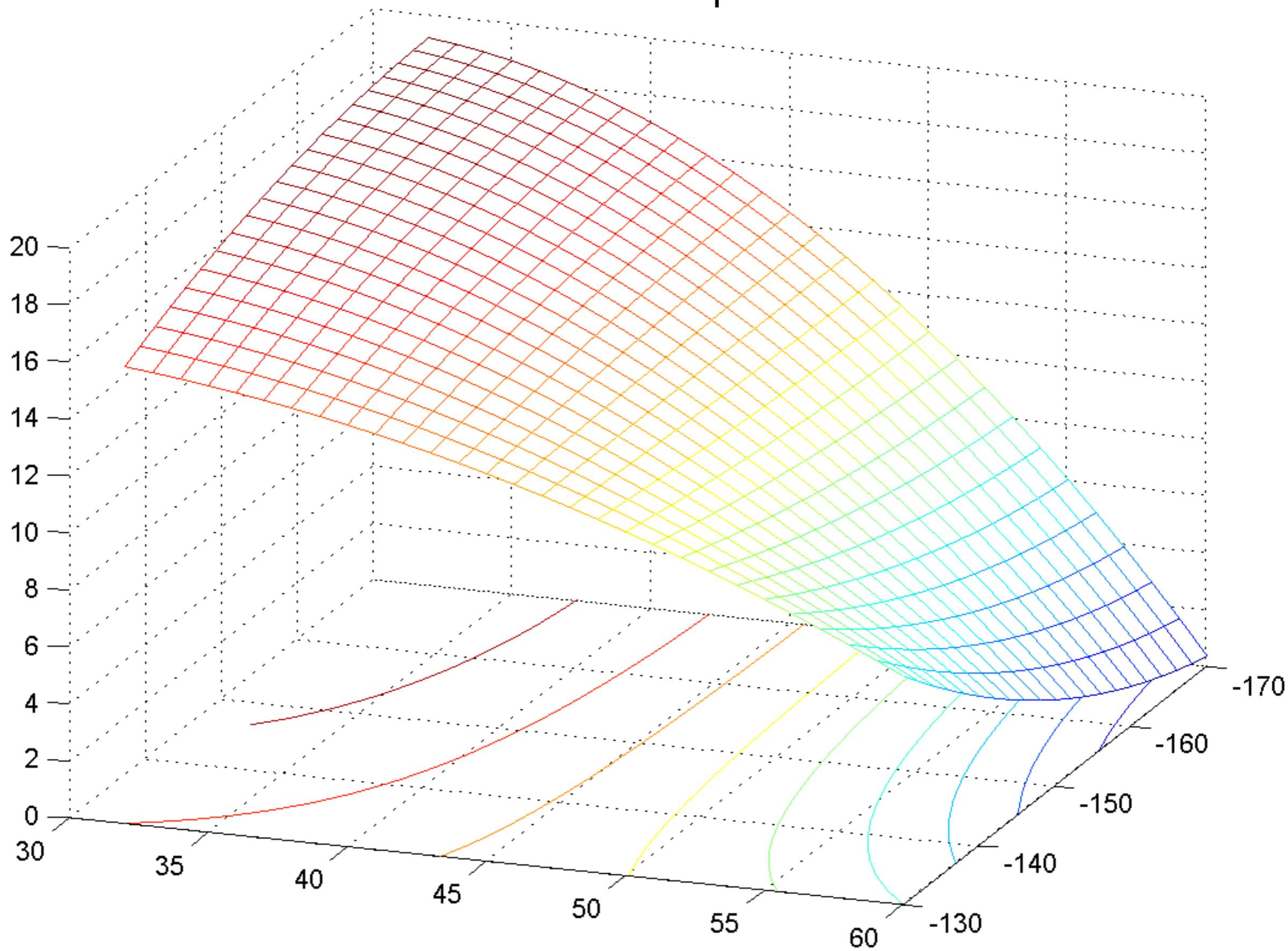
Jan 2014



NOAA Extended SST V4 (ERSST)  
Surface SST (C) Composite Mean

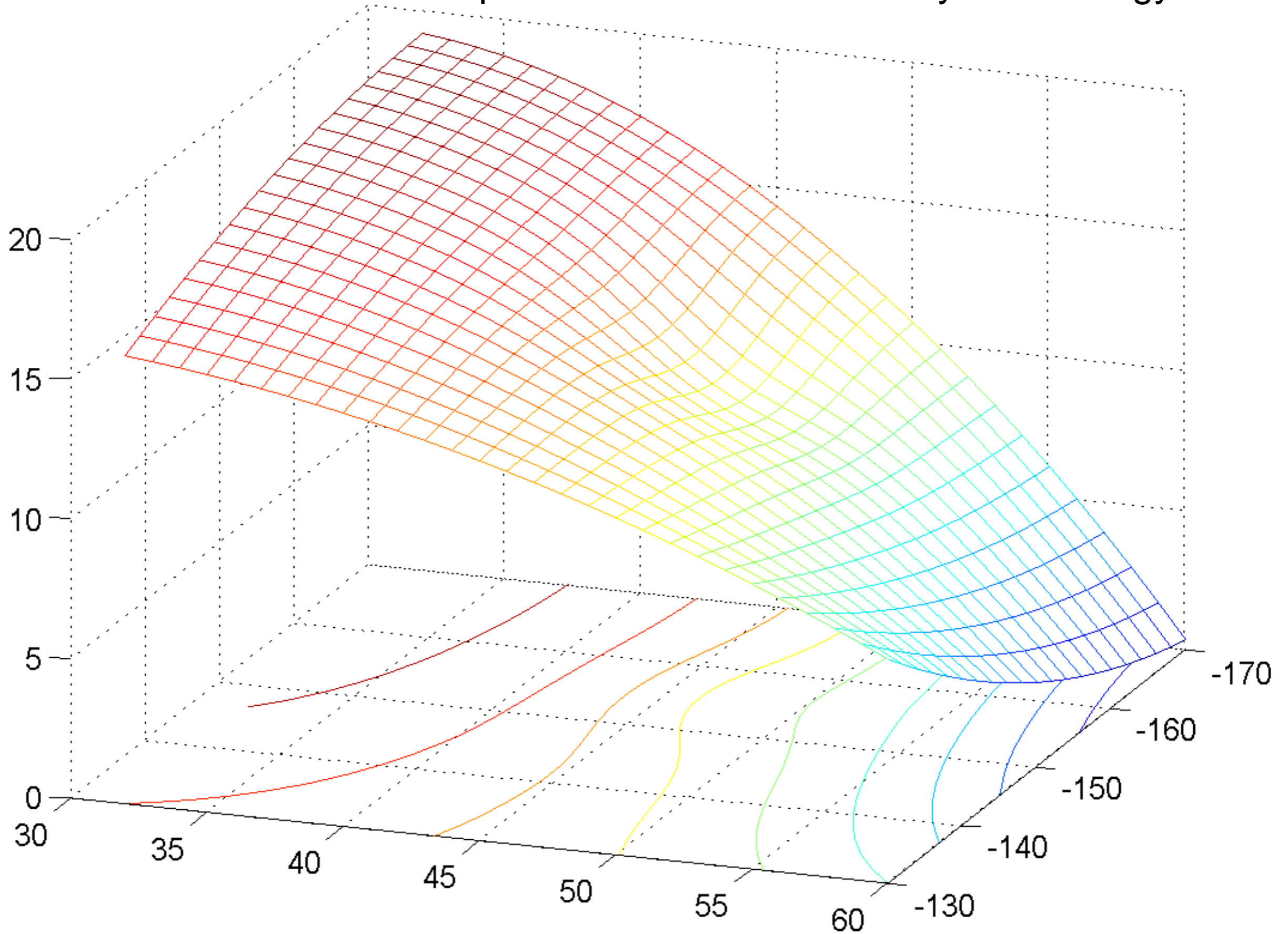


# Idealized Smooth NEP Temperature Surface

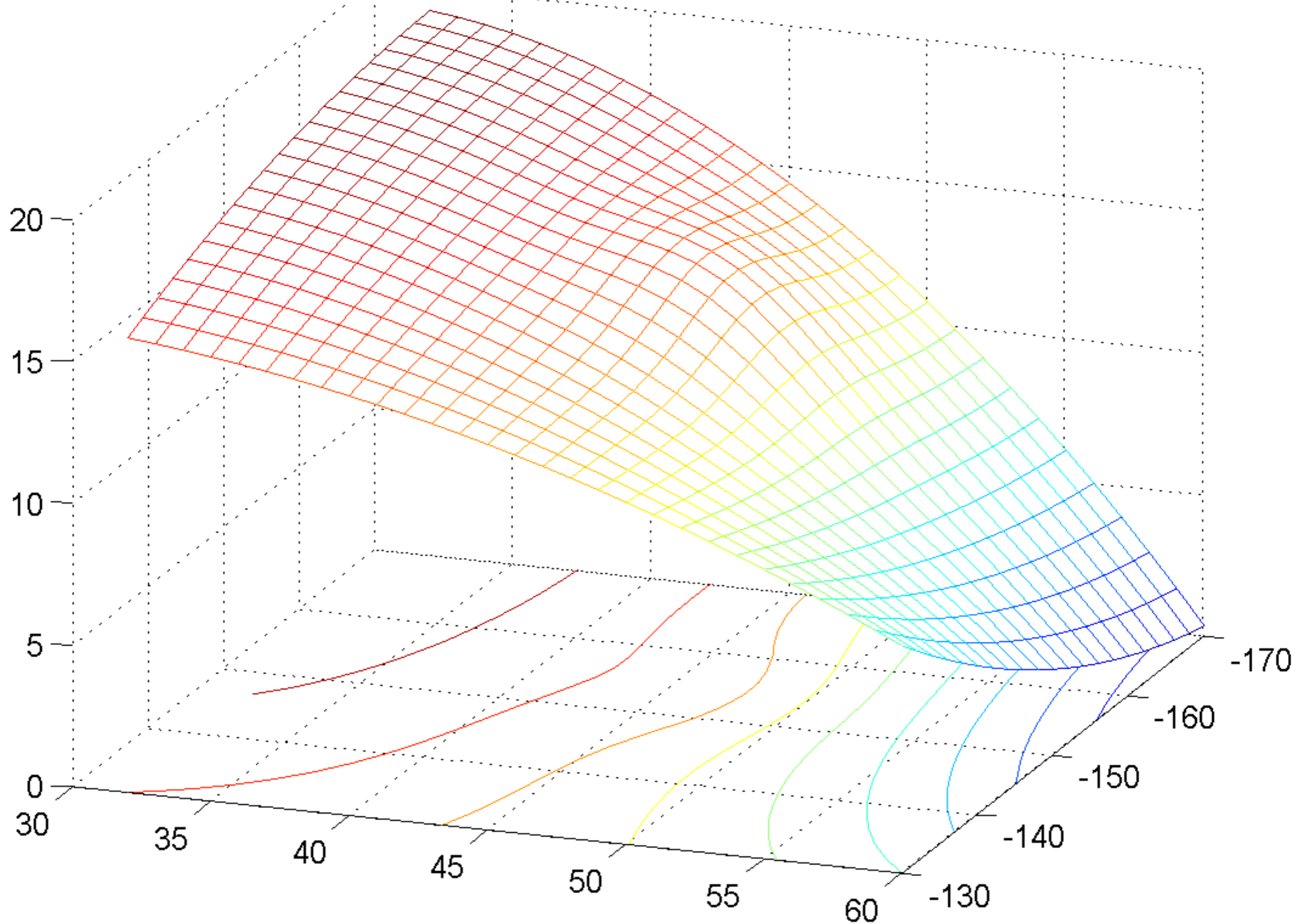




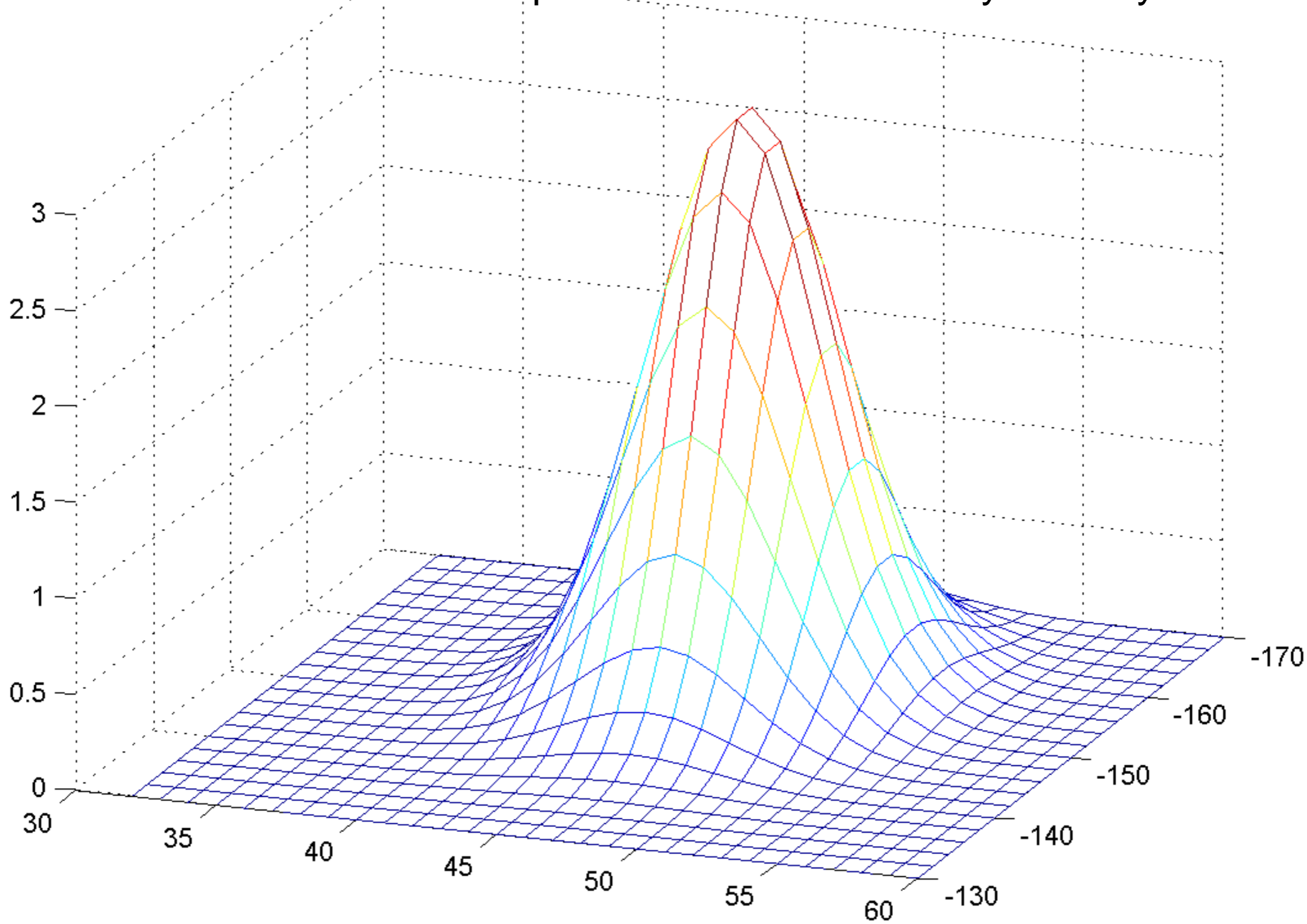
# Idealized Smooth NEP Temperature Surface – January Climatology



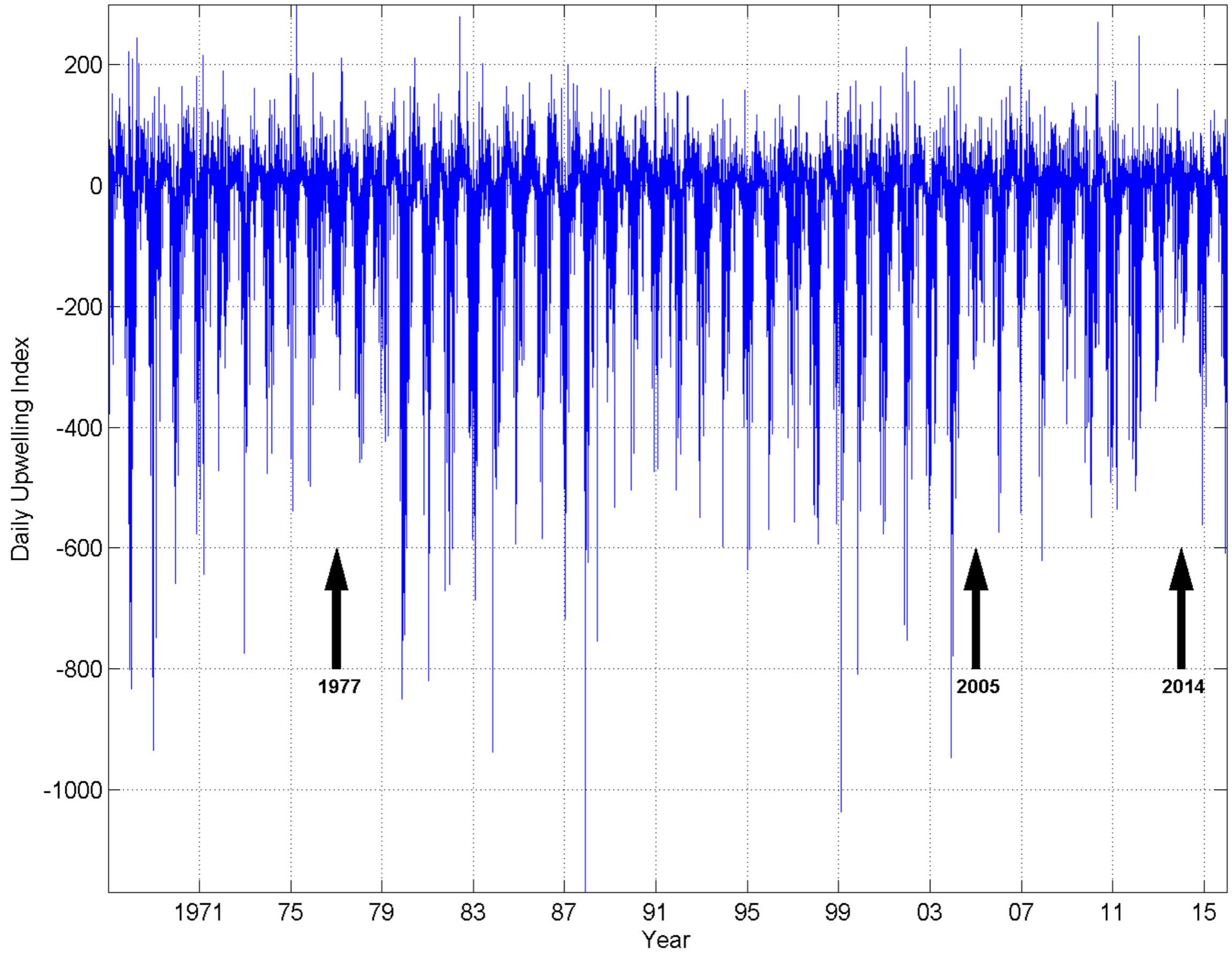
Idealized Smooth NEP Temperature Surface – January 2014



# Idealized Smooth NEP Temperature Surface Anomaly January 2014

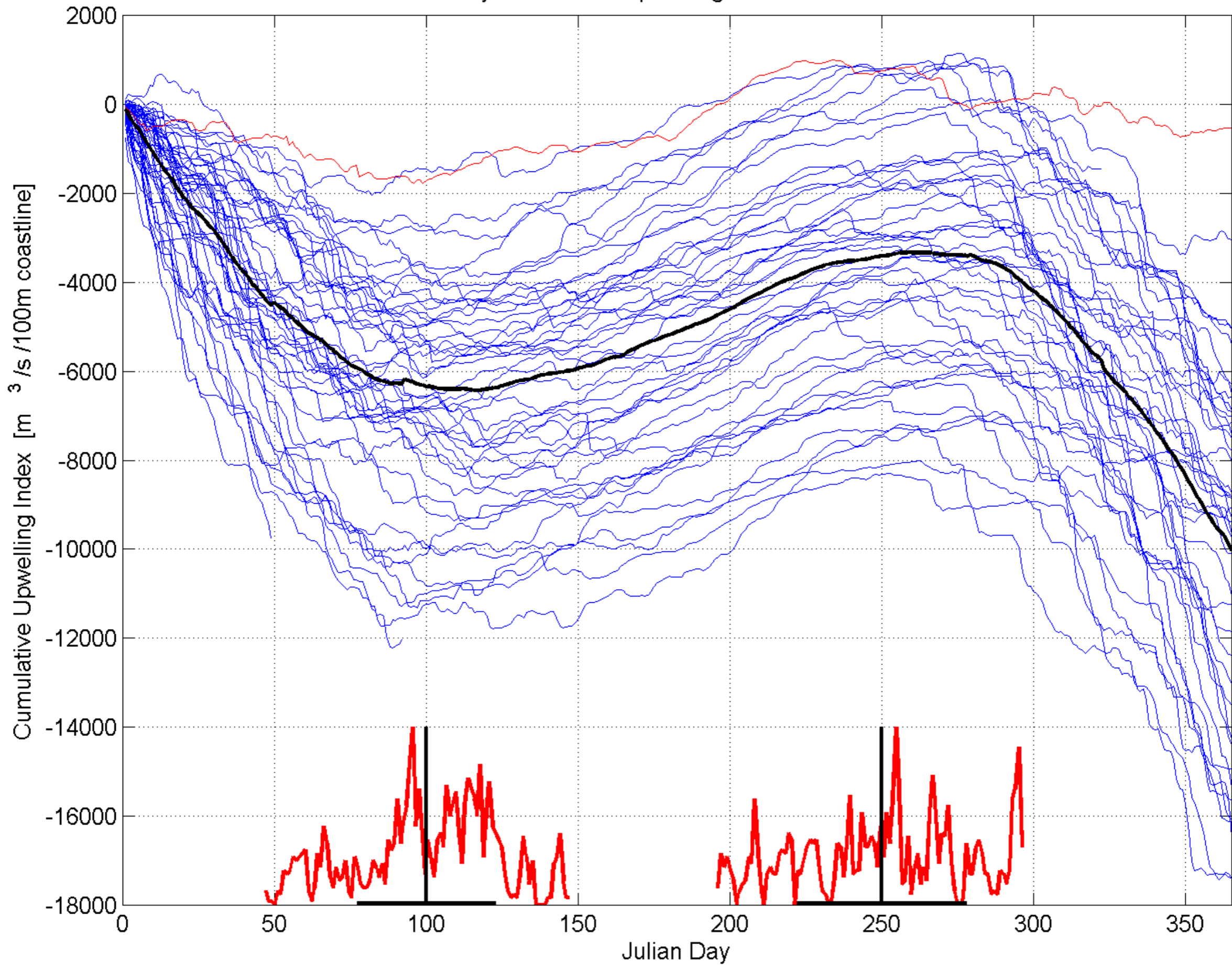


# Daily Upwelling Index from 48°N 125°W

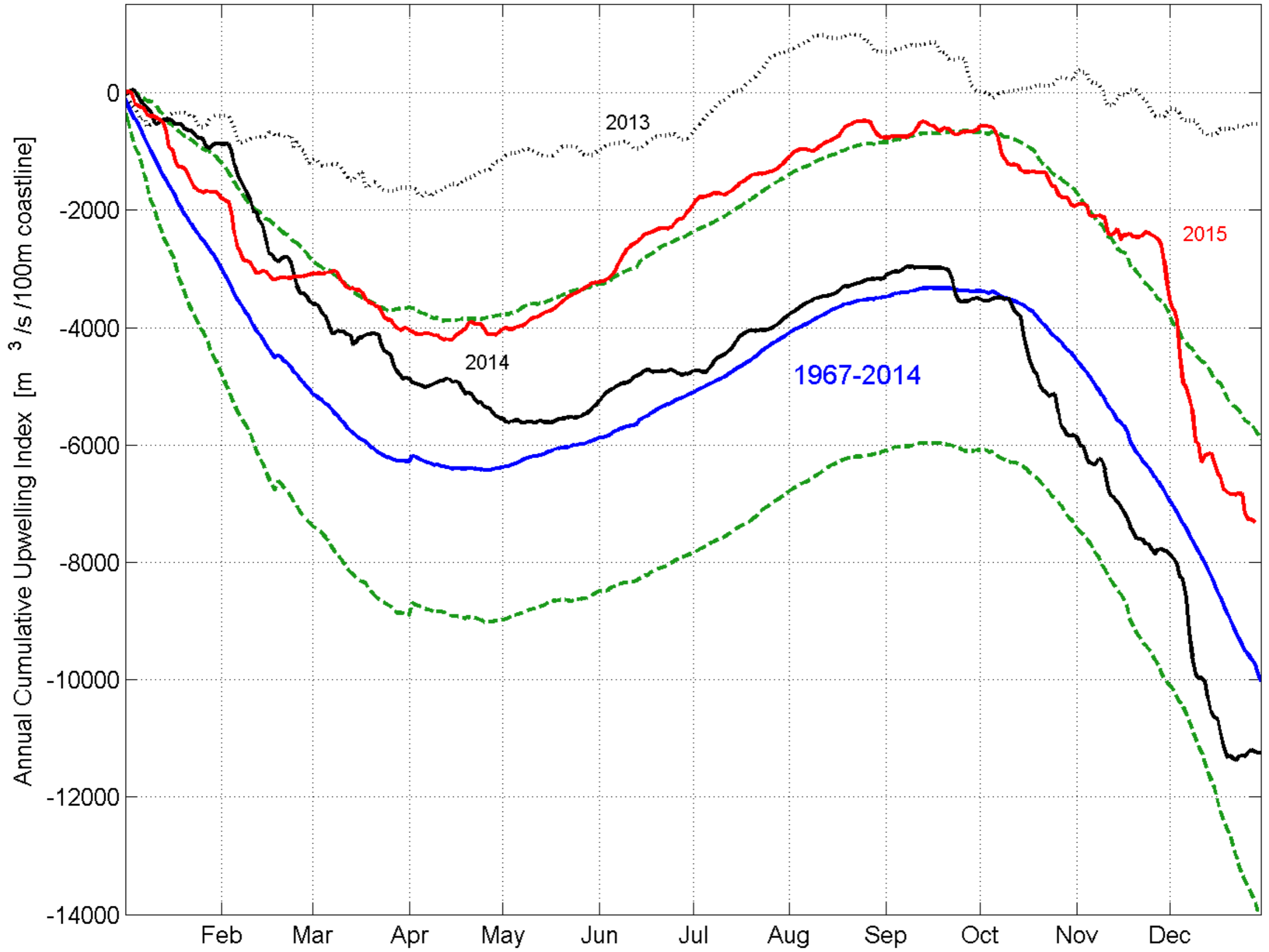


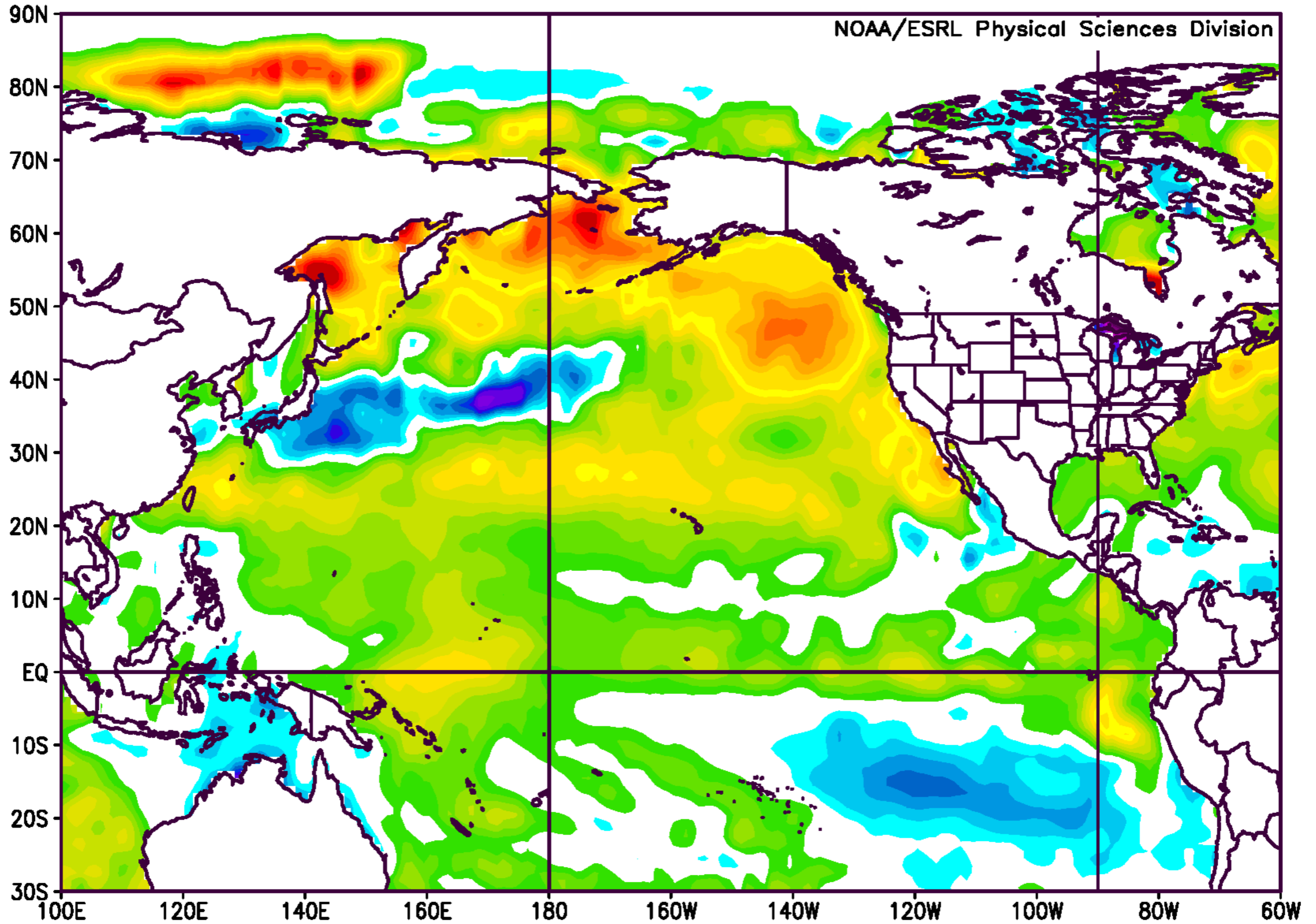


Yearly Cumulative Upwelling Index 48°N 125°W

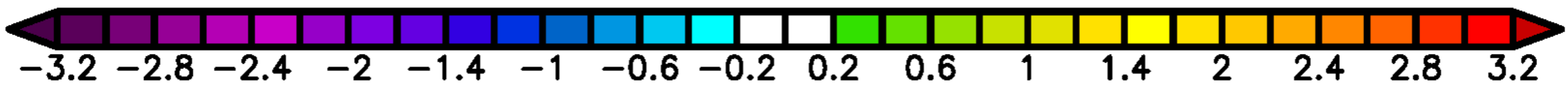


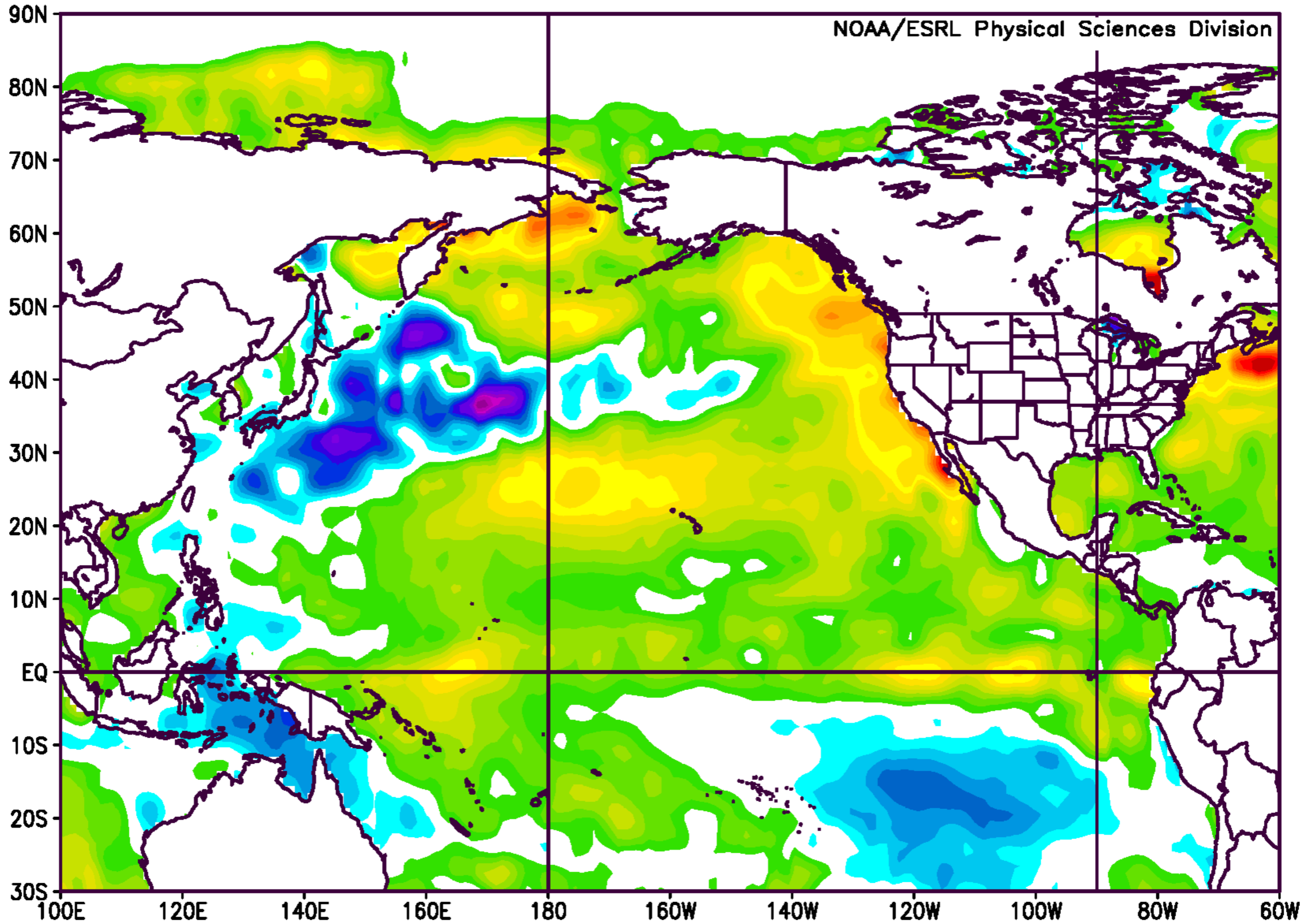
Cumulative Upwelling Index from 48°N 125°W



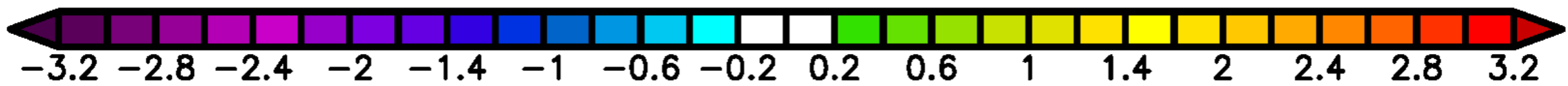


Sep 2014

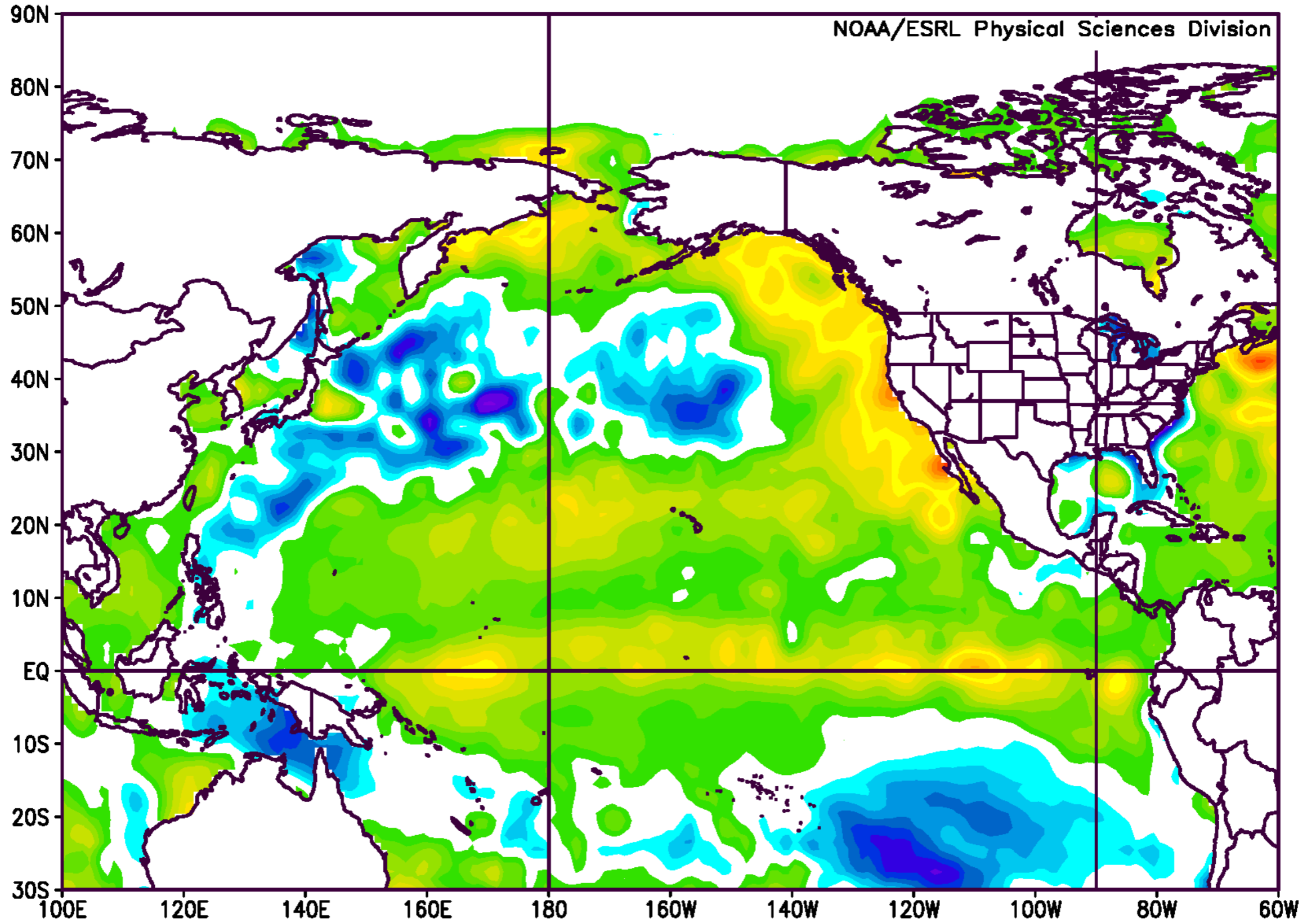




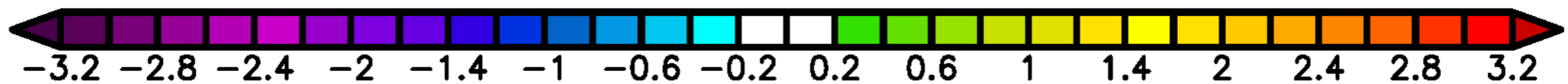
Oct 2014



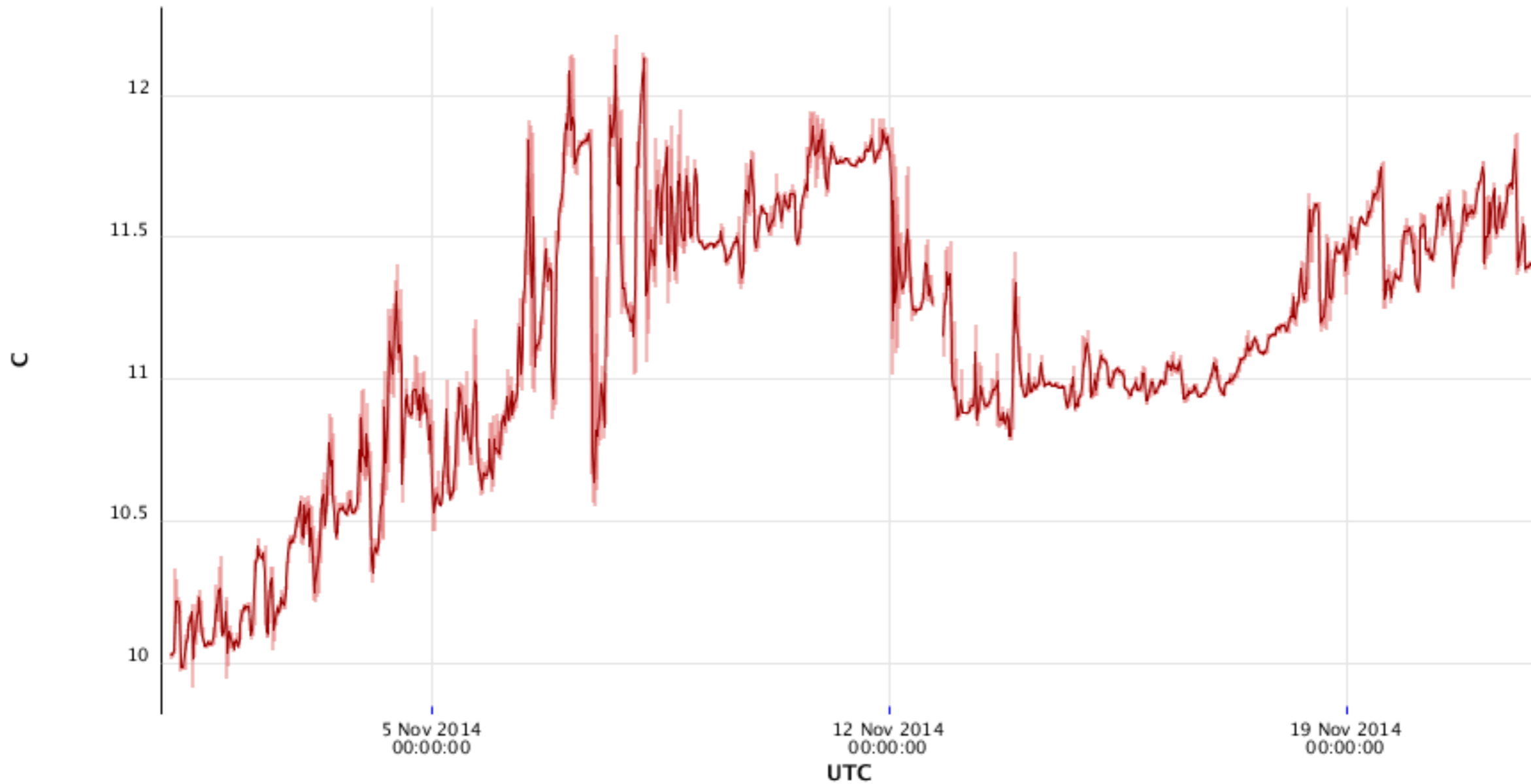




Nov 2014



Northeast Pacific Ocean - Folger Passage - Folger Deep - CTD - Temperature

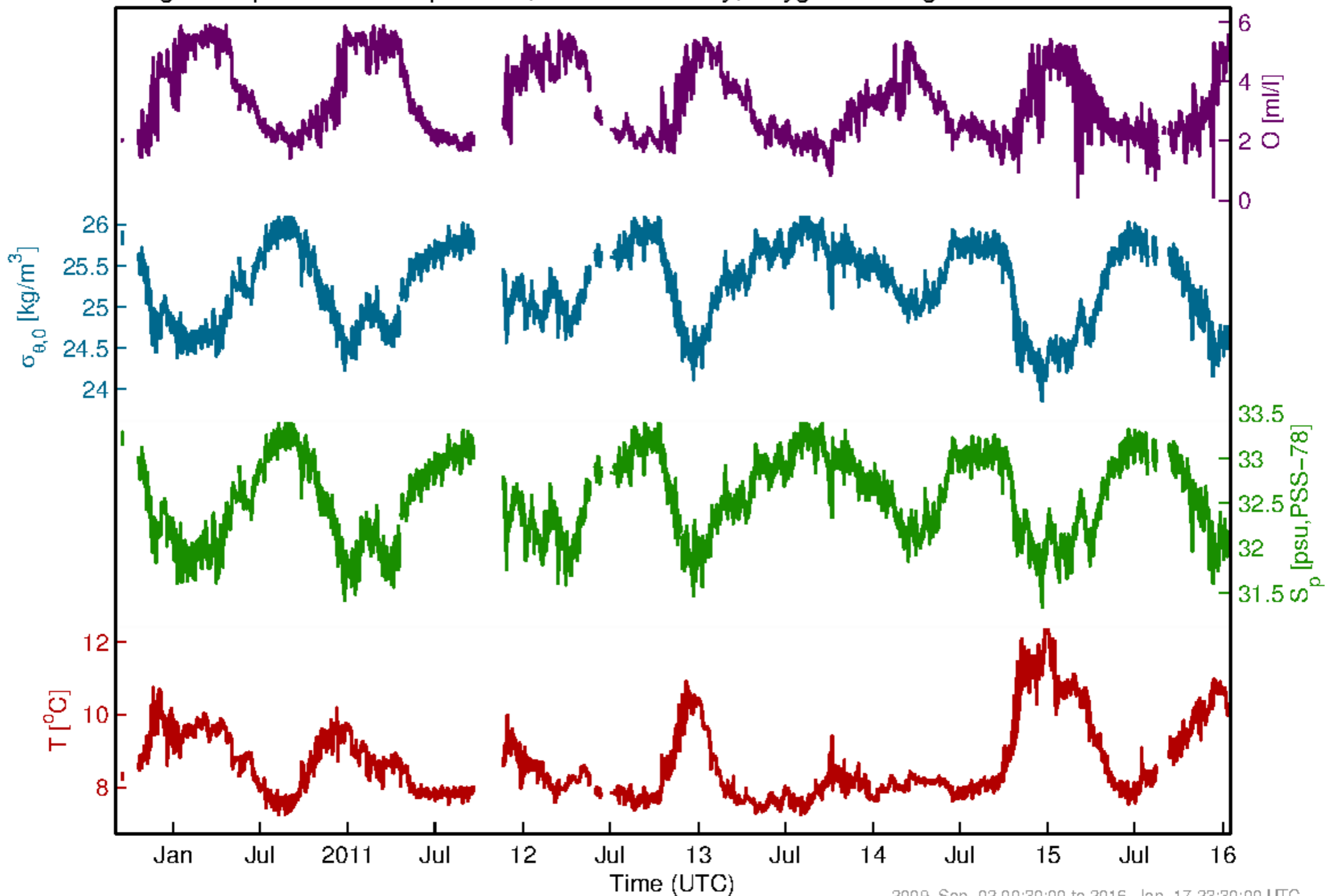


Northeast Pacific Ocean - Folger Passage - Folger Deep - CTD - Temperature

- Northeast Pacific Ocean - Folger Passage - Folger Deep - CTD - Temperature (85 11) - Clean - MinMax - Downsampled
- Northeast Pacific Ocean - Folger Passage - Folger Deep - CTD - Temperature (85 11) - Clean - Avg - Downsampled

# OCEAN NETWORKS CANADA NEPTUNE

Folger Deep at 97m: Temperature, Practical Salinity, Oxygen and Sigma-Theta

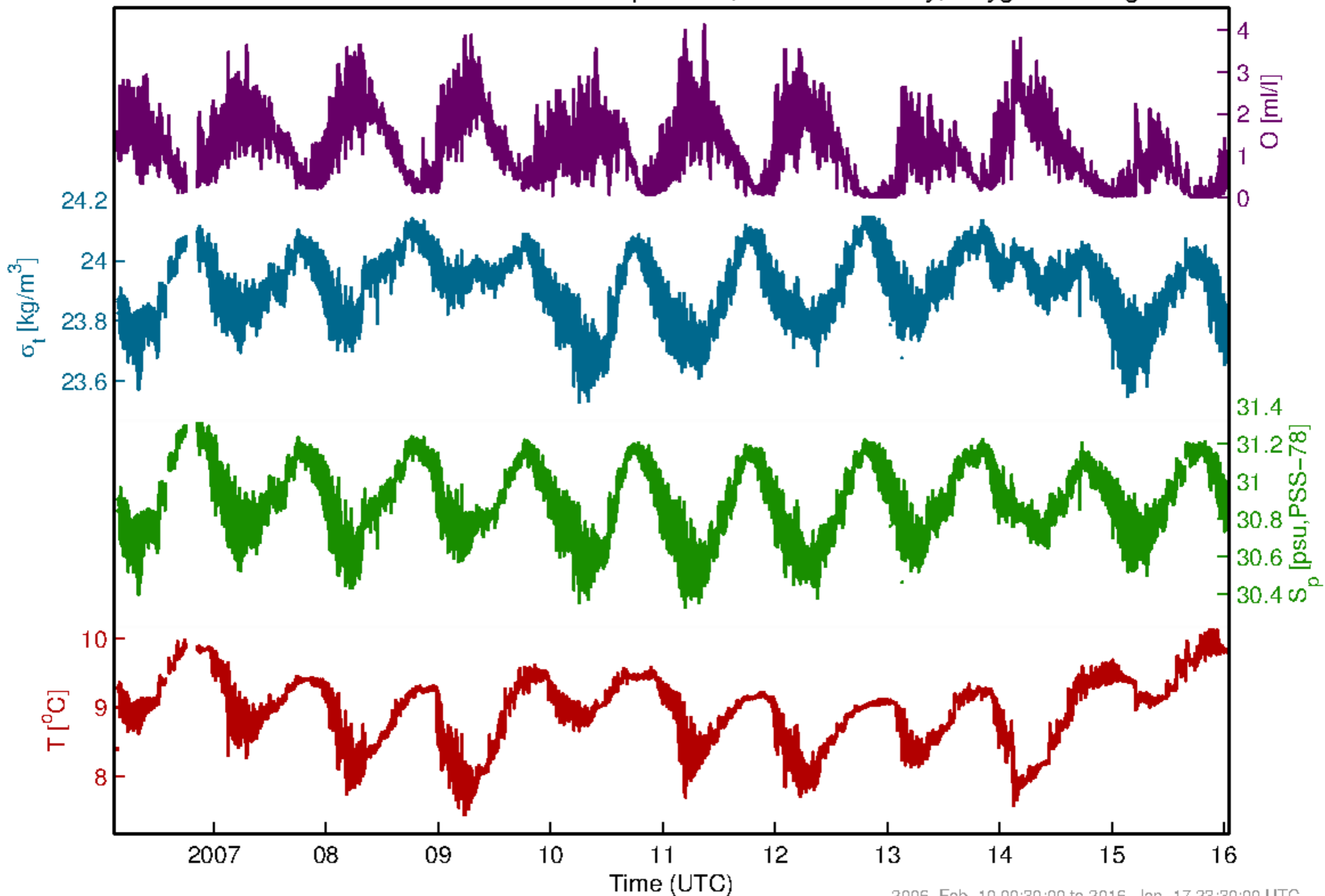


2009-Sep-02 00:30:00 to 2016-Jan-17 23:30:00 UTC

Plot generated on 2016-Jan-18 10:23:49 PST

# OCEAN NETWORKS CANADA VENUS

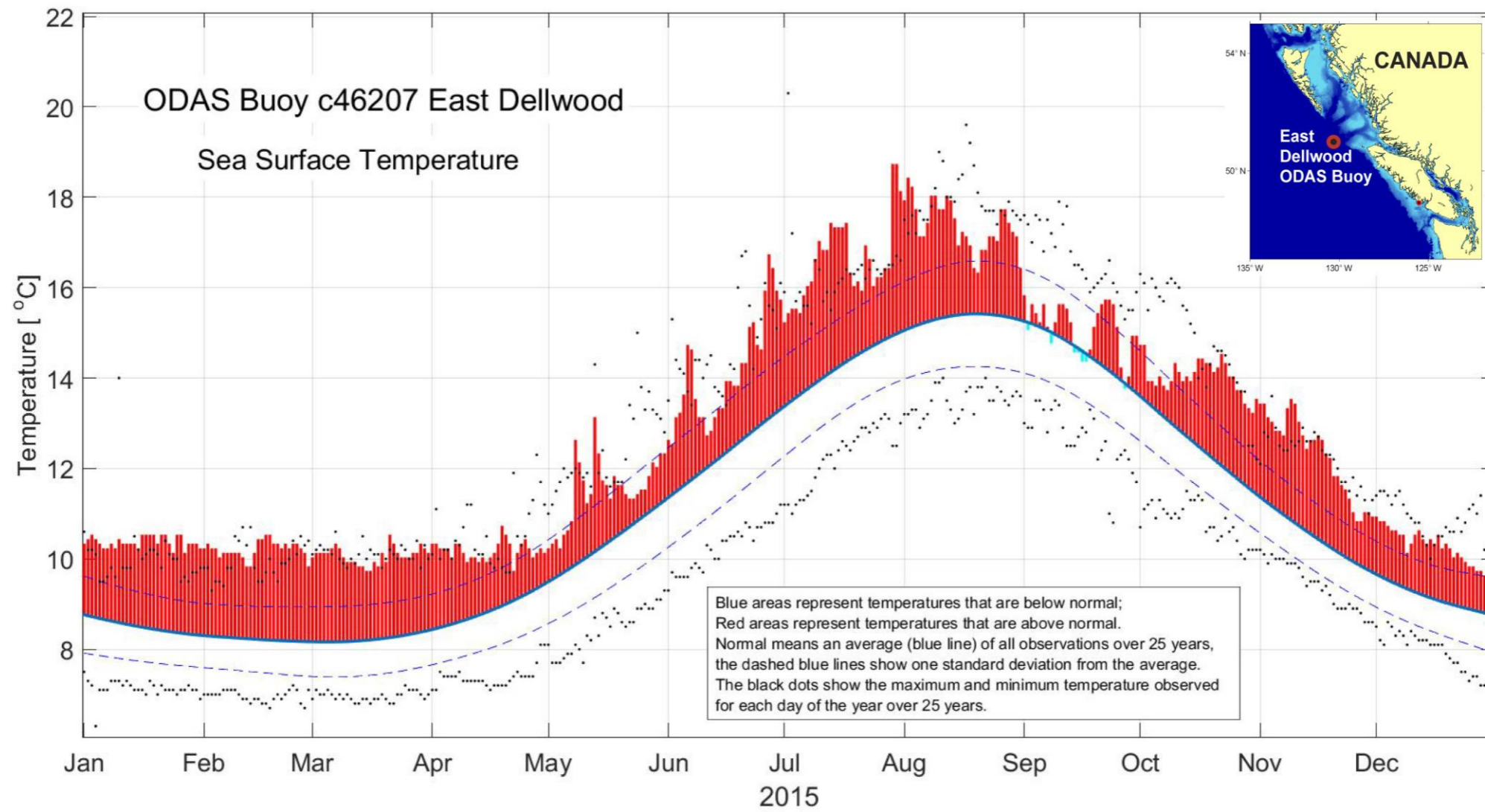
Saanich Inlet Central Node VIP at 96m: Temperature, Practical Salinity, Oxygen and Sigma-T

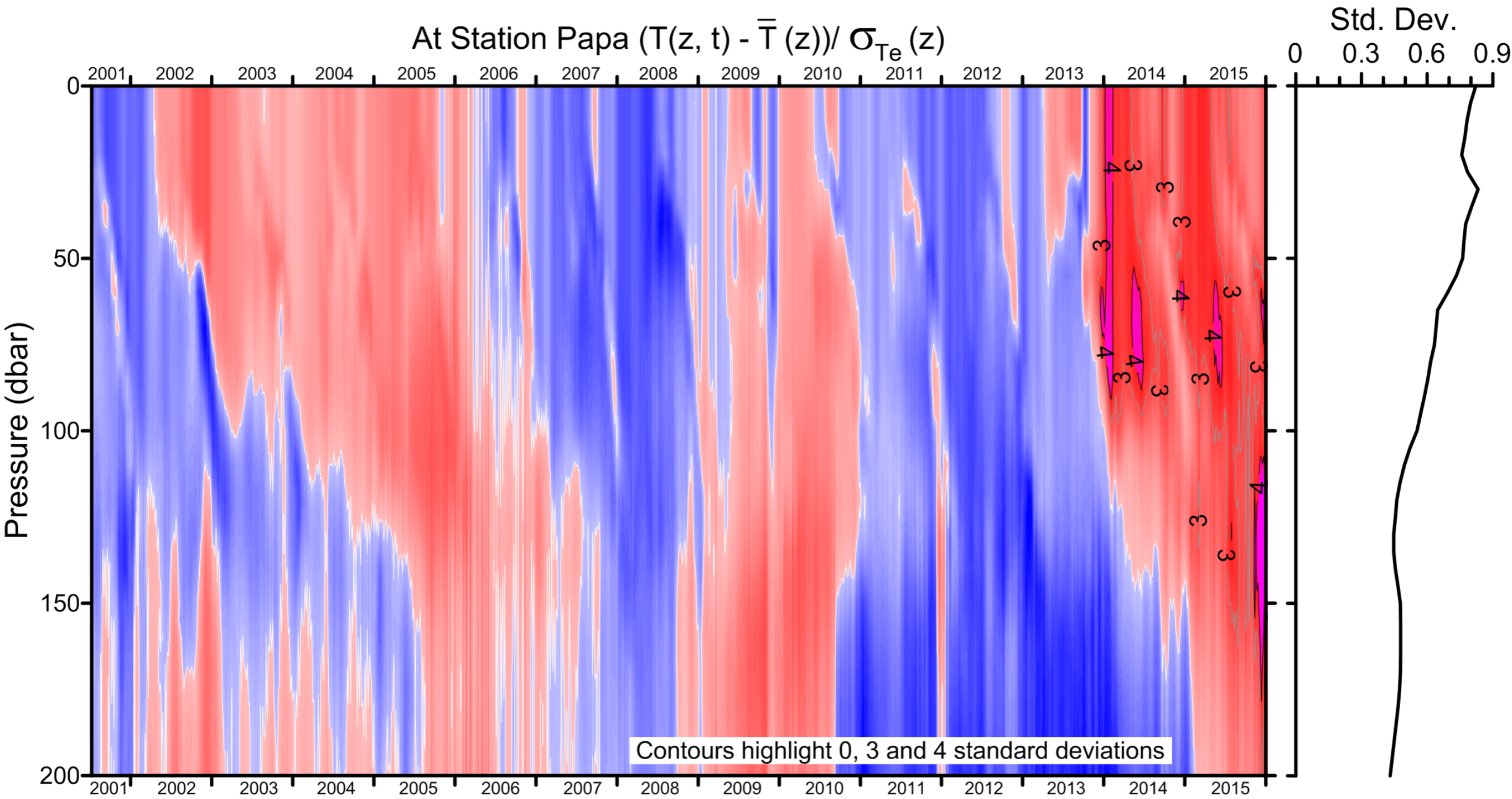


2006-Feb-10 00:30:00 to 2016-Jan-17 23:30:00 UTC

Plot generated on 2016-Jan-18 06:24:53 PST







Argo Profile Data Composite near Station Papa  
(Freeland)

## Summary – A Brief Overview

- 1) NEP Warm Anomaly
  - Atmospheric Forced Ocean Response
- 2) Weak Aleutian Low, weak winds, minimal storms, reduced cooling → warm anomaly
- 3) Status:
  - Surface signature becoming washed out by recent winds/storms
  - Subsurface signature still remains
- 4) Thoughts on cause of weak Aleutian Low
  - Arctic: Low seasonal ice 2012, Arctic Vortex, Jet Stream
- 5) Monthly plots of SLP/SLPa, SST/SSTa

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