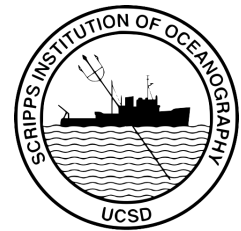


# The evolution and known forcing mechanisms behind the 2013-2015 North Pacific warm anomalies

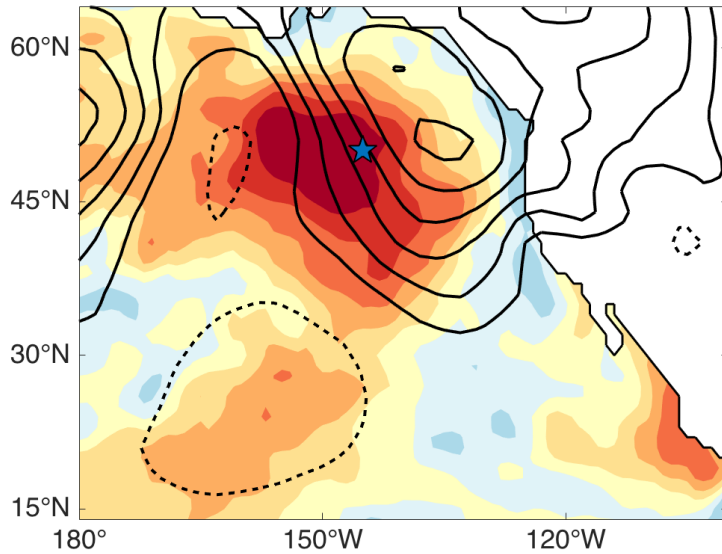
Dillon J. Amaya, Nicholas E. Bond,  
Arthur J. Miller, and Michael J. DeFlorio

“A Tale of Two Blobs” in *Variations*

June 7, 2016



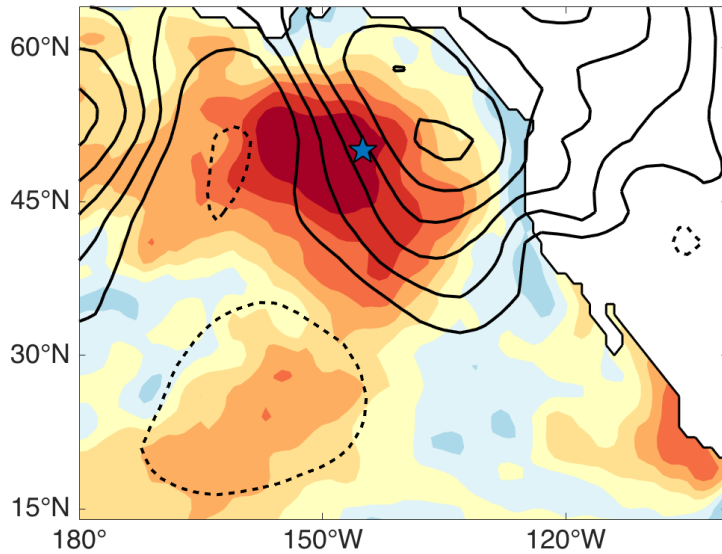
## The Blob



Normalized SSTAs (shading)  
SLPAs (black contours)

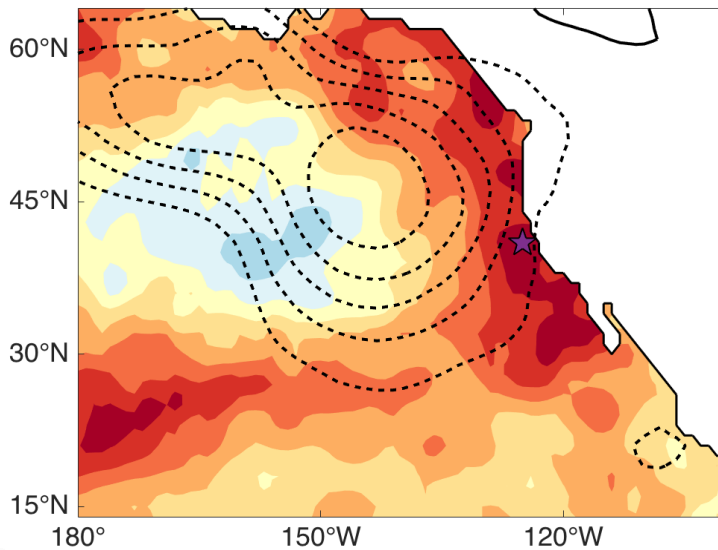
A series of unfortunate  
(warm) events

The Blob

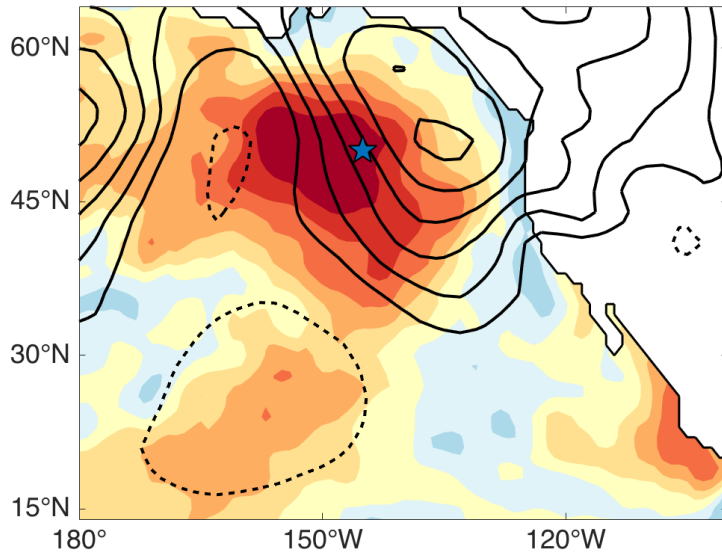


A series of unfortunate  
(warm) events

Arc Pattern

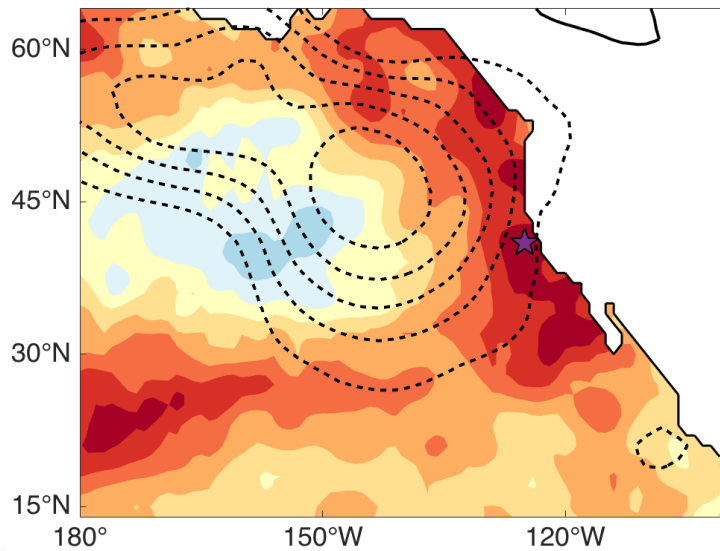


The Blob

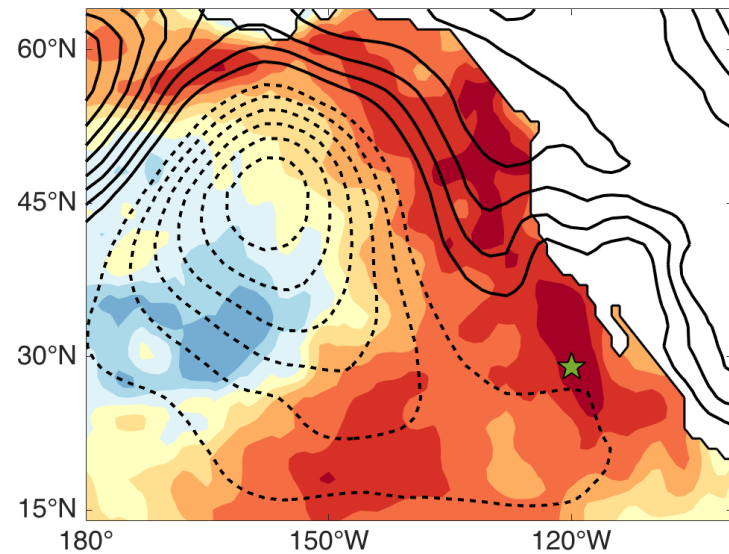


A series of unfortunate  
(warm) events

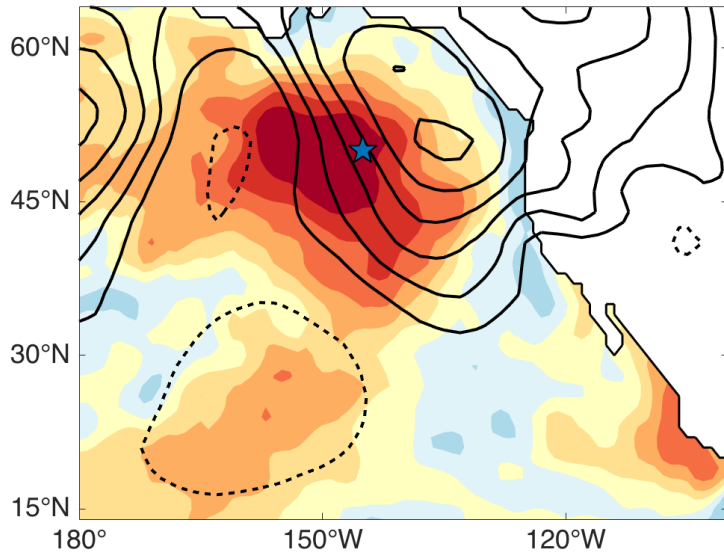
Arc Pattern



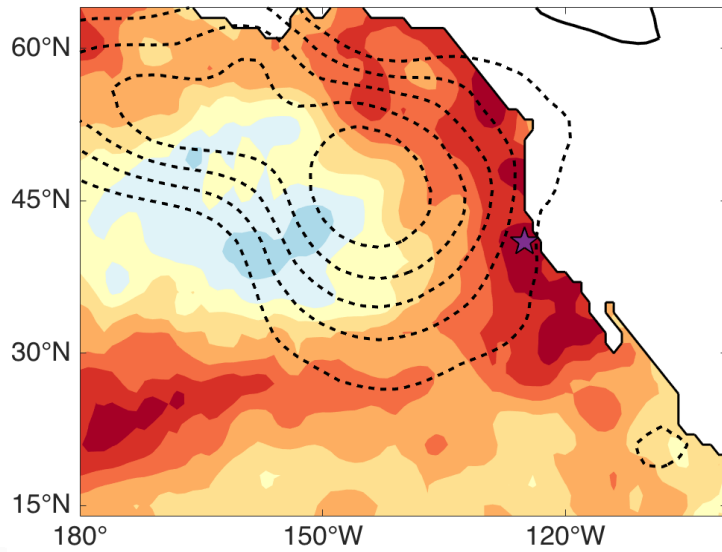
Baja Warming



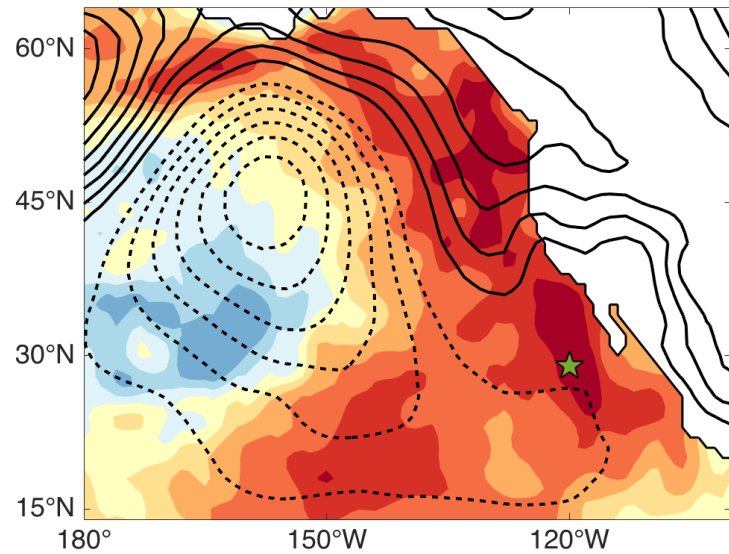
### The Blob

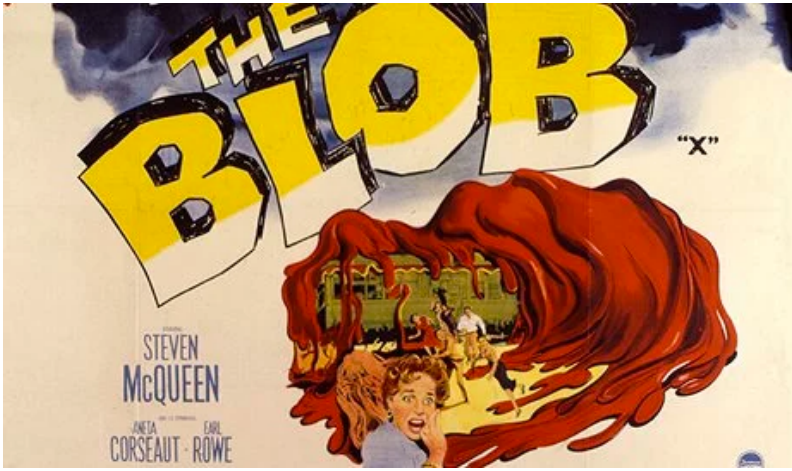


### Arc Pattern

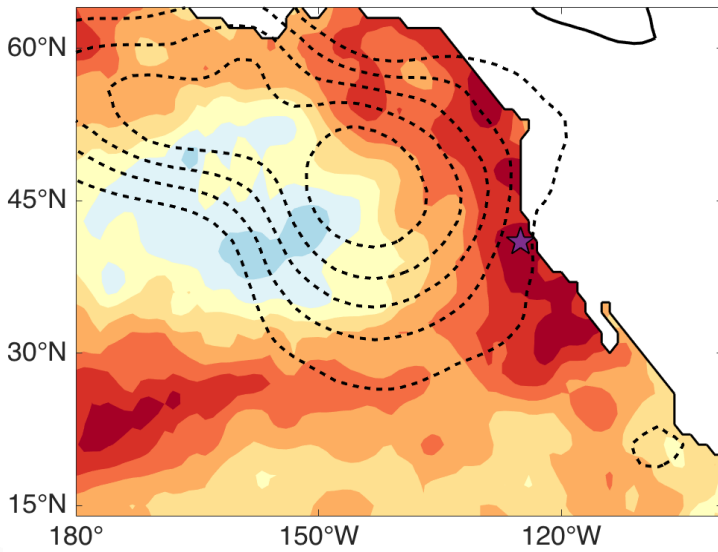


### Baja Warming

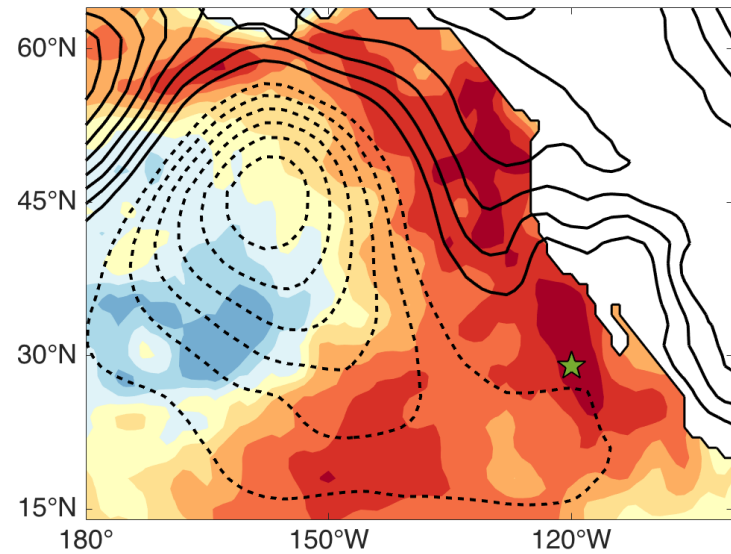


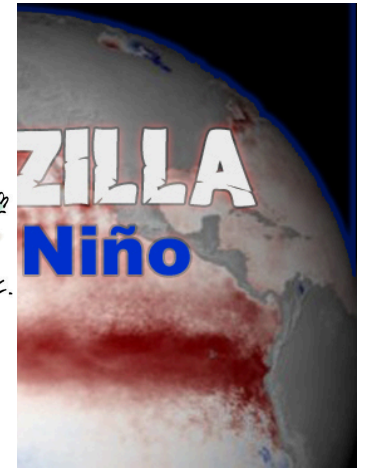


Arc Pattern

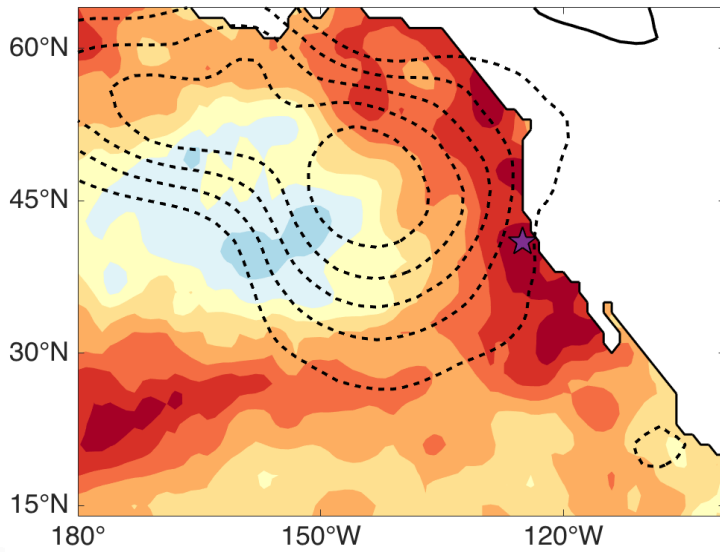


Baja Warming

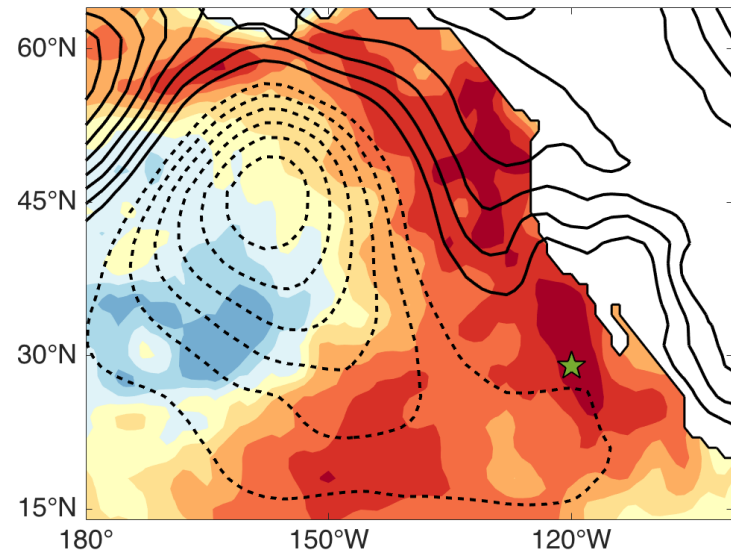


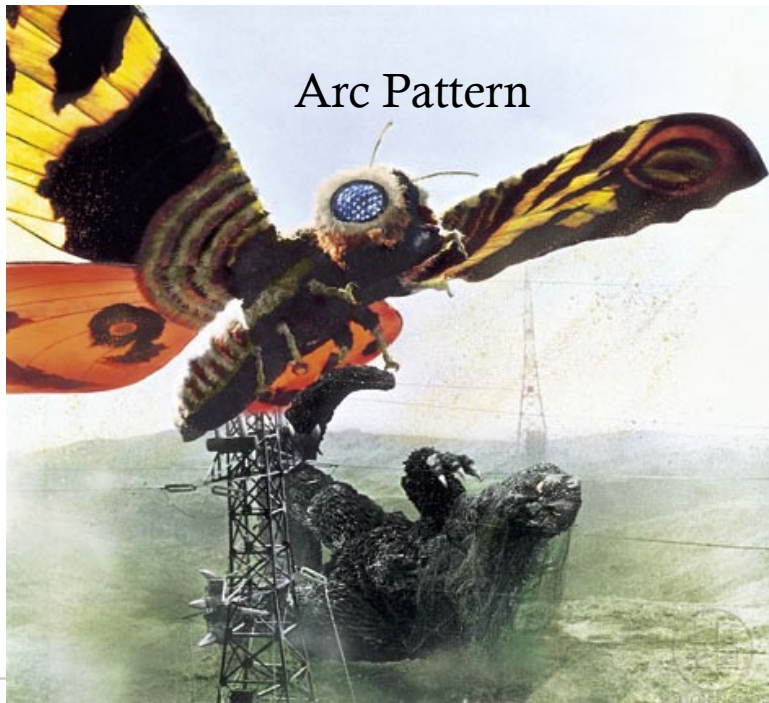
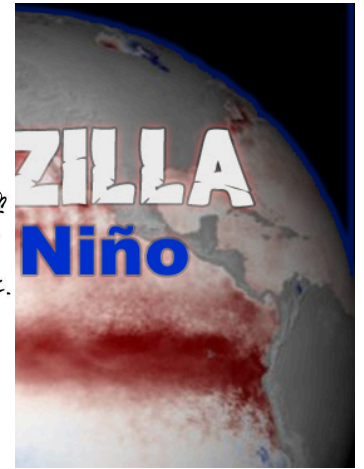


Arc Pattern



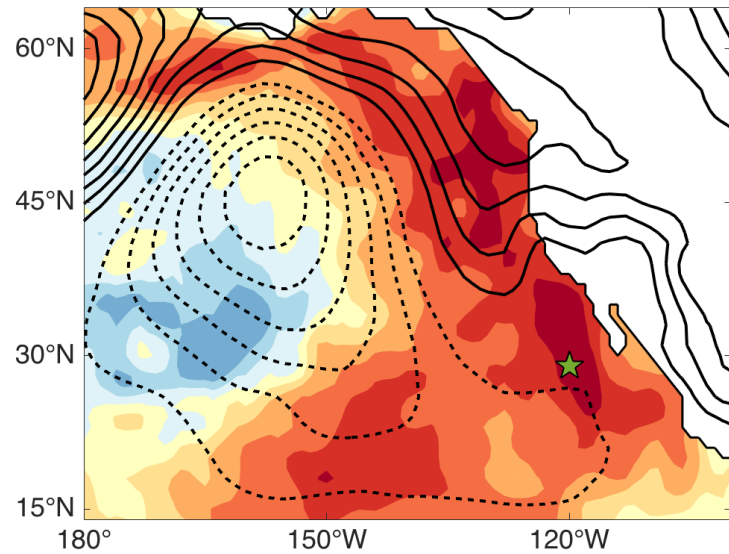
Baja Warming



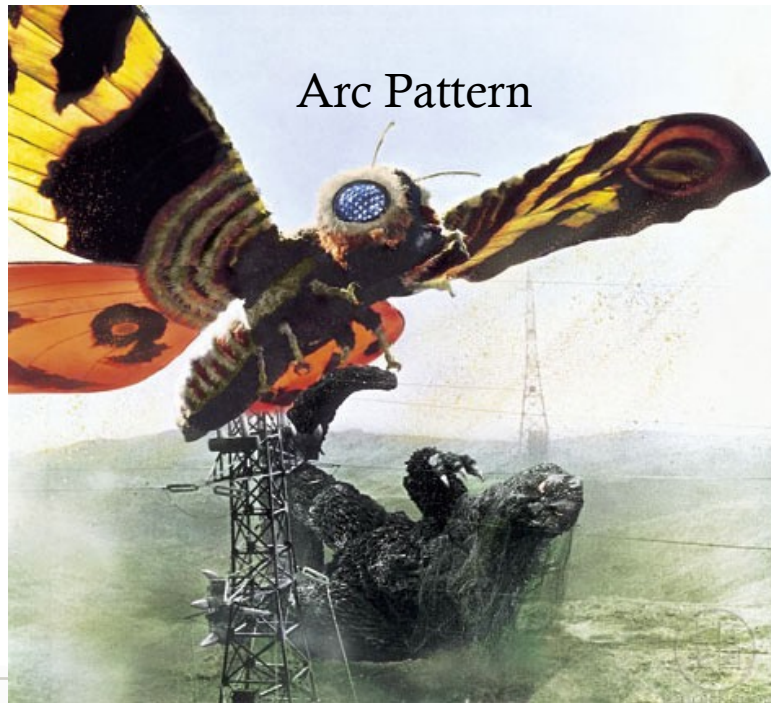
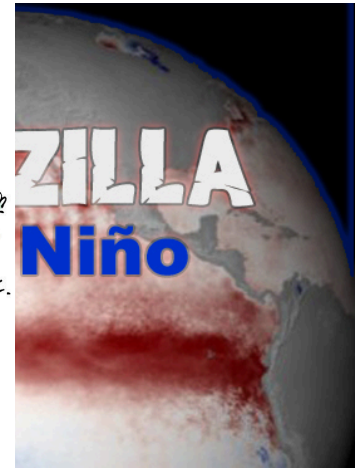


Arc Pattern

Baja Warming









# Timeline

*Ridiculous Resilient*

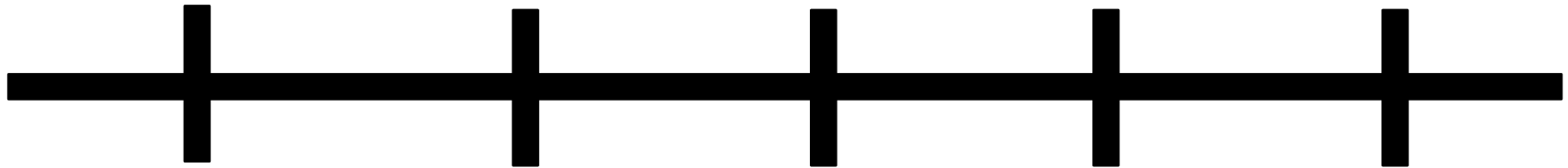
*Ridge &  
Gulf of Alaska  
Warming*

Late summer  
to fall 2014

*Arc  
Pattern*

Spring 2015

*Godzilla  
El Niño*



Oct-Feb  
2013/2014

*“El Niño that  
wasn’t”*

Late fall  
2014

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Warming*

Winter  
2015/2016

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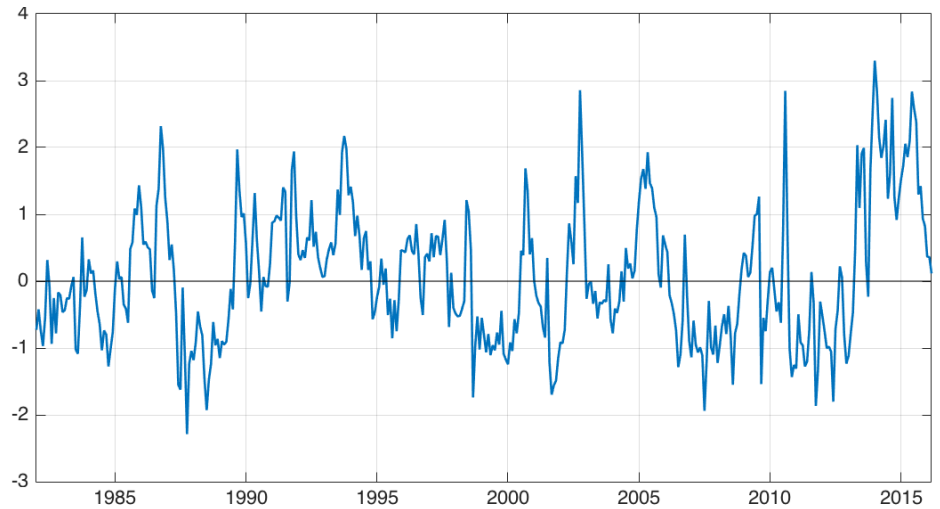
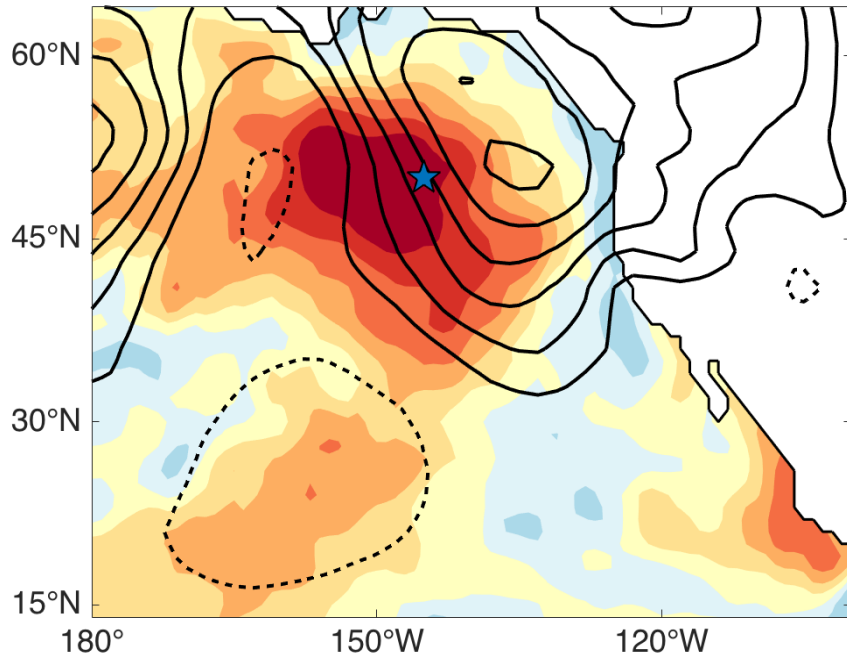
Late fall  
2014

*Baja  
Warming*

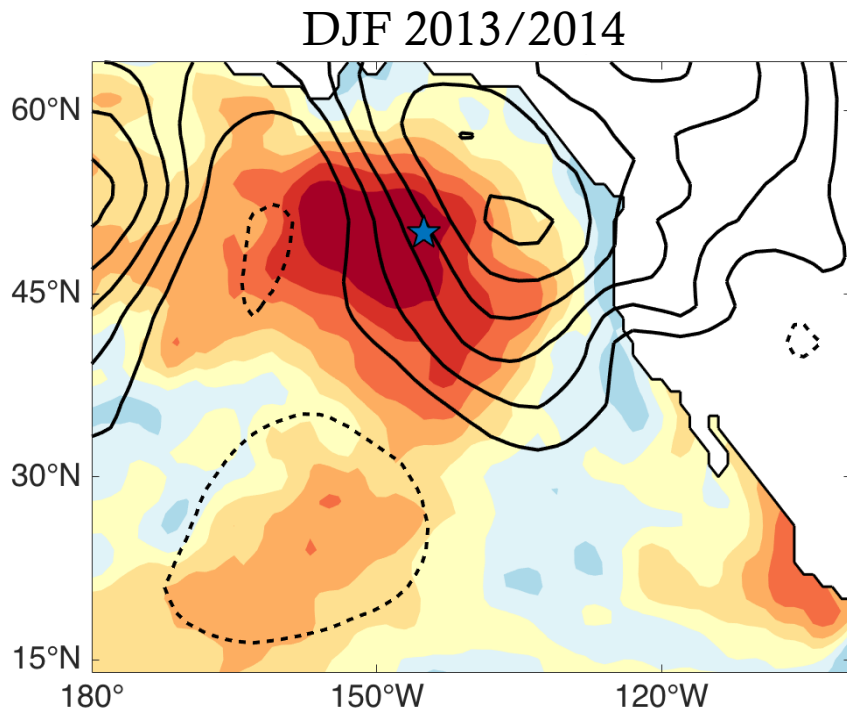
Winter  
2015/2016

# RRR & Gulf of Alaska Warming

DJF 2013/2014

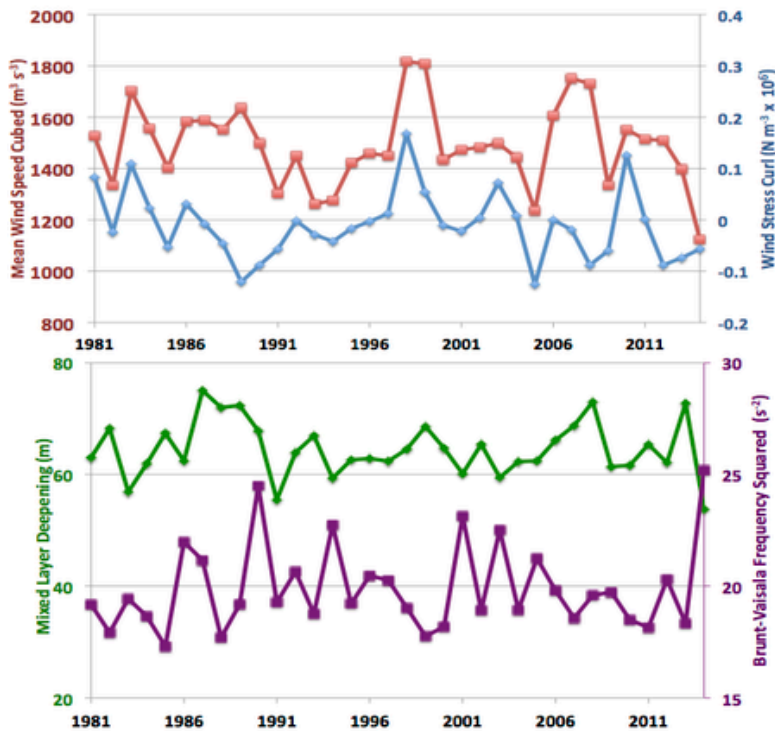


# RRR & Gulf of Alaska Warming



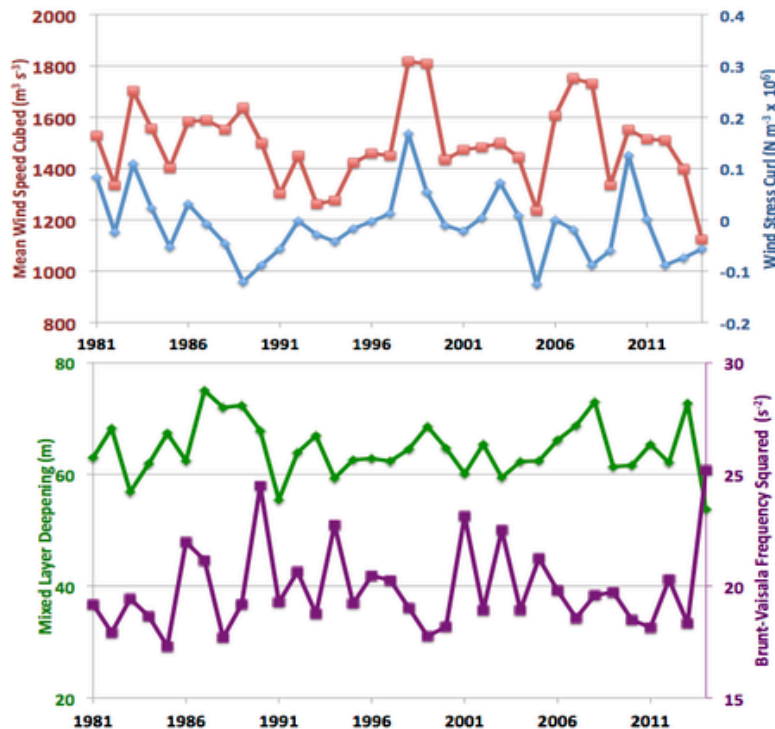
- Deflected wintertime storms north of California, intensifying “Mega-Drought”. [e.g., Swain et al., 2014]
- Jet stream perturbations, contributing to historically cold North America 2013/2014 winter. [Hartmann, 2015]
- Main forcing mechanism for the Gulf of Alaska Warming. [Bond et al., 2015]

# RRR & Gulf of Alaska Warming



Adapted from Bond et al., 2015

# RRR & Gulf of Alaska Warming

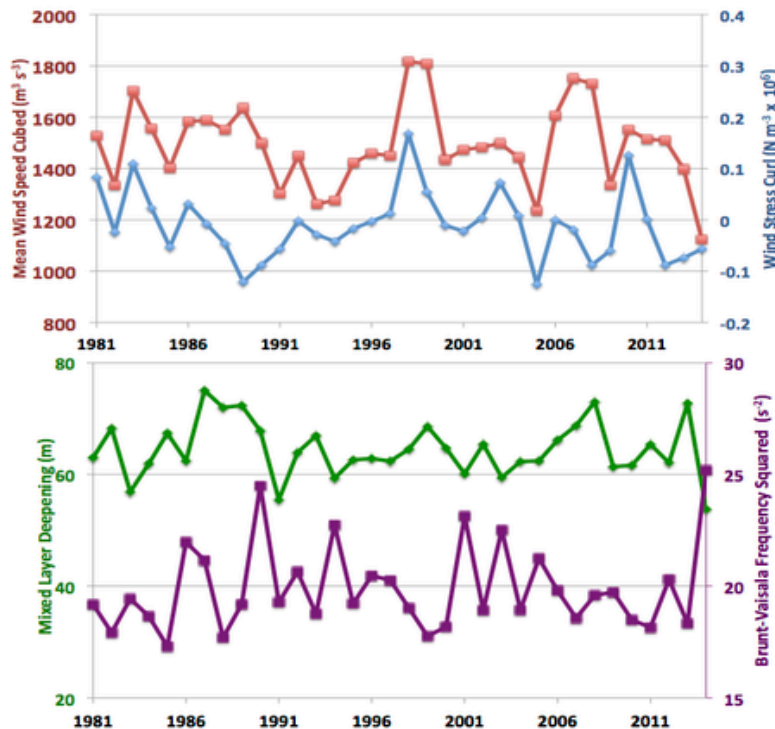


- Significant reduction in energy imparted by atmosphere into ocean for wintertime mixing processes.

Adapted from Bond et al., 2015



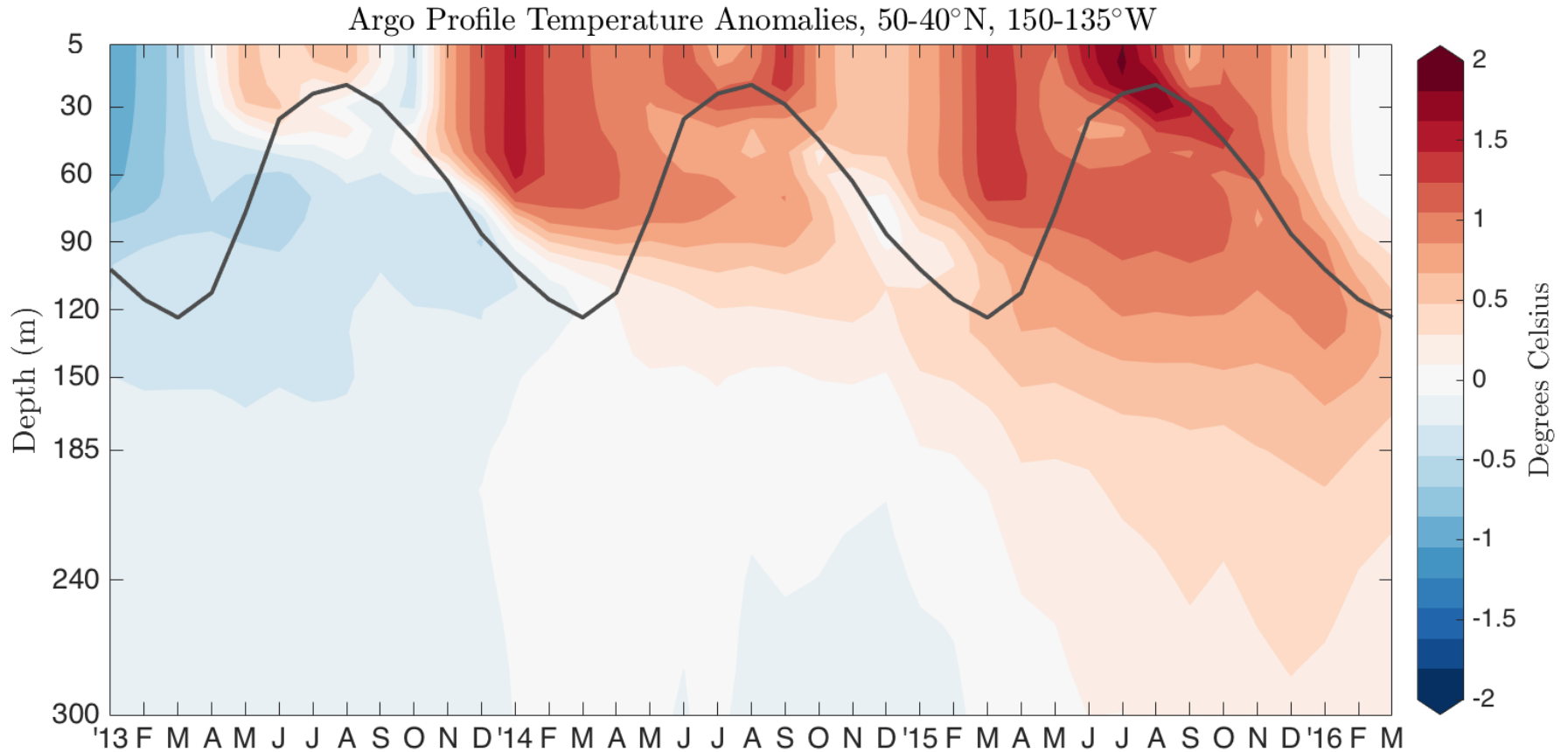
# RRR & Gulf of Alaska Warming



- Significant reduction in energy imparted by atmosphere into ocean for wintertime mixing processes.
- Gulf of Alaska Warming is the result of a lack of seasonal cooling.

Adapted from Bond et al., 2015

# RRR & Gulf of Alaska Warming



# Timeline

*Ridiculous Resilient  
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# “El Niño that wasn’t”

Mid-Apr IR/CPC Plume-Based Probabilistic ENSO Forecast

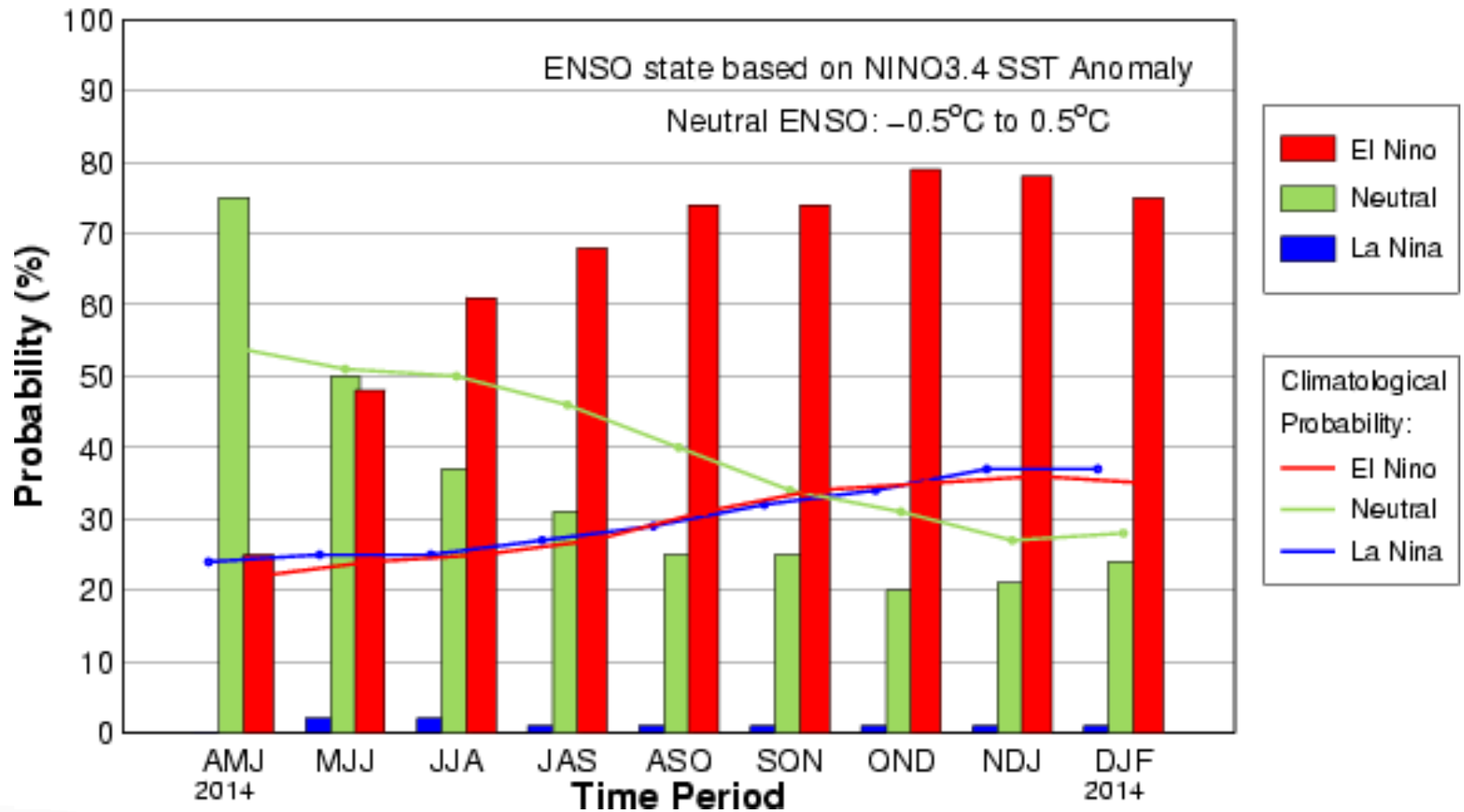
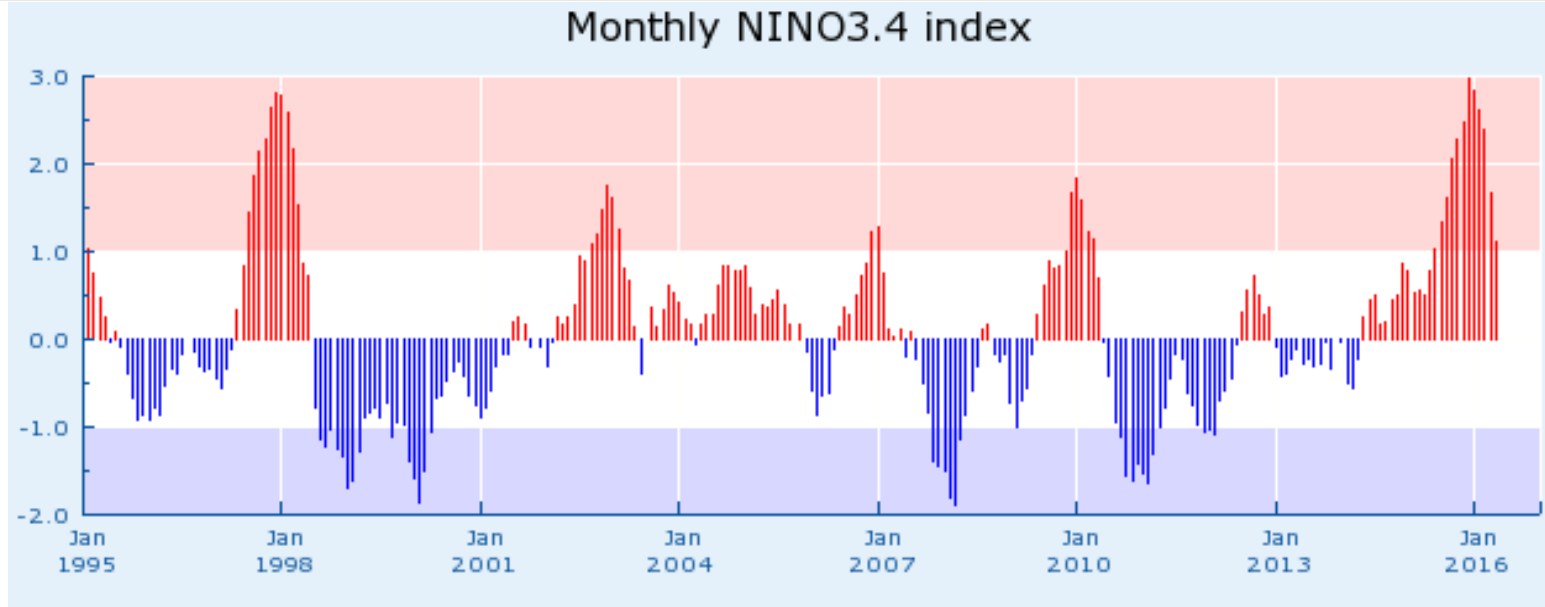


Image courtesy of IRI/CPC

# “El Niño that wasn’t”



North Pacific Index



# Timeline

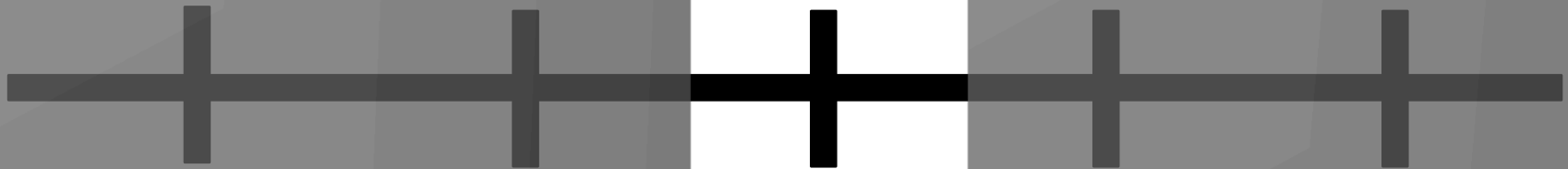
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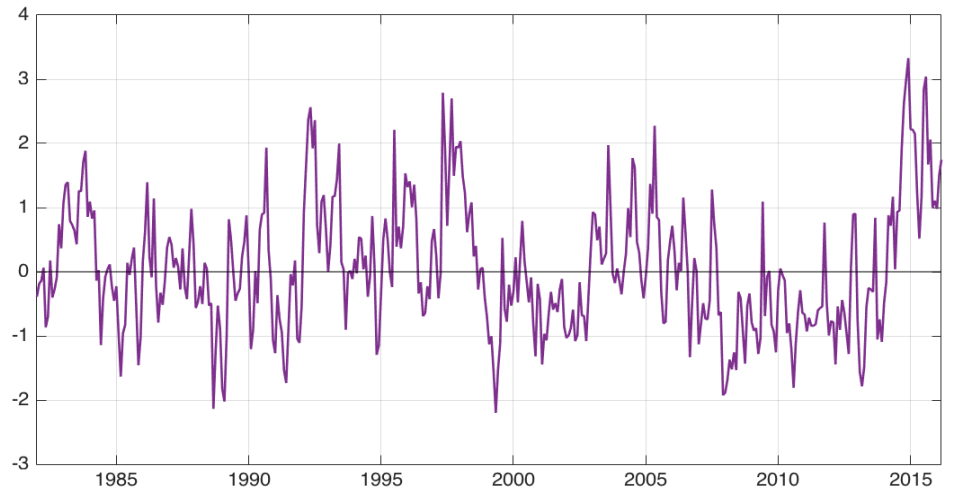
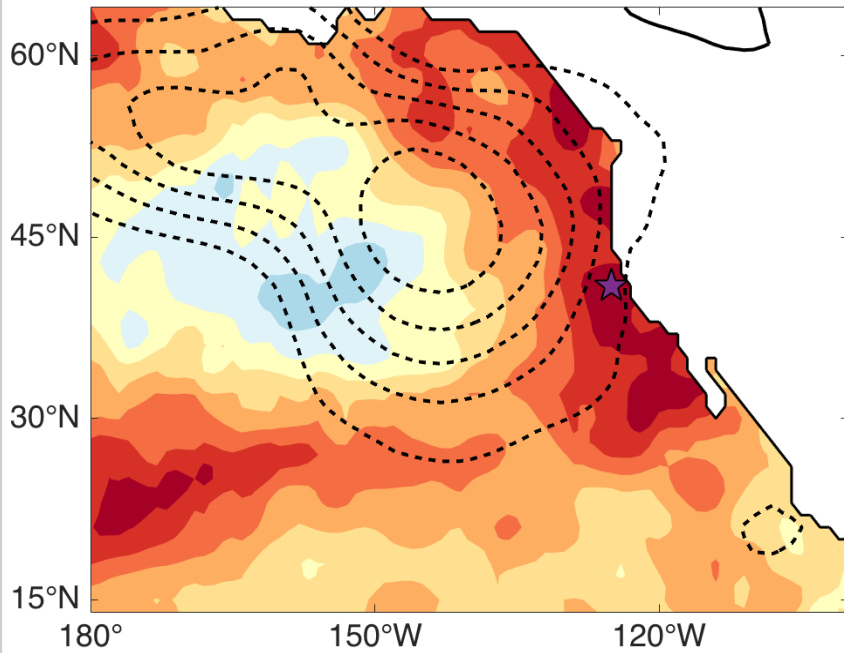
Late fall  
2014

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2015/2016

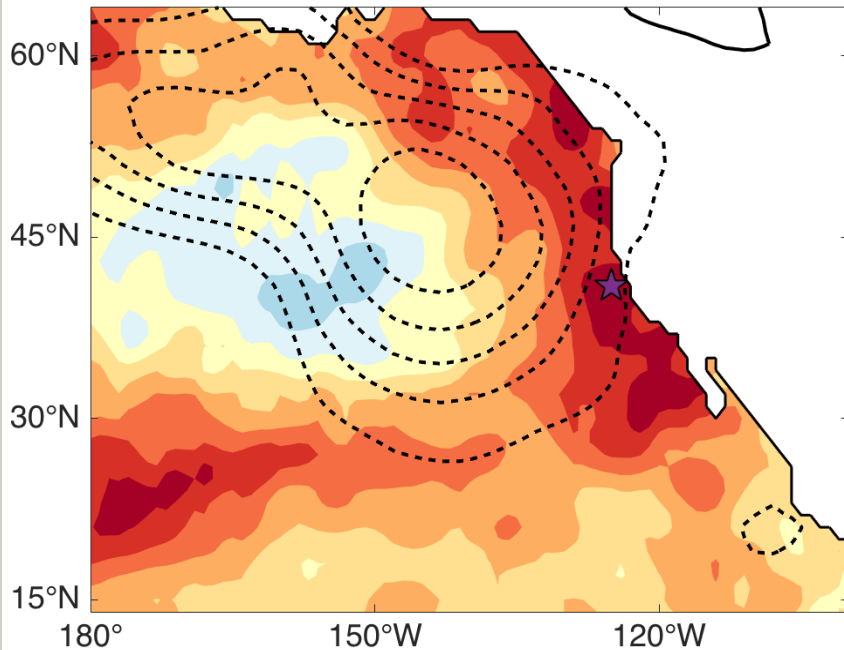
# Arc Pattern

OND 2014



# Arc Pattern

OND 2014



- PDO-like pattern likely a result of surface heat fluxes. [e.g., Alexander and Scott, 1997]
- California coastal warming (within 400km of shore) largely due to suppressed mixing and seasonal upwelling. [Zaba and Rudnick, 2016]



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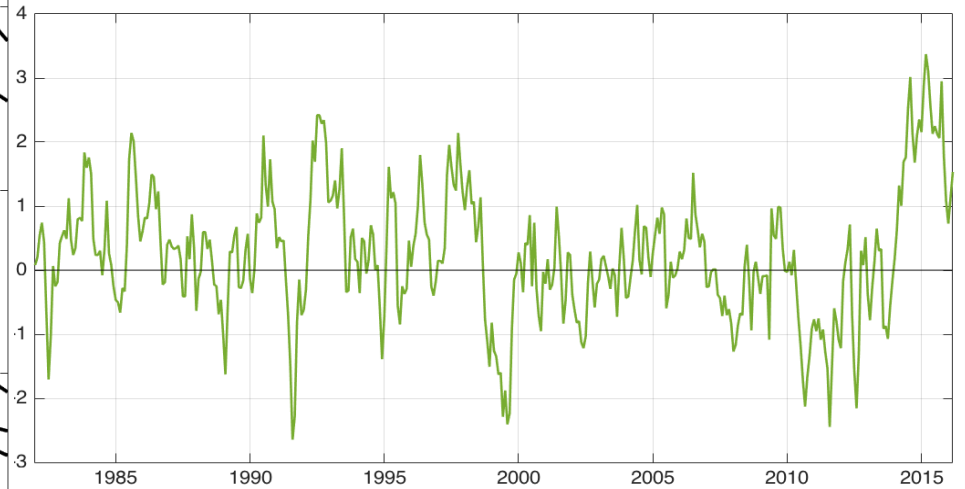
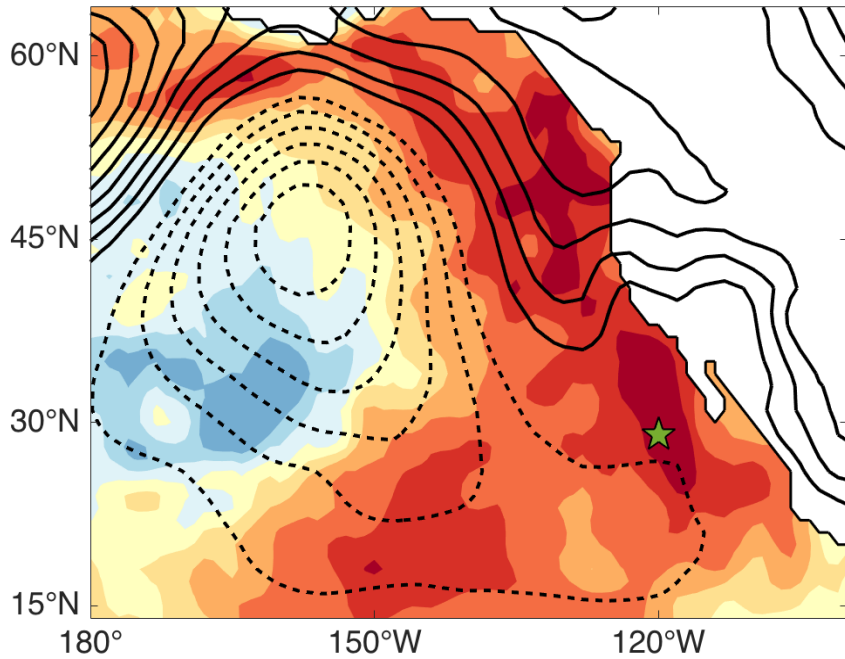
Late fall  
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2015/2016

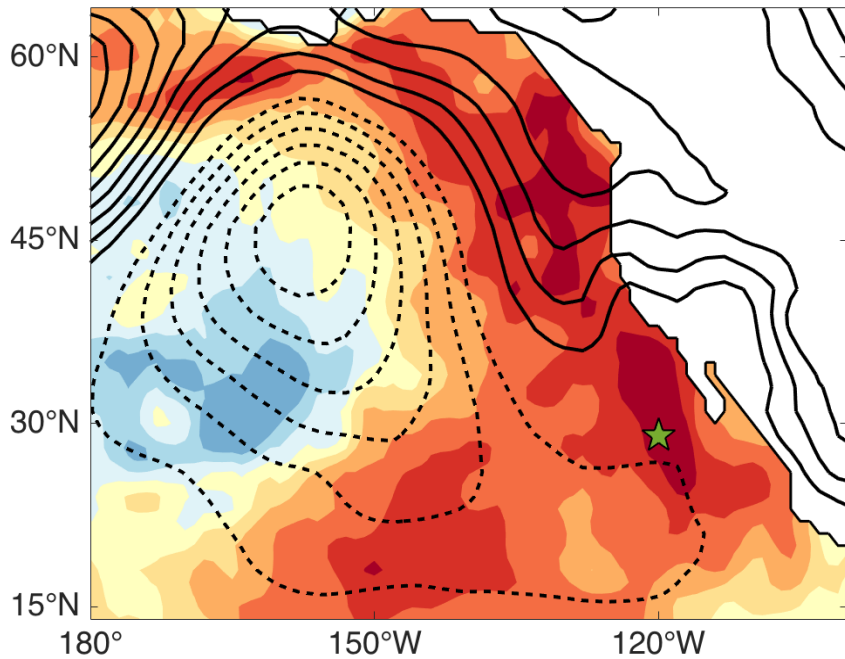
# Baja Warming

JFM 2015

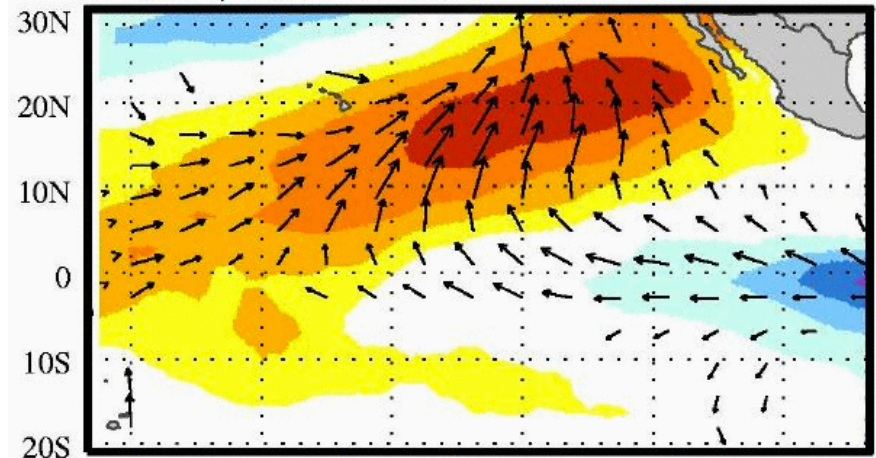


# Baja Warming

JFM 2015



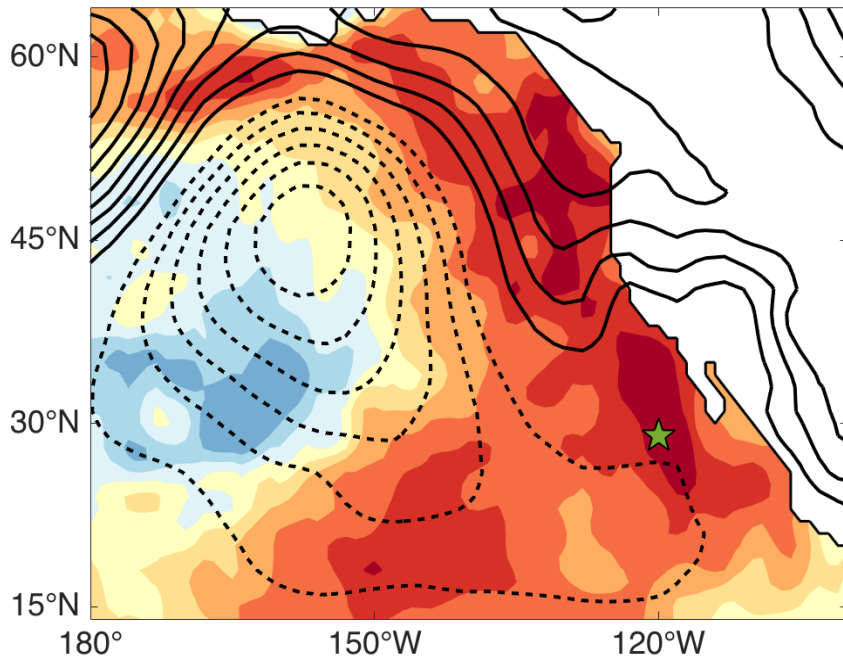
a. SST, 10m Winds



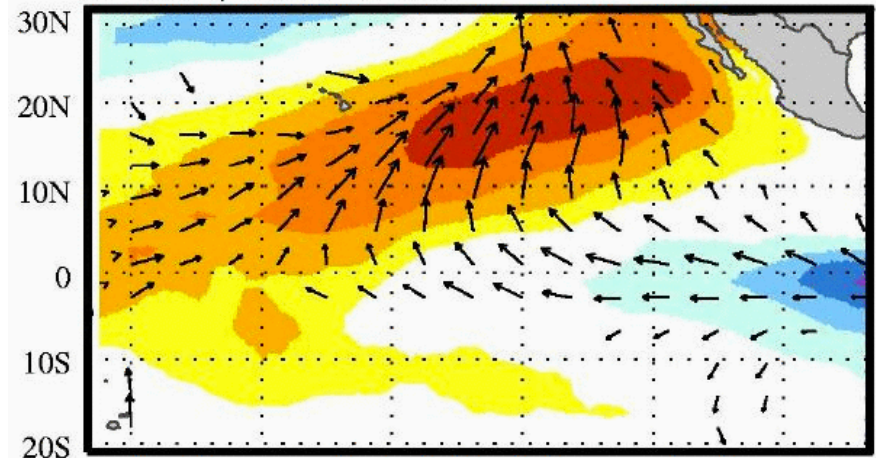
Chiang and Vimont, (2004)

# Baja Warming

JFM 2015



a. SST, 10m Winds



Chiang and Vimont, (2004)

- Air-sea interactions such as wind-evaporation-SST feedback and low-cloud/SST feedback likely important in broad scale Baja warming.

# Timeline

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2015/2016

# Godzilla El Niño

SST Anomalies (°C)

02 DEC 2015

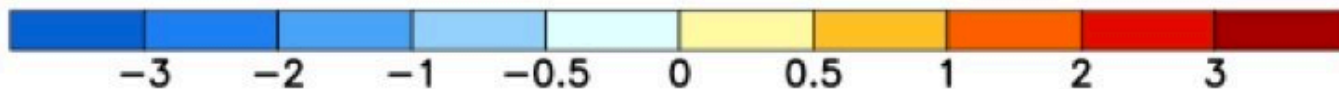
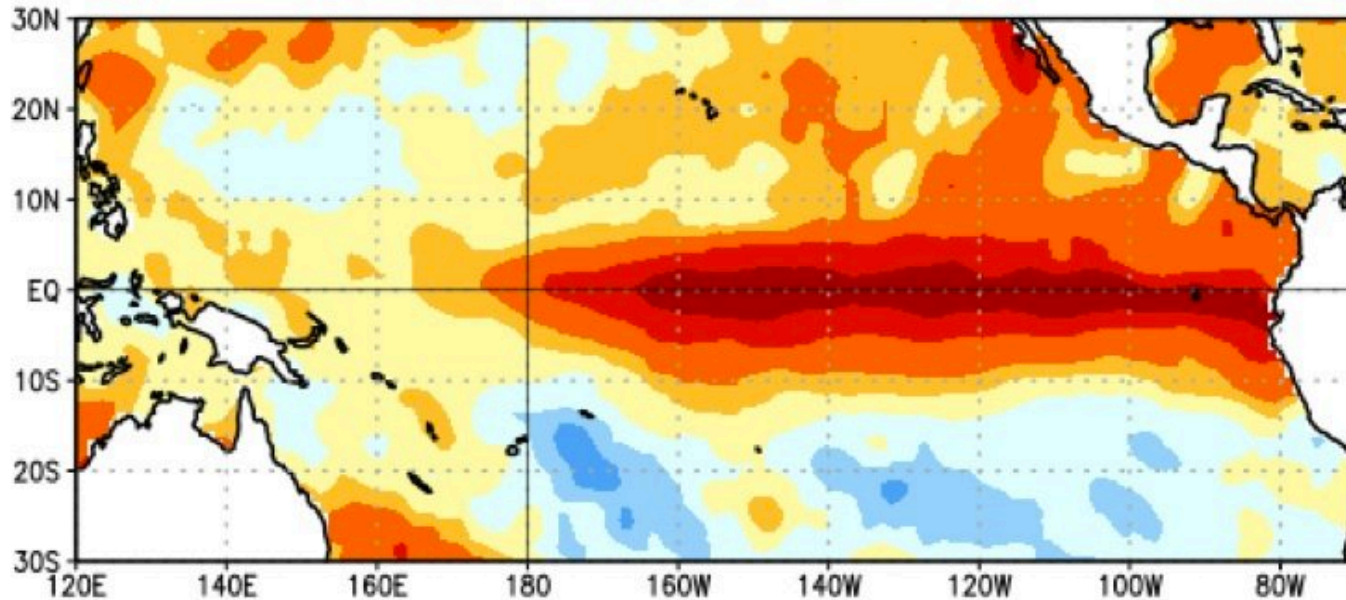
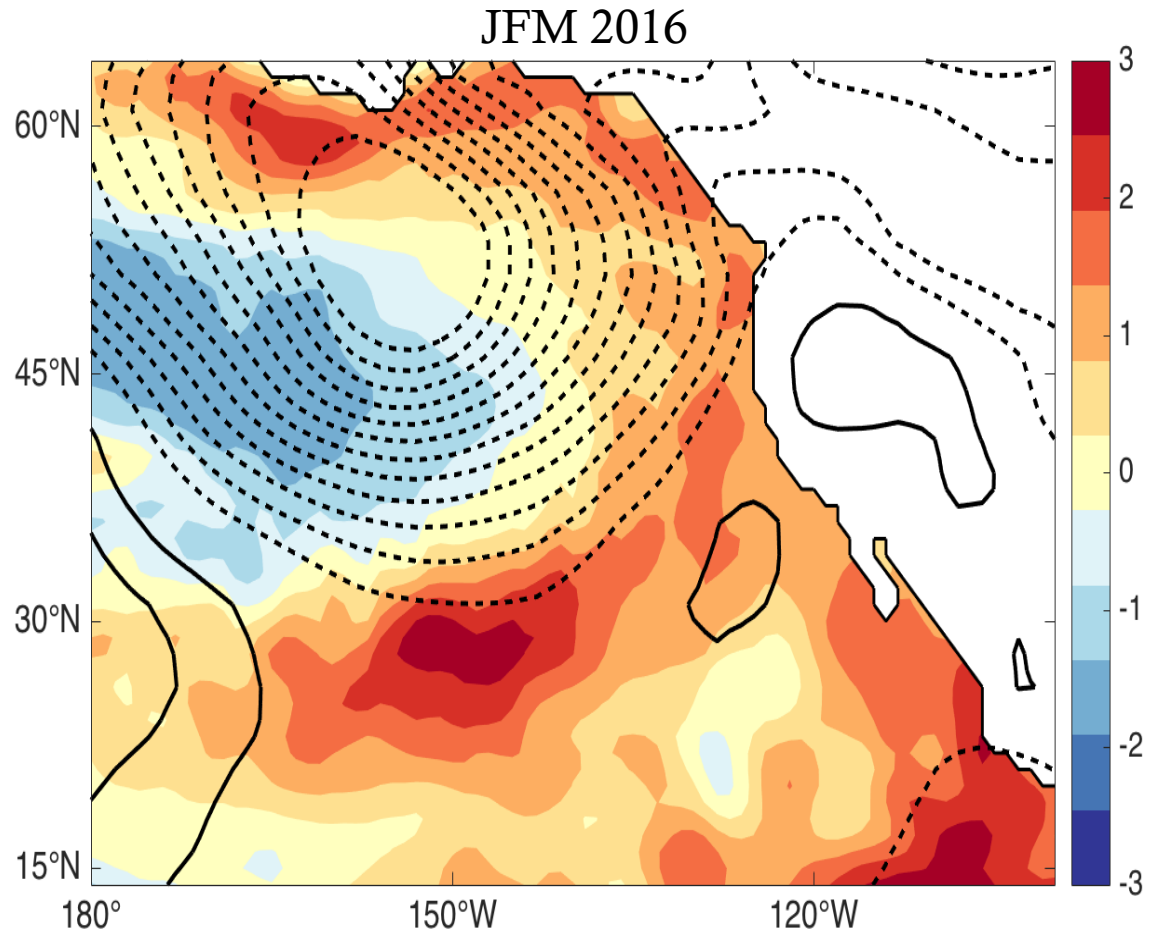


Image courtesy of IRI/CPC

# Godzilla El Niño



# Do we get a sequel?



1958

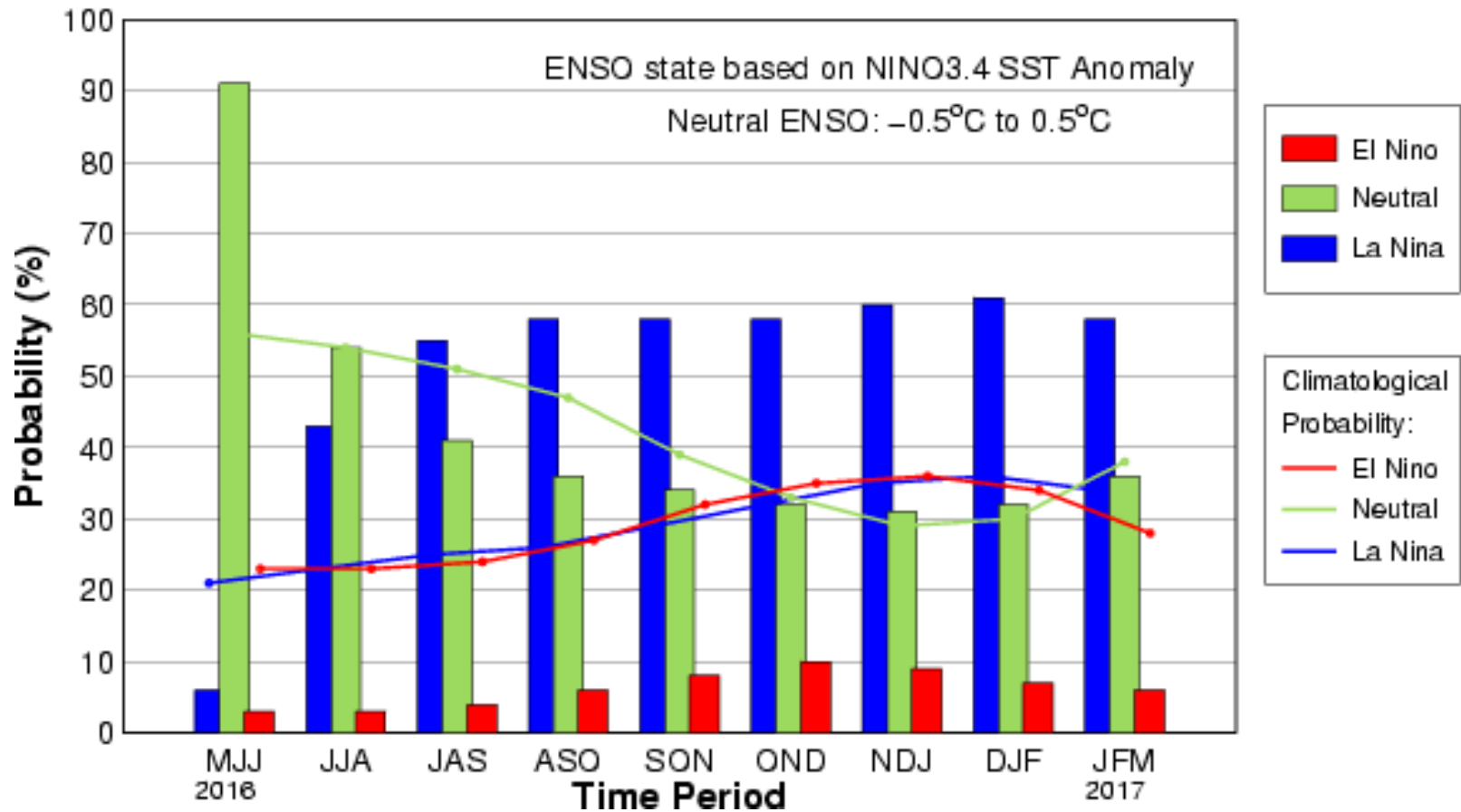


1972



# Do we get a sequel?

Mid-May IRI/CPC Model-Based Probabilistic ENSO Forecast



Thank you!