North Pacific Gyre Oscillation synchronizes climate fluctuations in the eastern and western North Pacific

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Niklas Schneider[2], and Carlos D. Hoyos[1]

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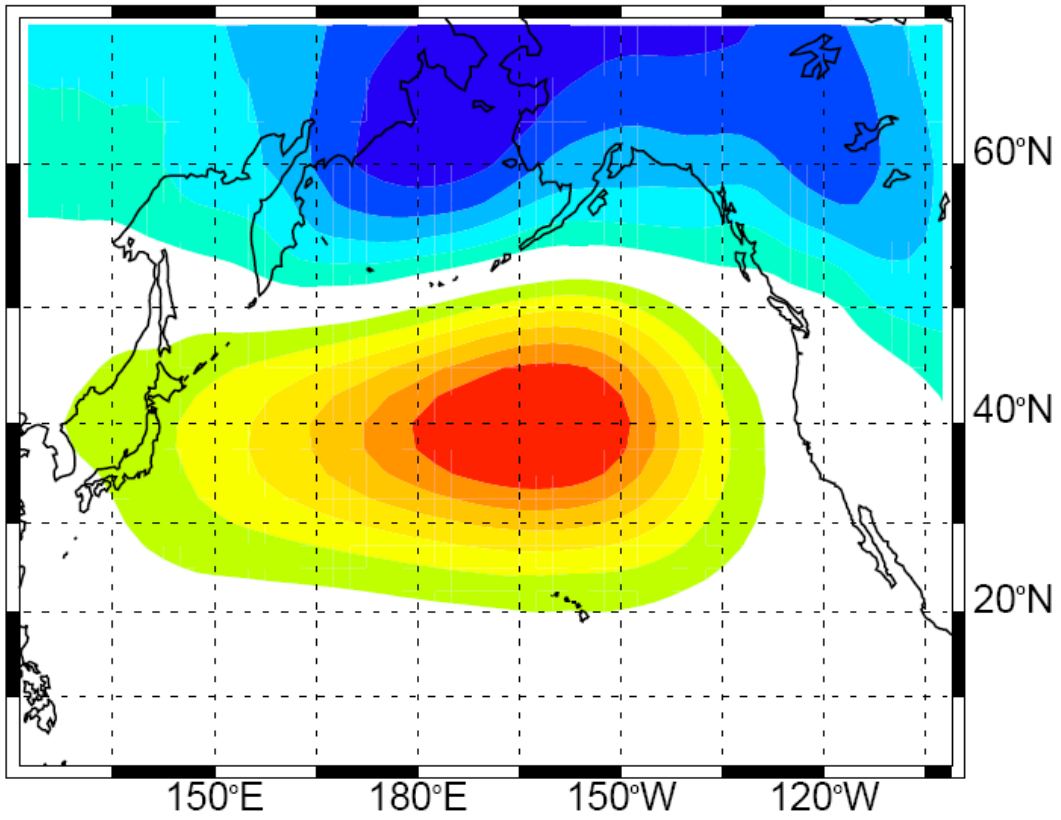
Western Pacific Geophysics Meeting, Cairns, Australia, 29 July - 1 August, 2008

North Pacific Oscillation (NPO)

SLPa EOF2



Atmosphere

North Pacific Oscillation
NPO

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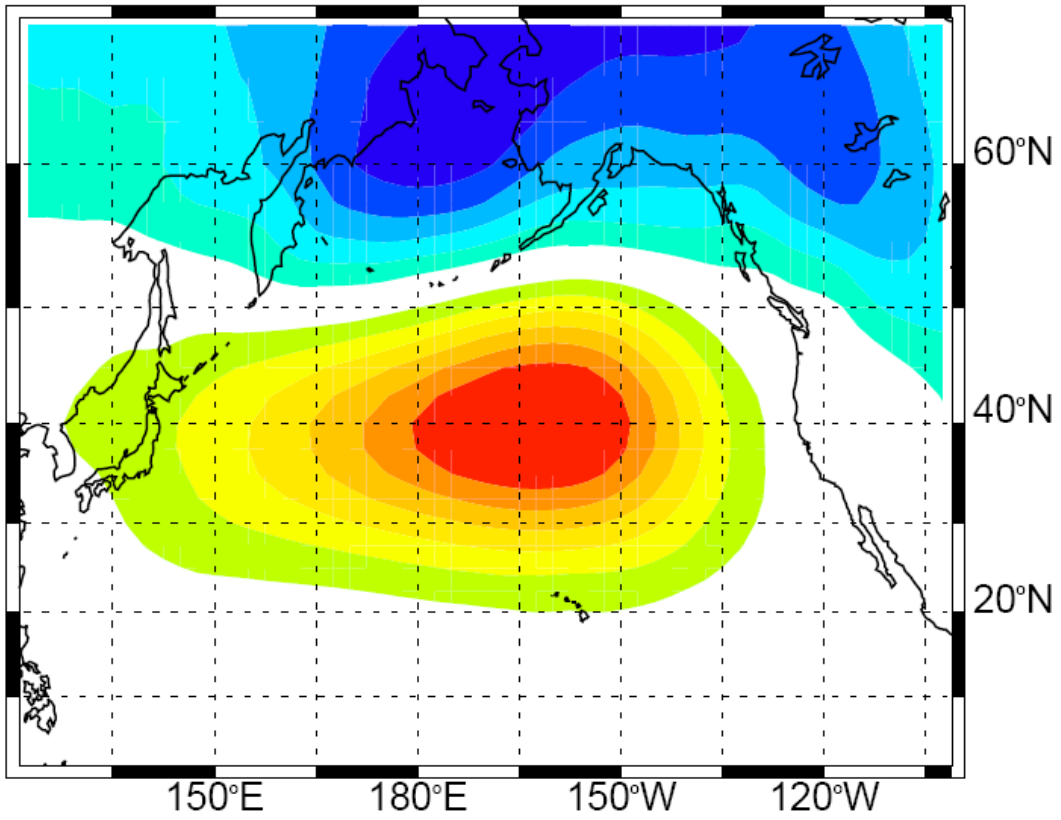


Atmosphere

North Pacific Oscillation

NPO

Ocean

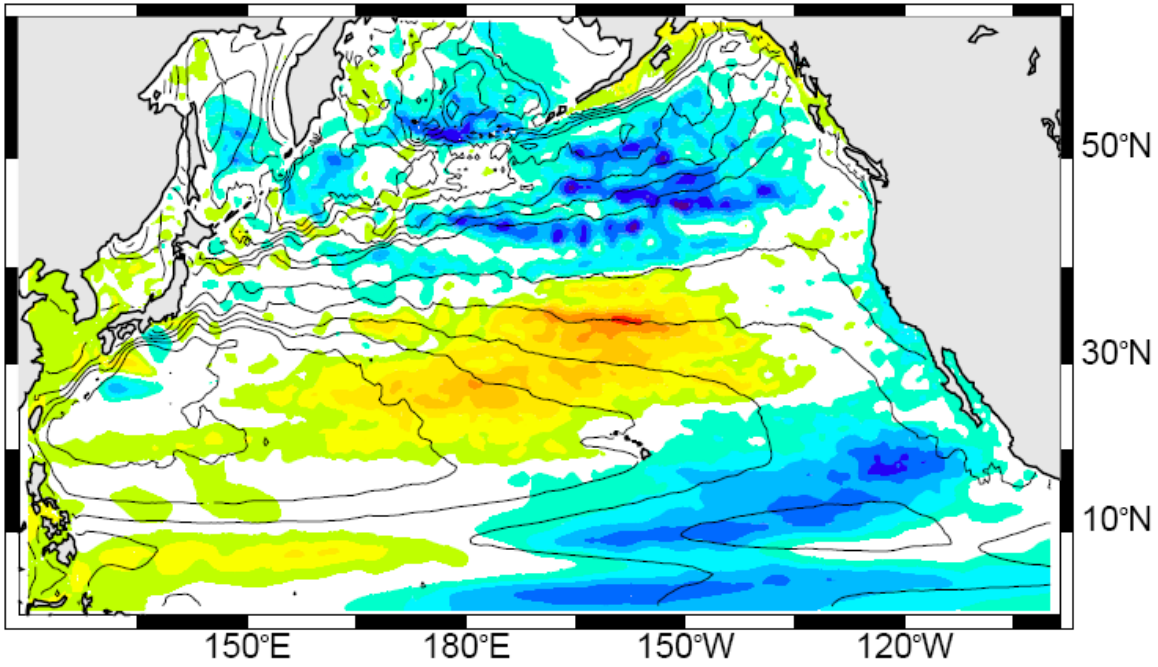
North Pacific Gyre Oscillation

NPGO

Di Lorenzo et al., 2008

North Pacific Gyre Oscillation (NPGO)

SSHa response to NPO



SSHa from Earth Simulator ocean model (OFES)

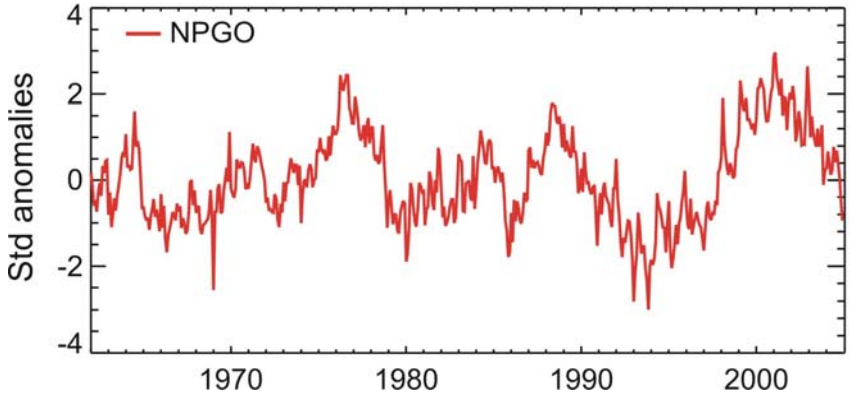
Ocean

North Pacific Gyre Oscillation

NPGO

Di Lorenzo et al., 2008

NPGO Index



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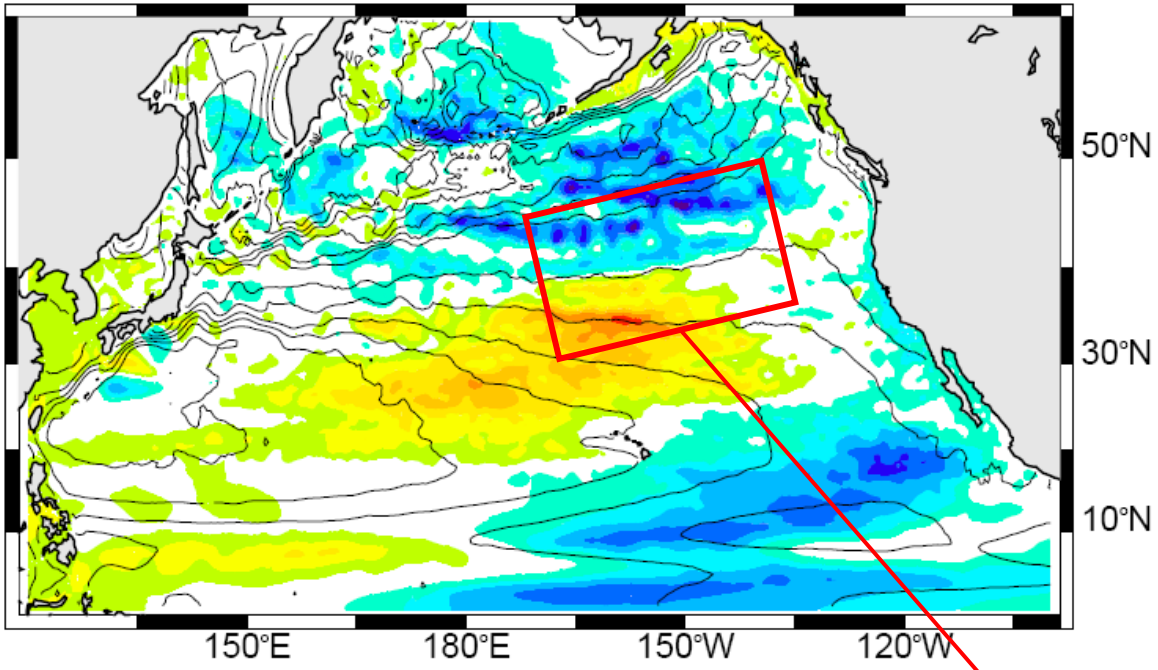

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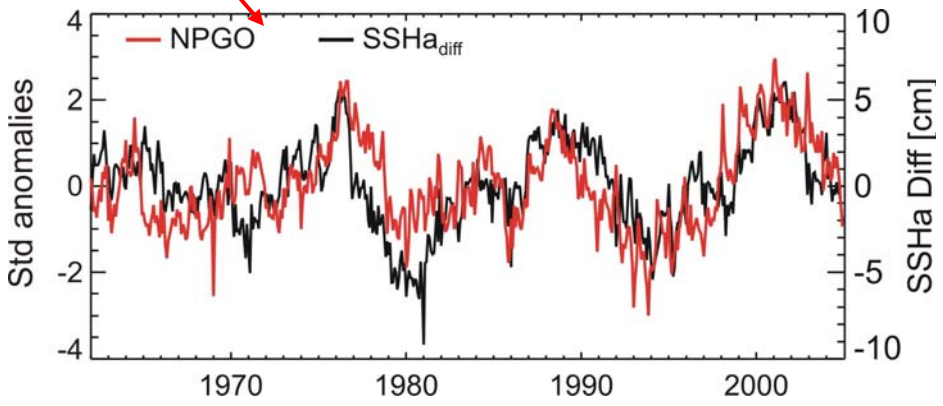

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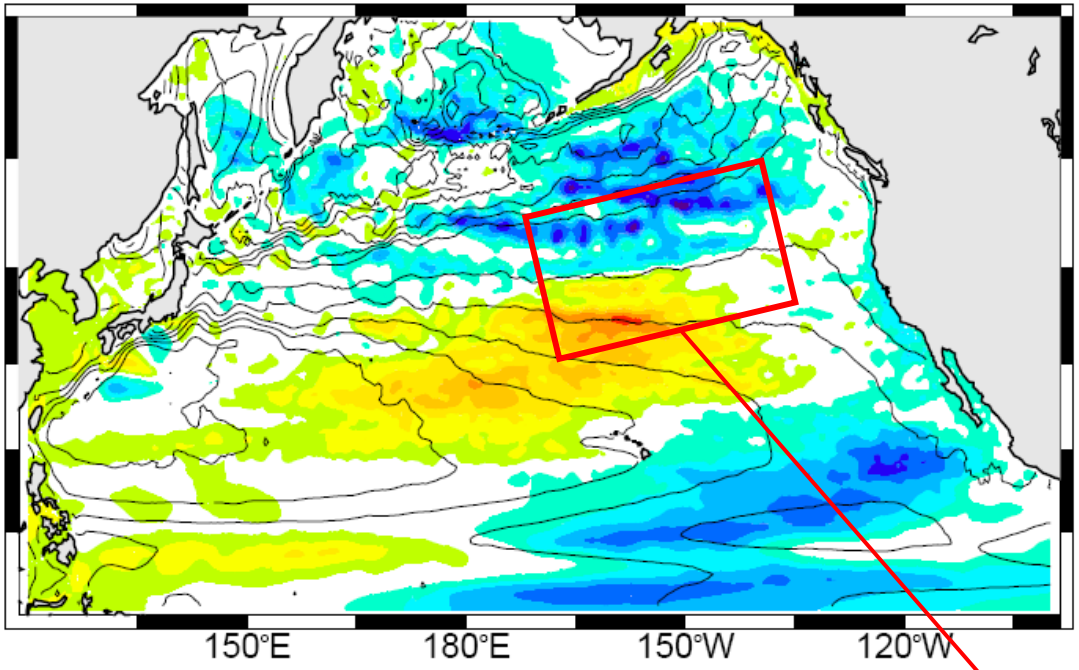
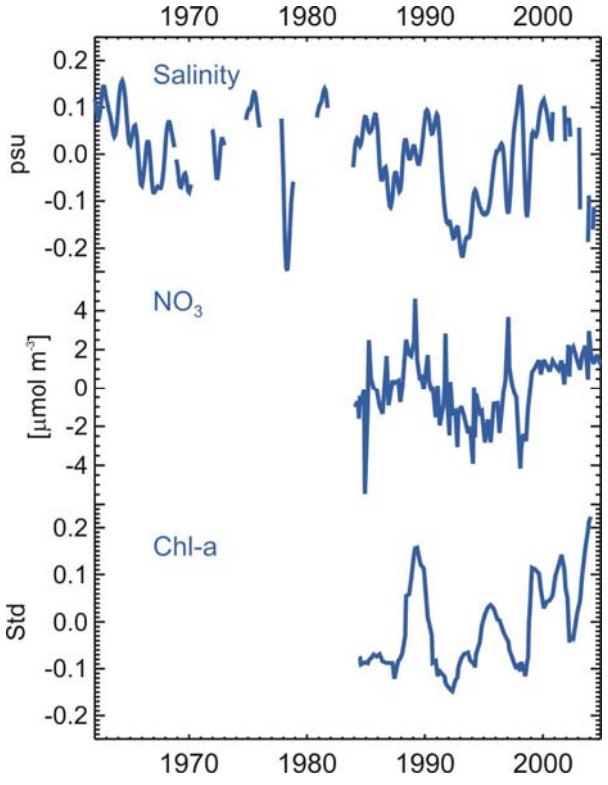
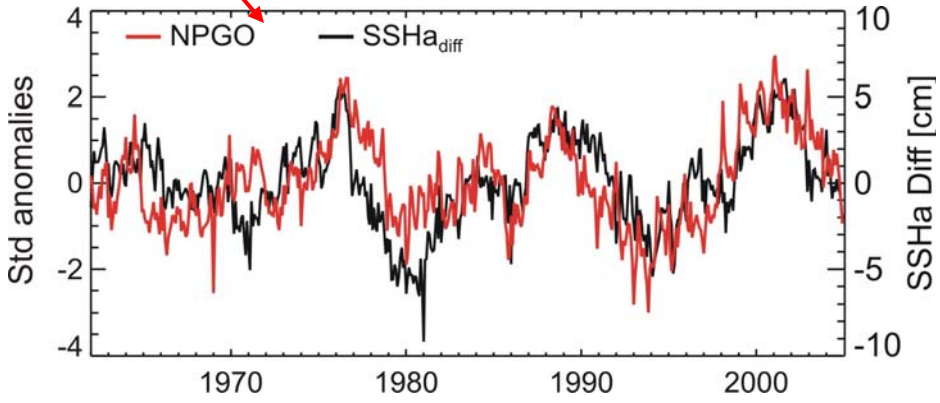


SSHa from Earth Simulator ocean model (OFES)

California Current
CalCOFI observations



Di Lorenzo et al., 2008



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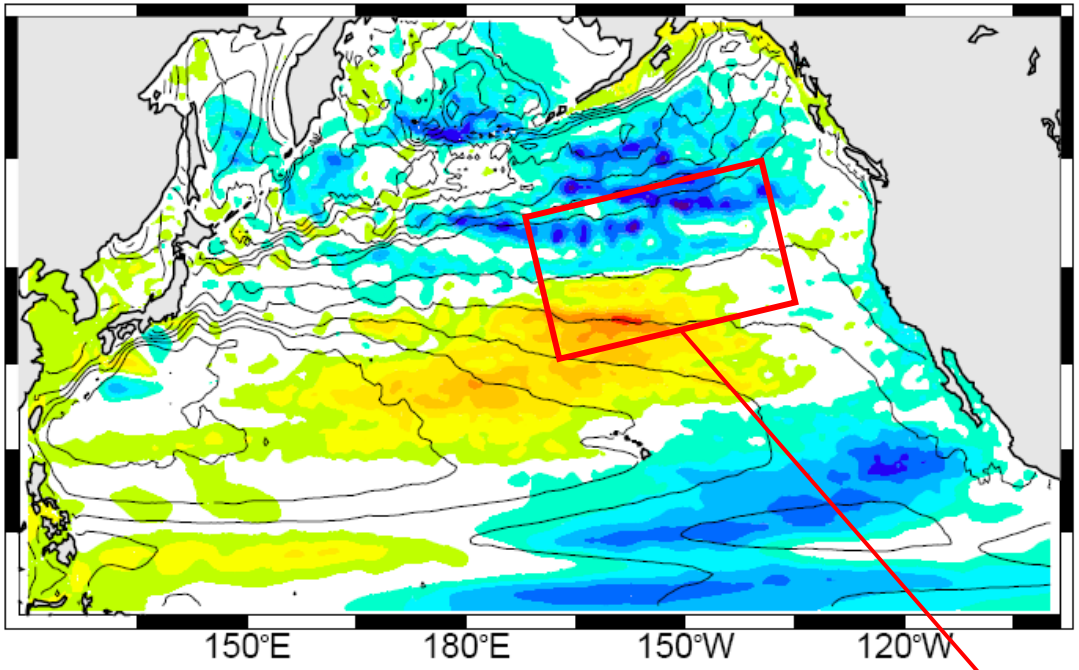

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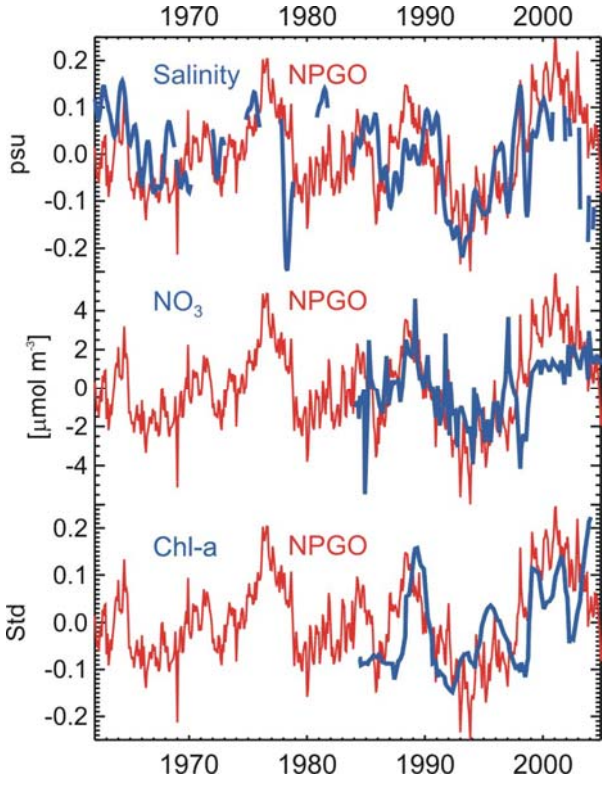

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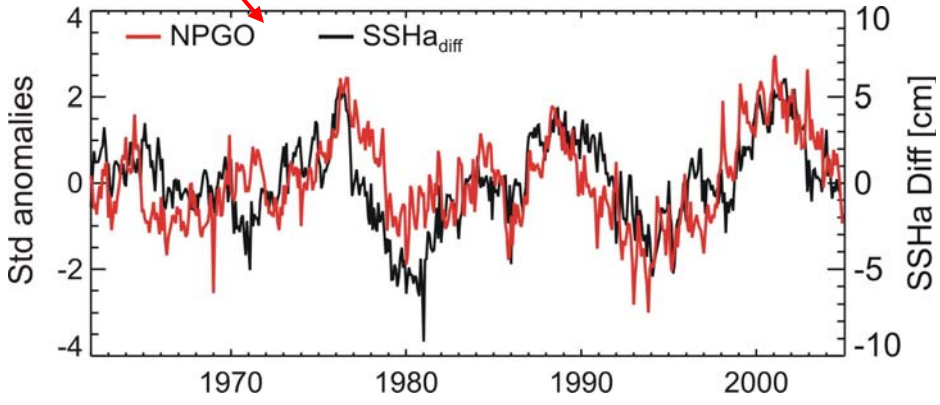

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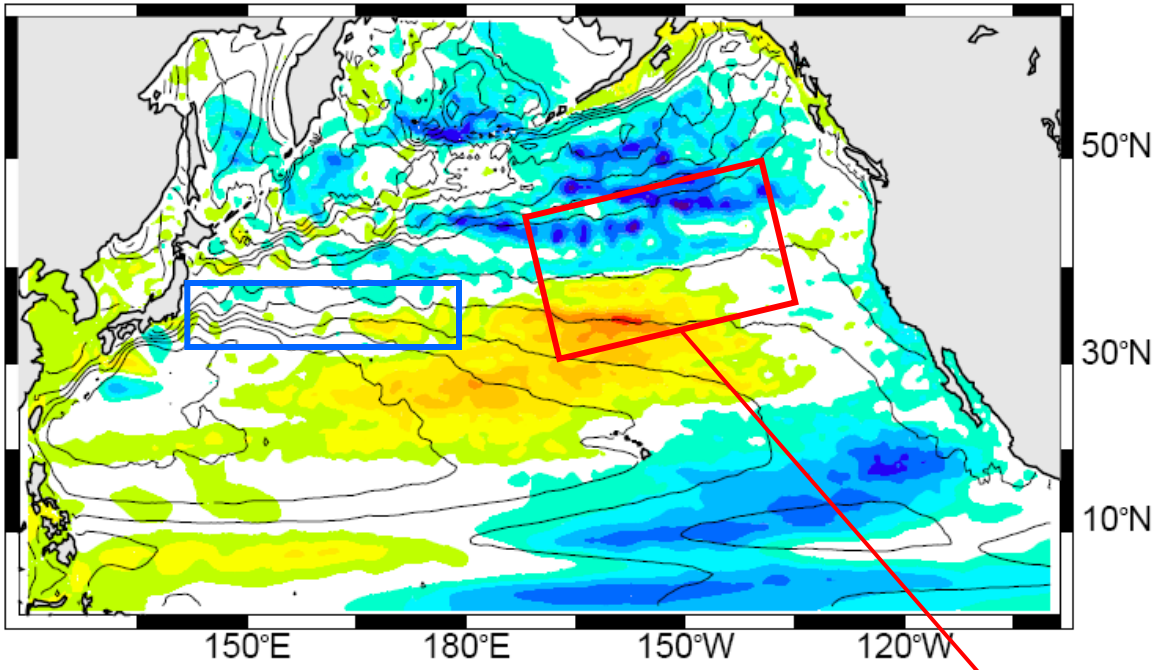
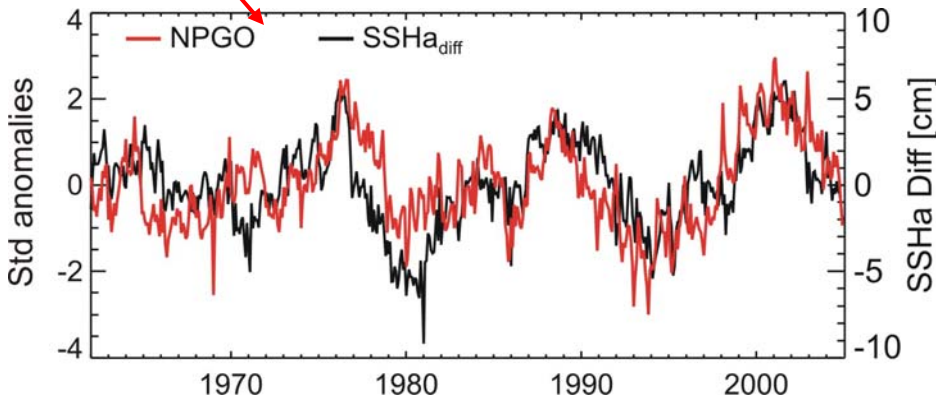


SSHa from Earth Simulator ocean model (OFES)

Is NPGO also linked to changes in the KOE?



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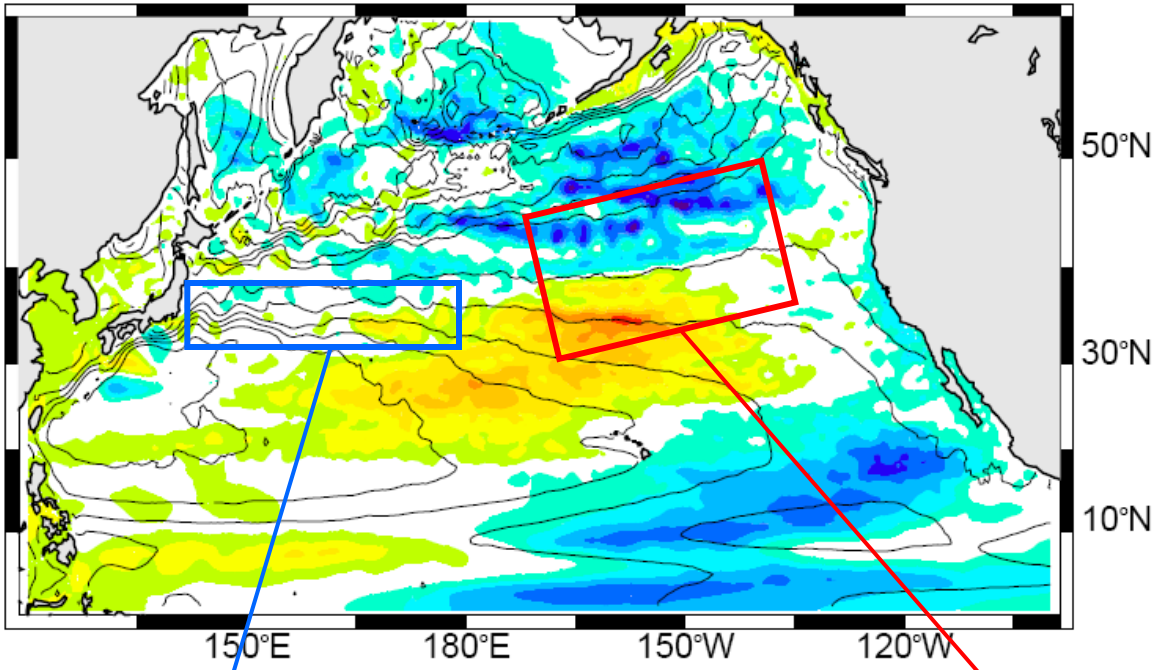

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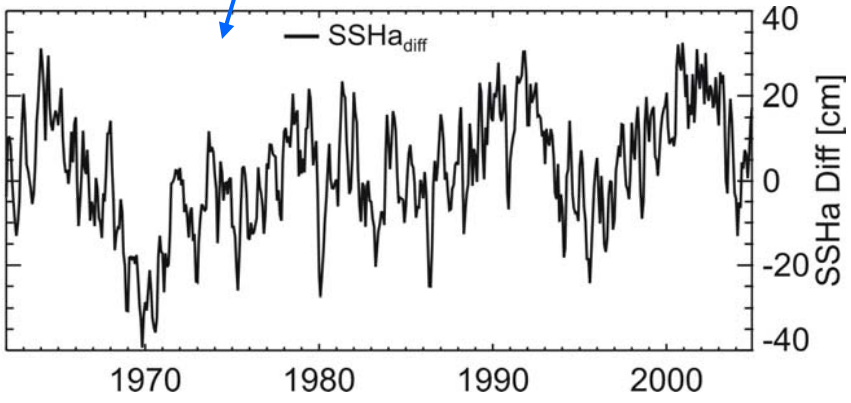

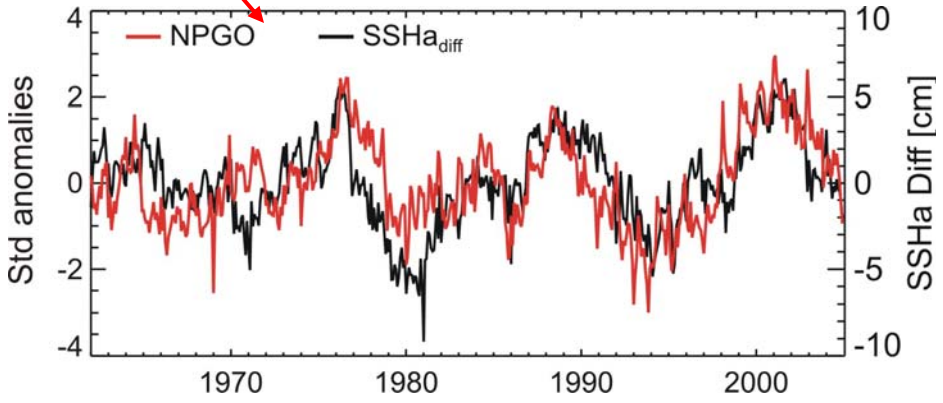

North Pacific Gvre Oscillation (NPGO)

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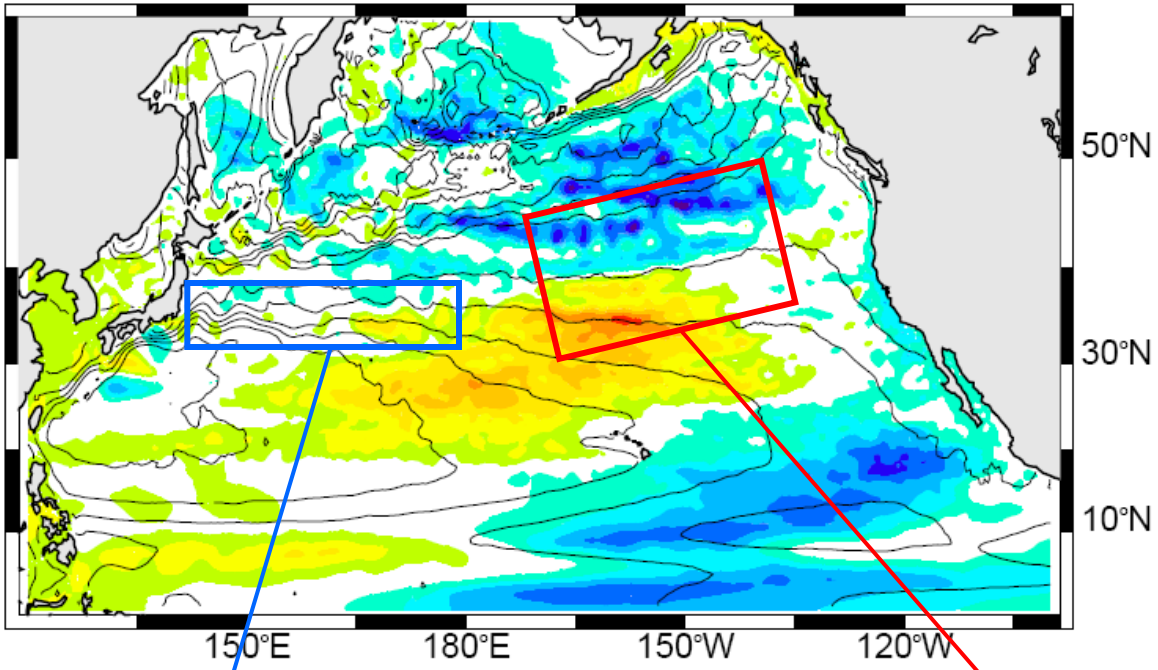

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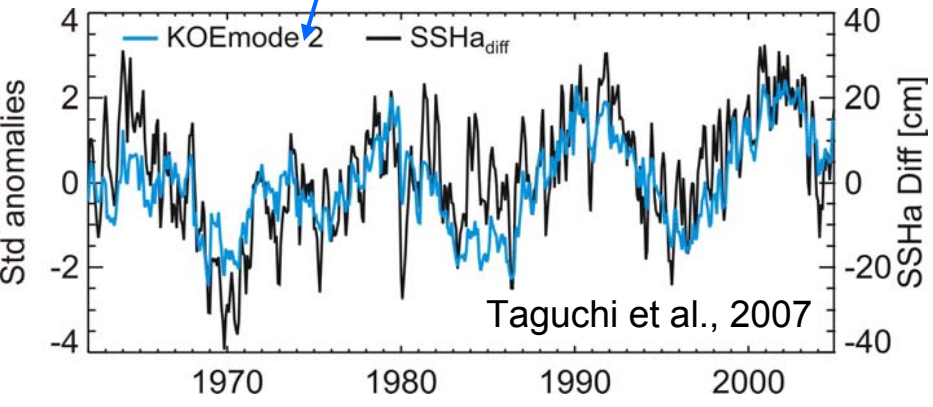
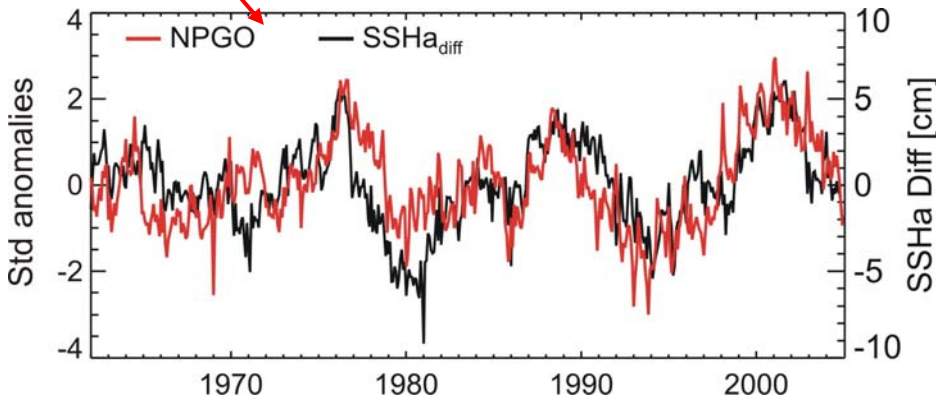
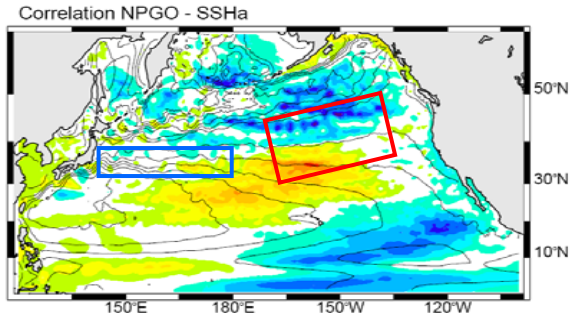




Are NPGO and KOE related?



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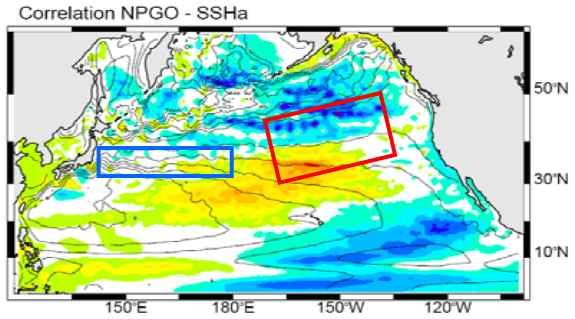

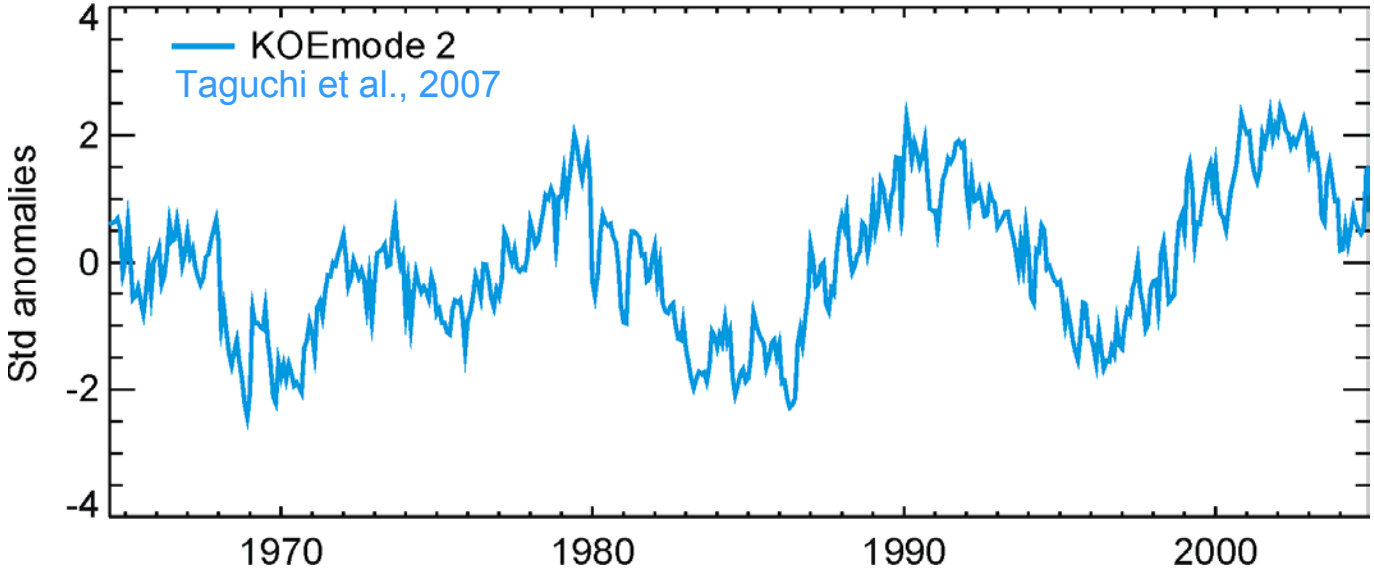

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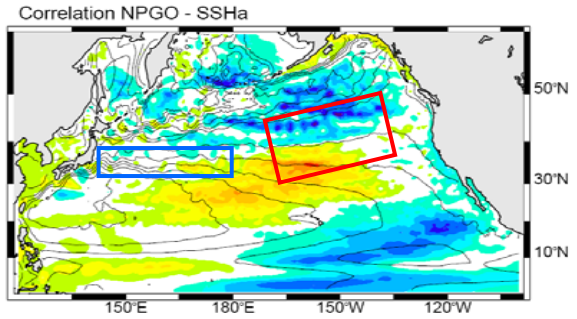

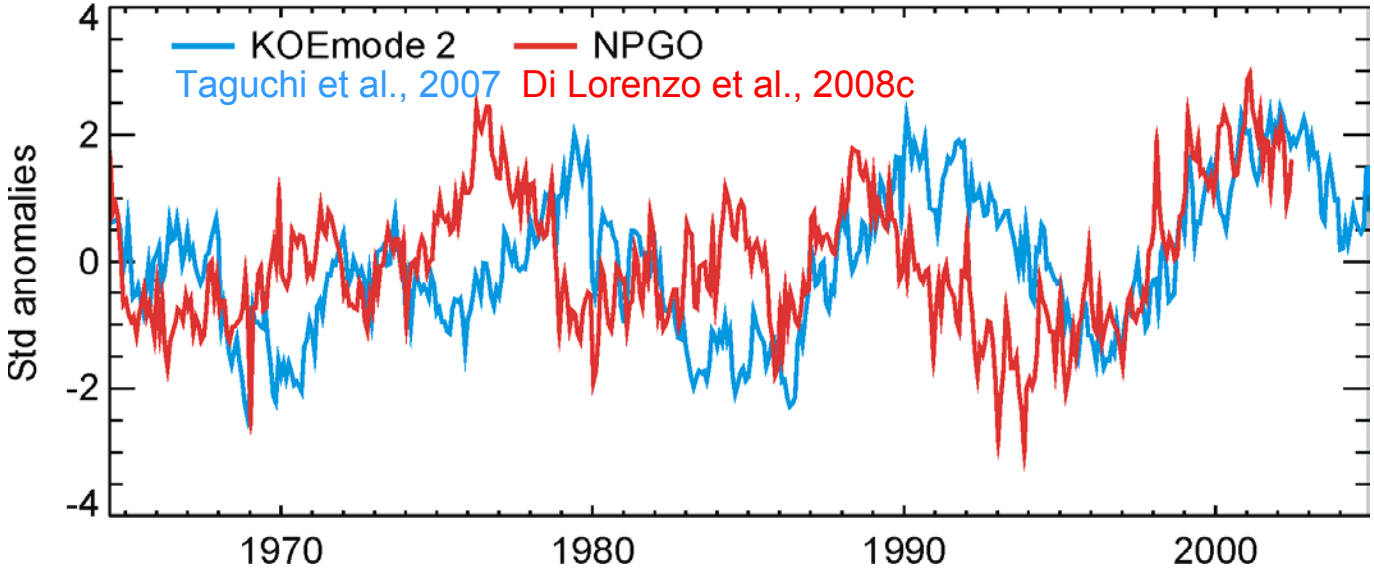

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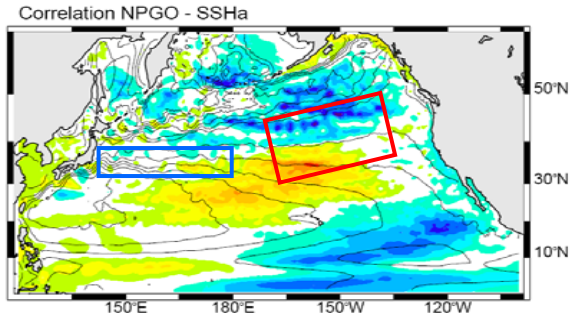
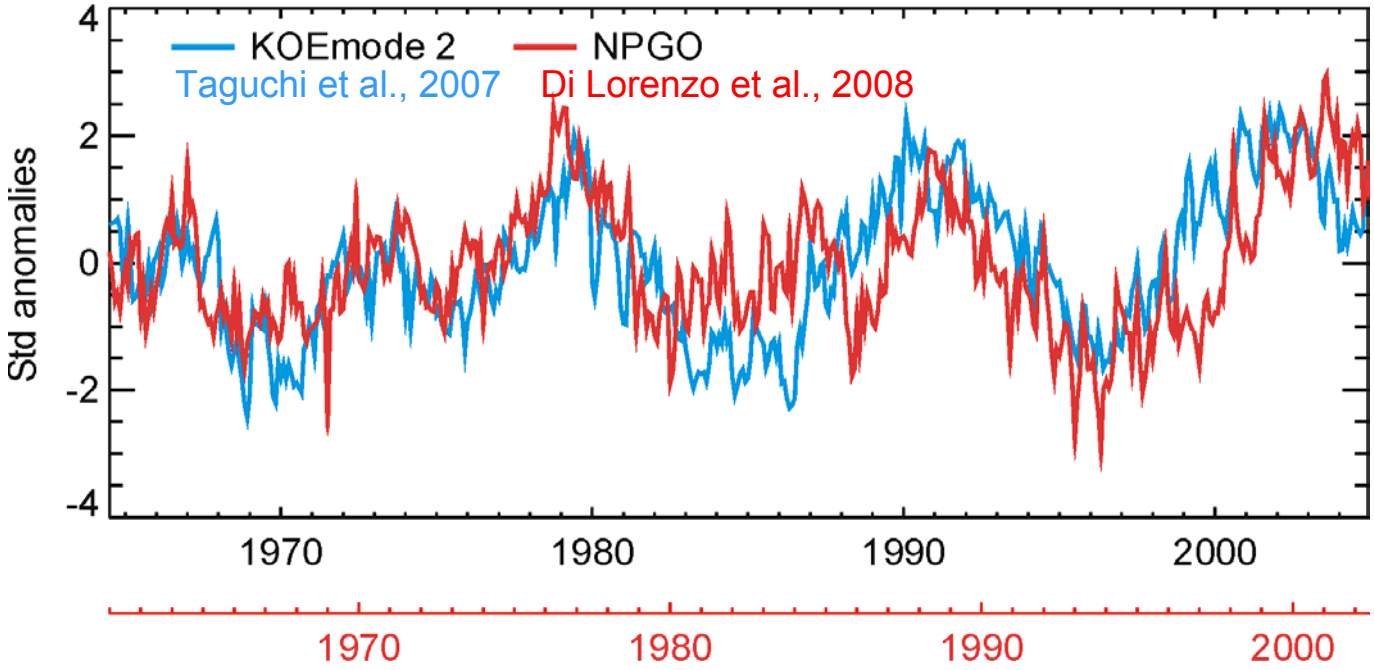


NPGO leads KOE by 3 yrs



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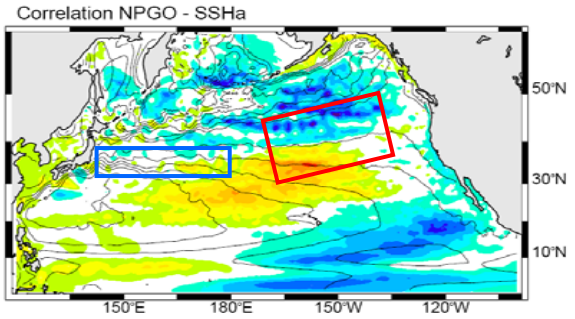
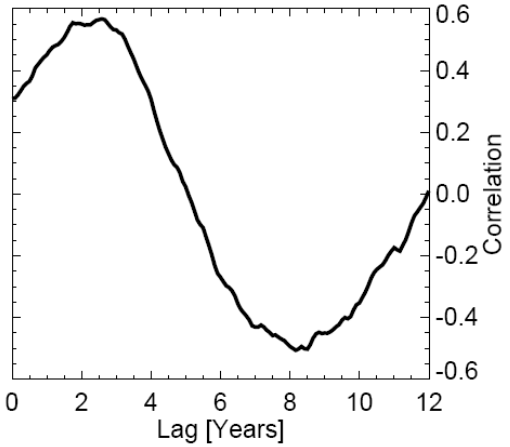


Correlation NPGO-KOE mode 2



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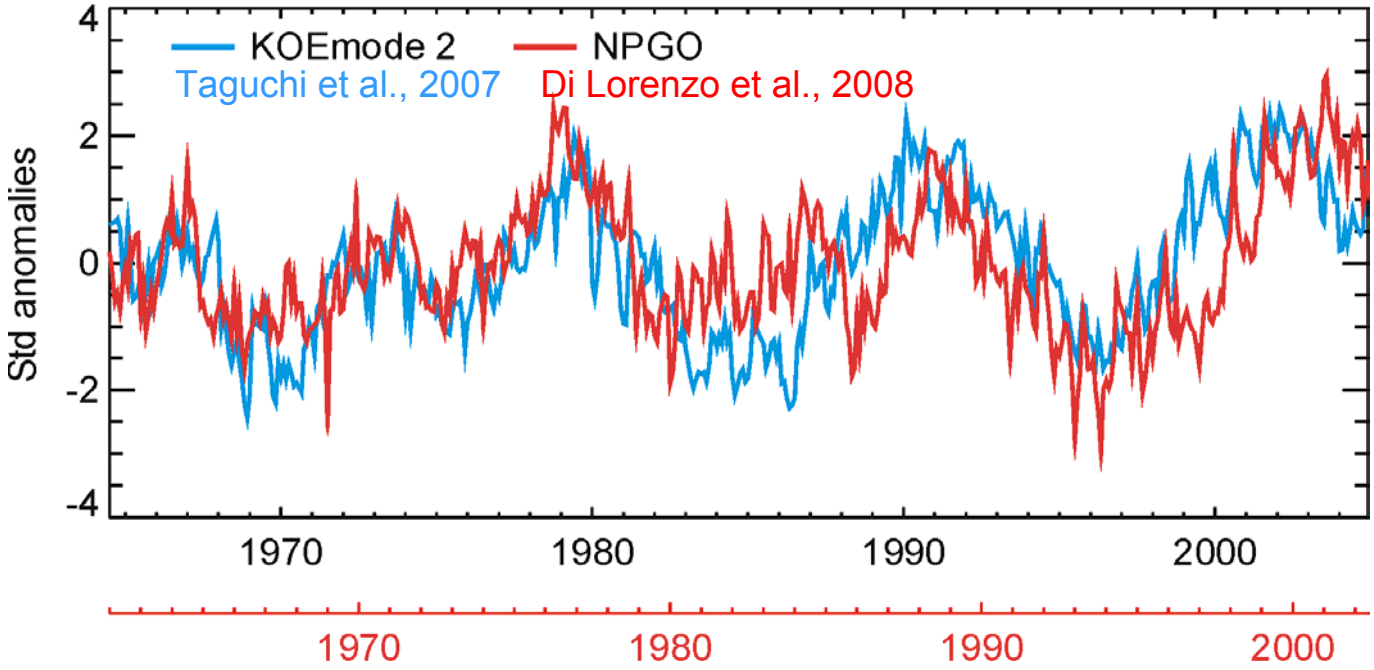

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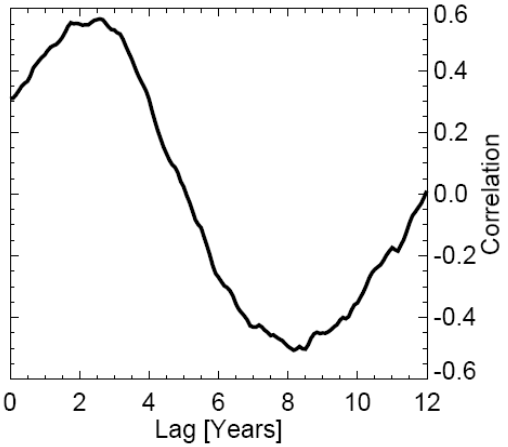
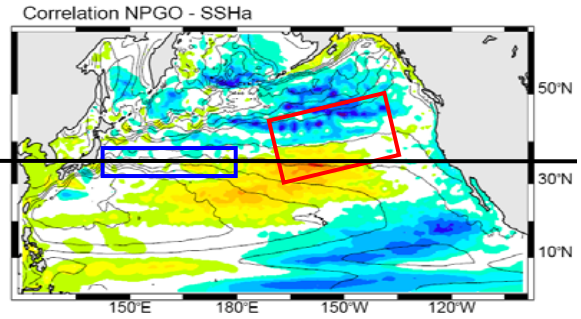


transect

35.25°N



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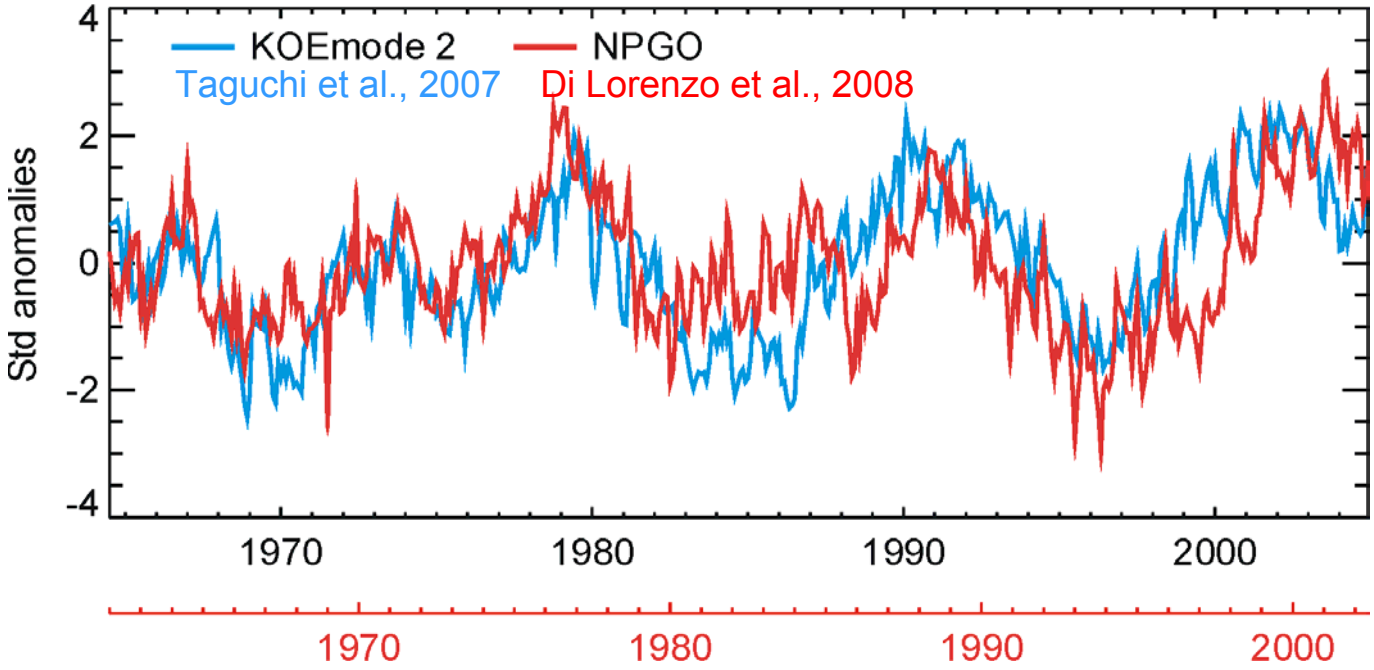

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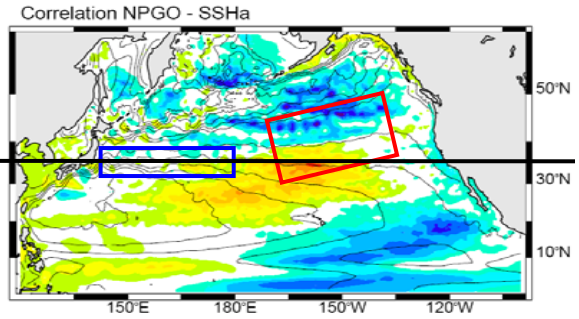

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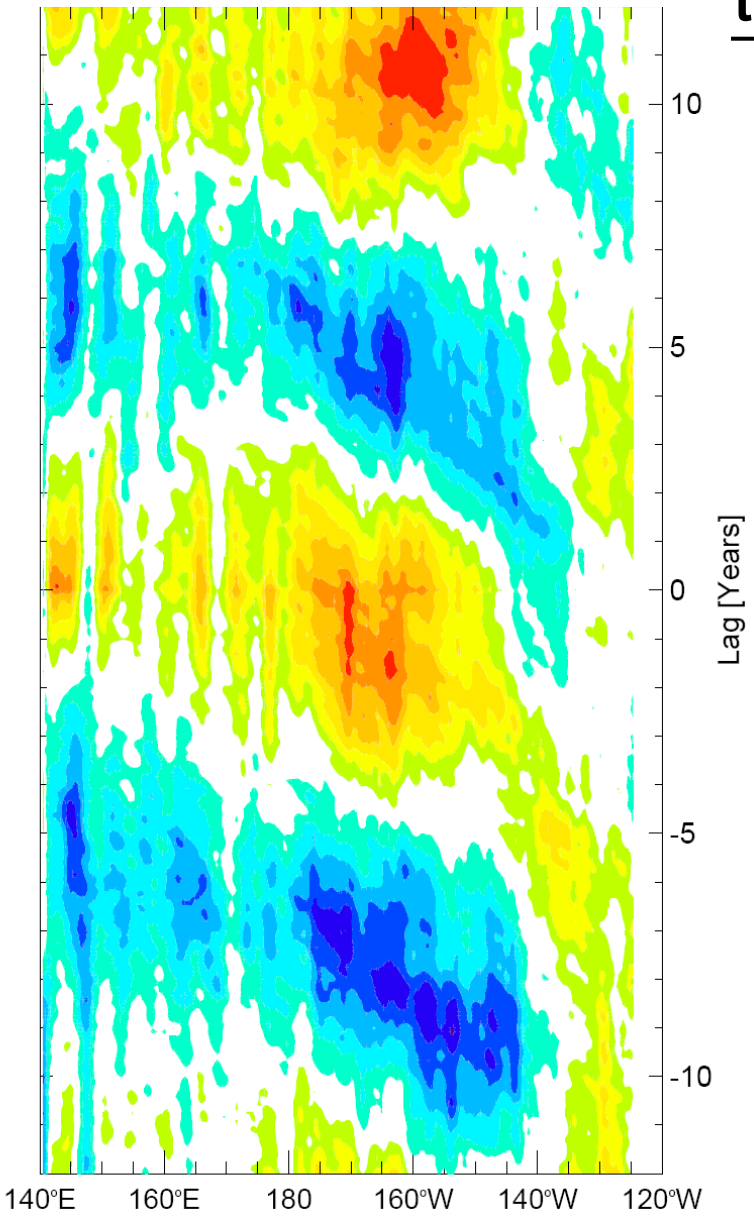
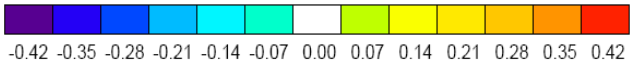
Western Boundary



Eastern Boundary

Lagged correlation KOE mode 2 vs. SSHa



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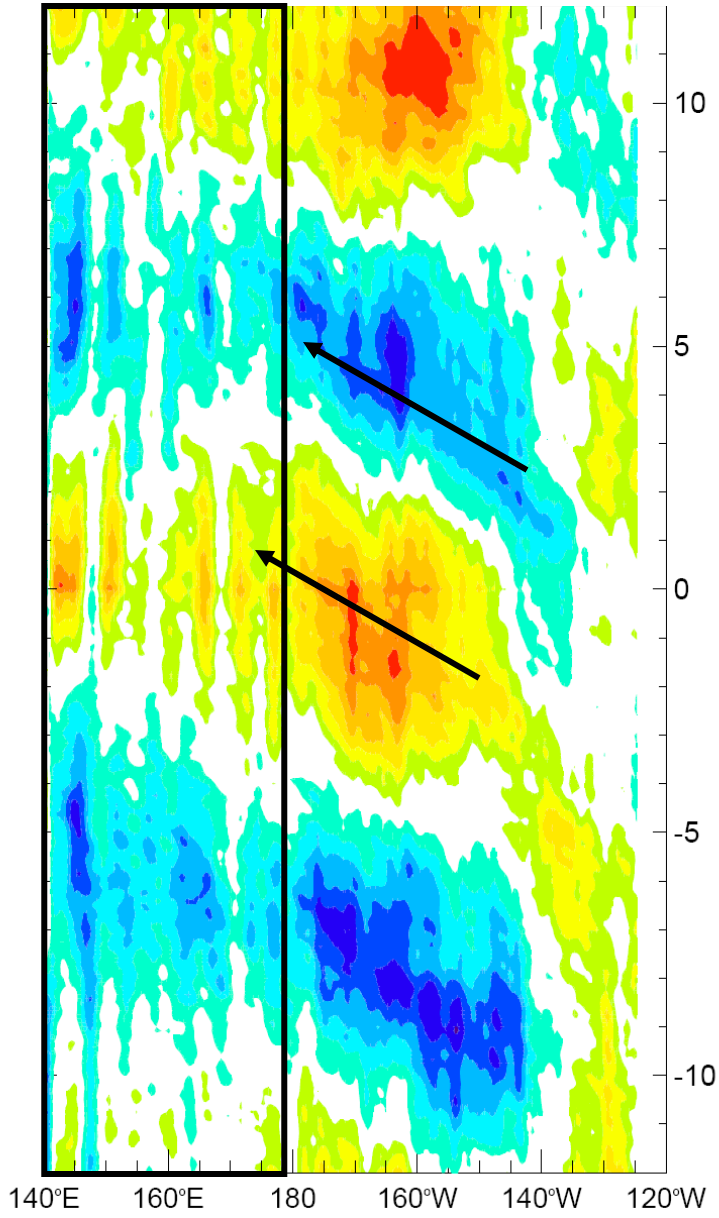

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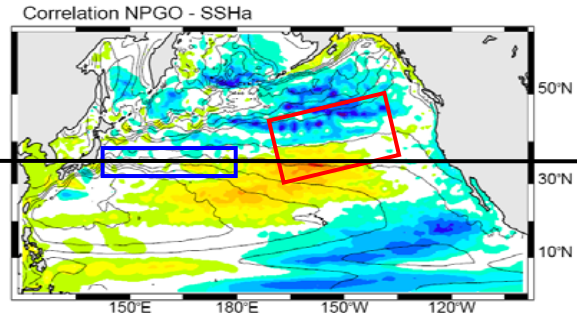
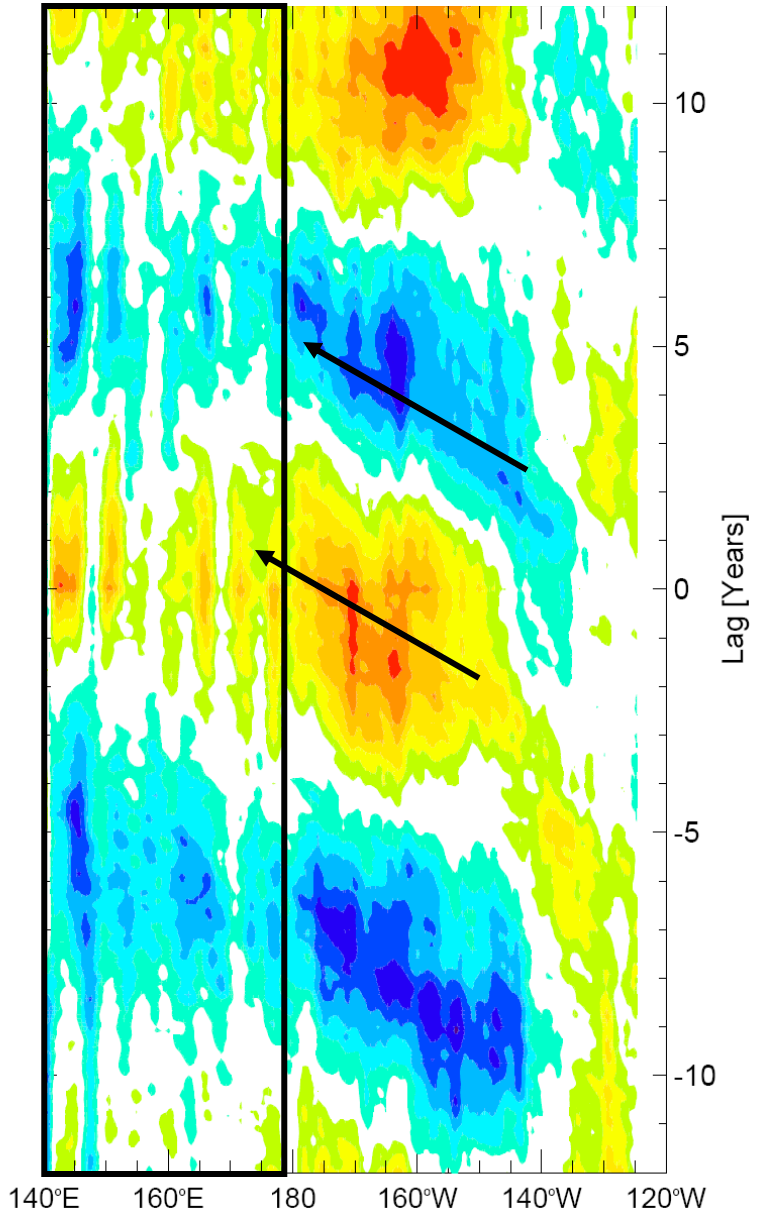


Lagged correlation KOE mode 2 vs. SSHa

What dynamics control the westward propagation?



Western Boundary

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Lagged correlation
KOE mode 2 vs. SSHa

Rossby wave model

(Qiu, 2003)

$$\frac{\partial h}{\partial t} - c_R \frac{\partial h}{\partial x} = -\frac{g'}{g} w_e$$

$$h(x,t) = \frac{g'}{c_R \rho_0 g f} \int_0^x w_e \left(x', t + \frac{x - x'}{c_R} \right) dx'$$

What dynamics control the westward propagation?

Rossby wave model

(Qiu, 2003)

Sea surface height anomaly

$$\frac{\partial h}{\partial t} - c_R \frac{\partial h}{\partial x} = -\frac{g'}{g} w_e$$

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Ekman pumping

Rossby wave model

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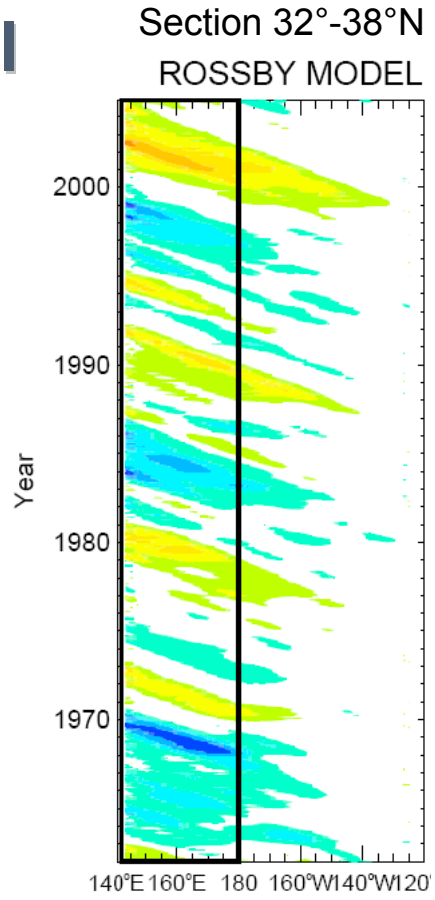
NCEP/NCAR monthly wind stress



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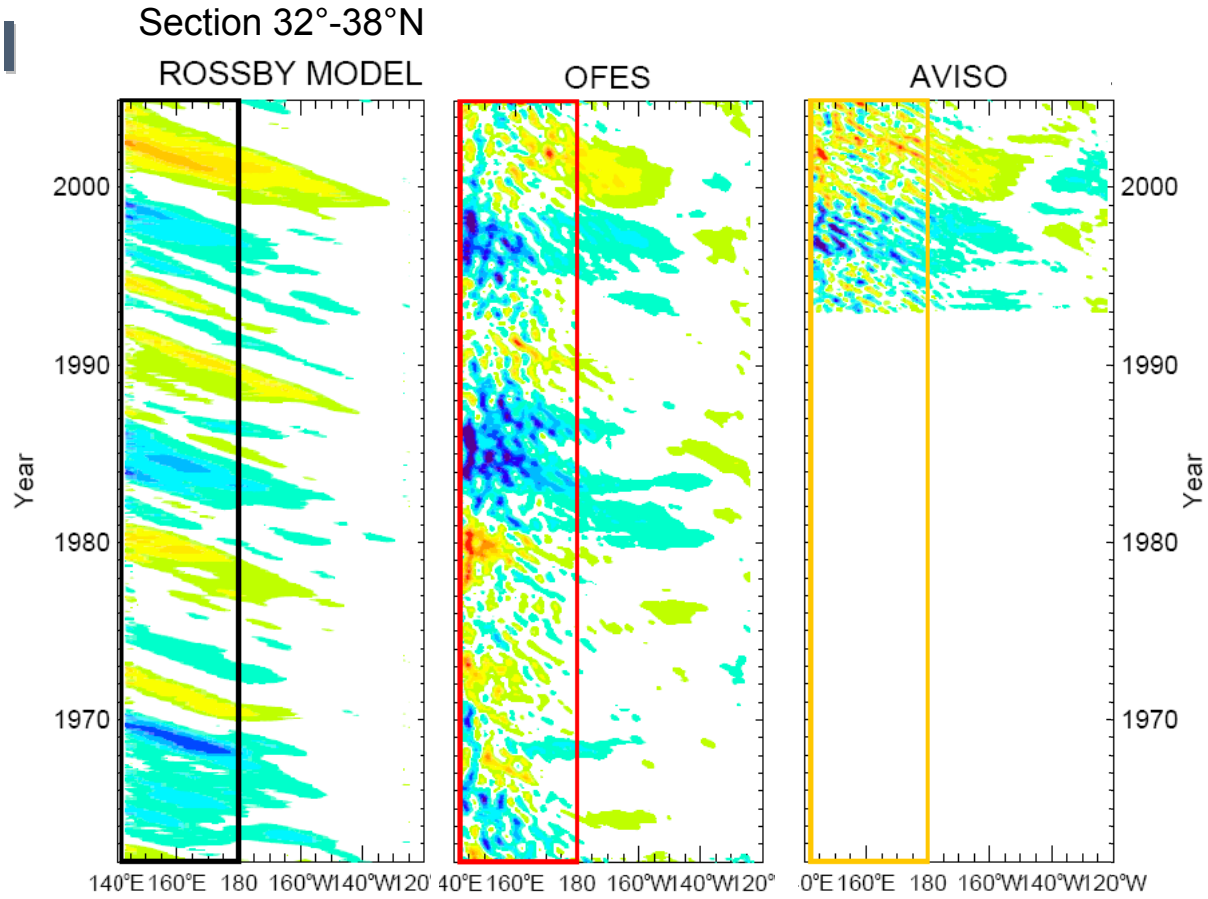

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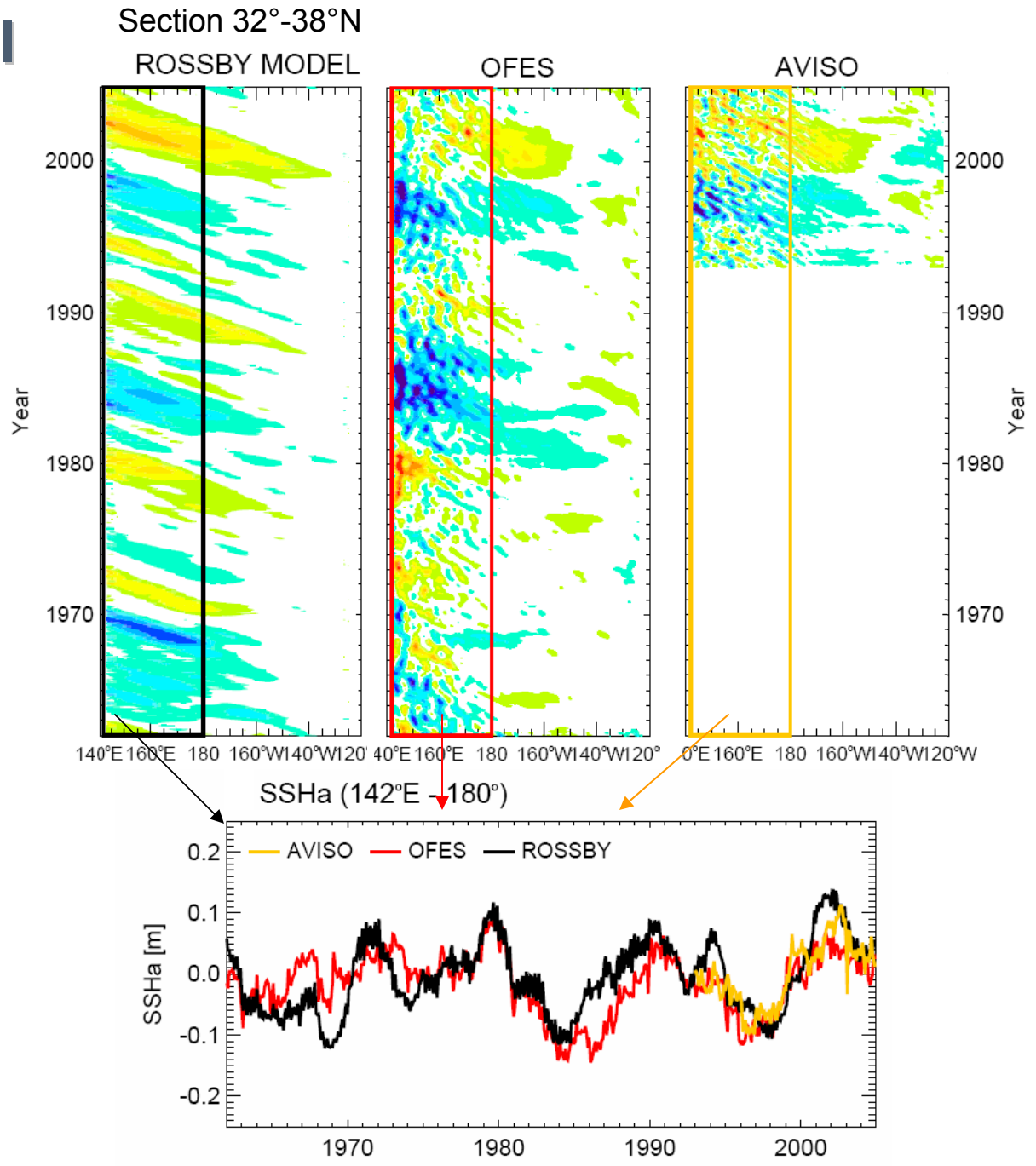

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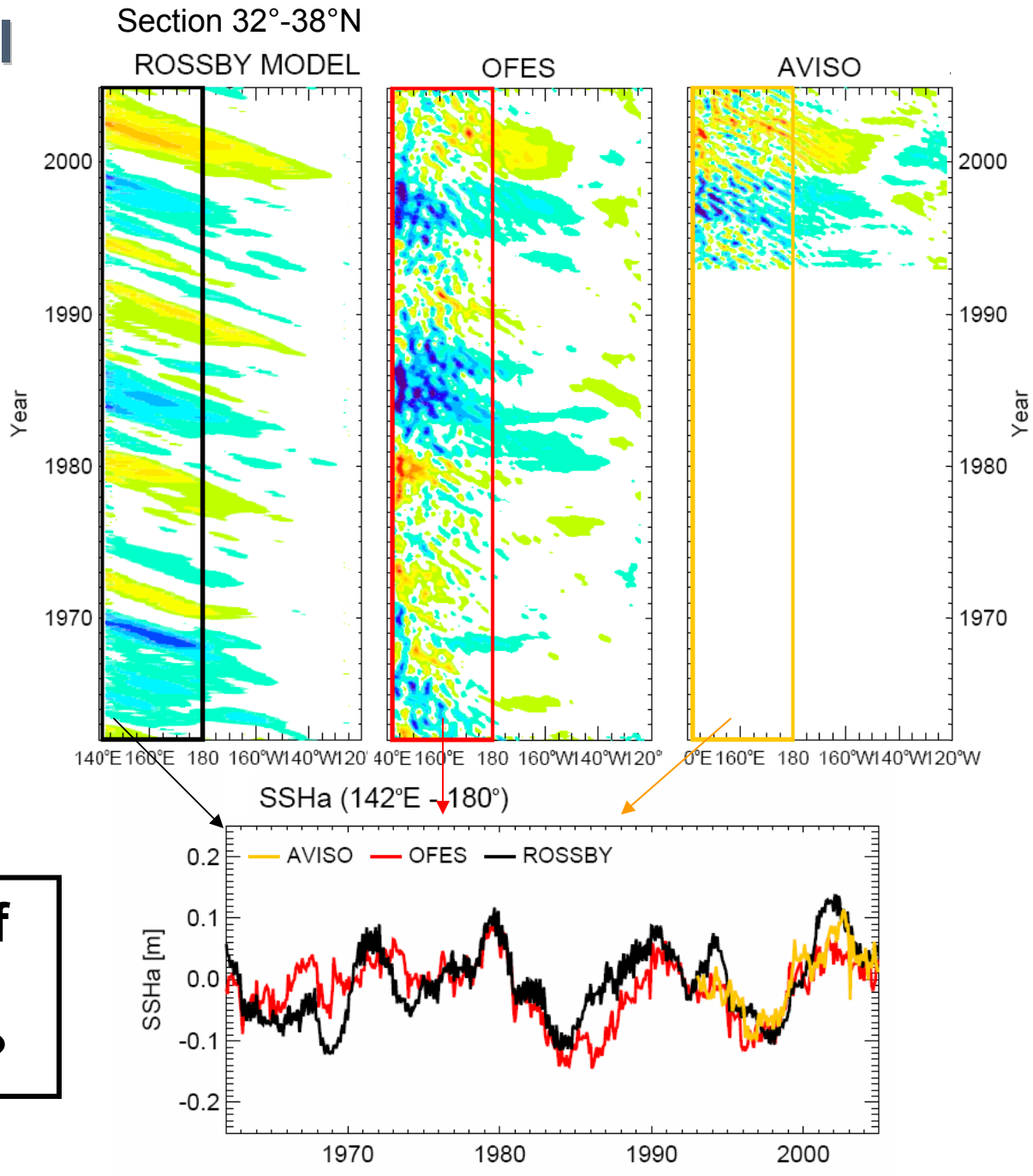
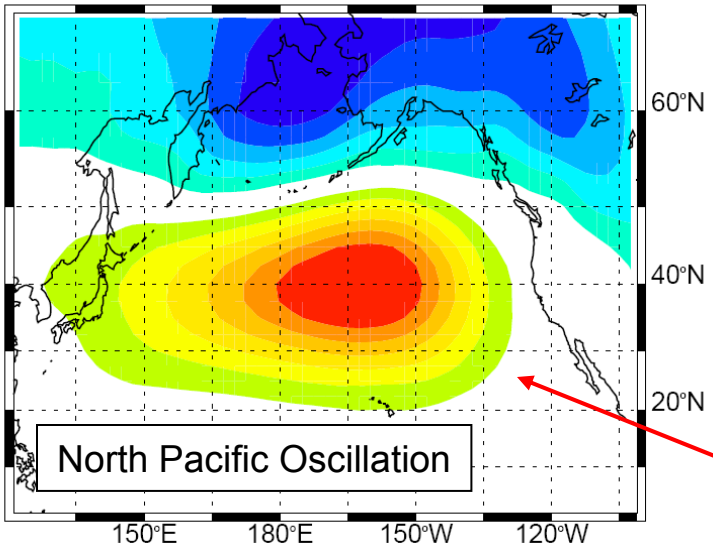


What is the role of NPO in driving SSHa in the KOE?

Modes of atmospheric variability

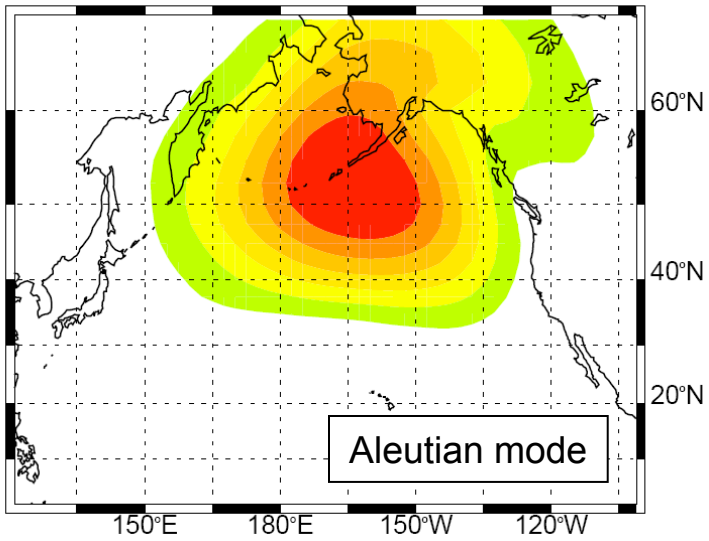
b) SLP EOF-2



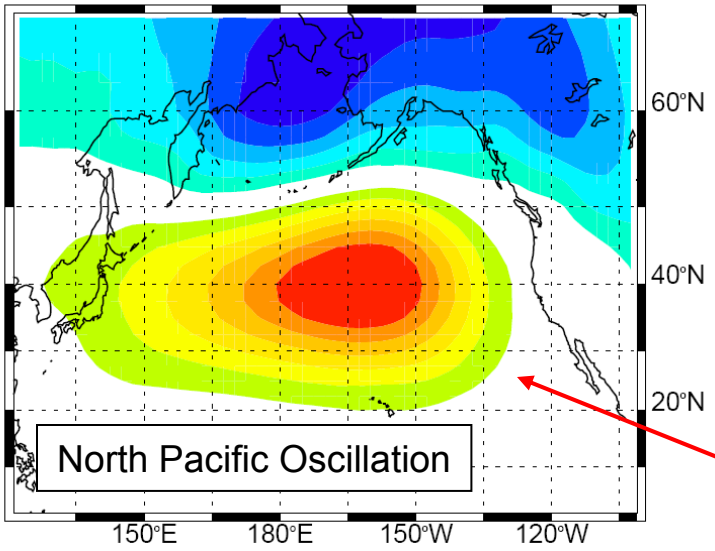
Forcing of the NPGO
(Di Lorenzo et al., 2008; Chhak et al.,2008)

Modes of atmospheric variability

a) SLP EOF-1



b) SLP EOF-2



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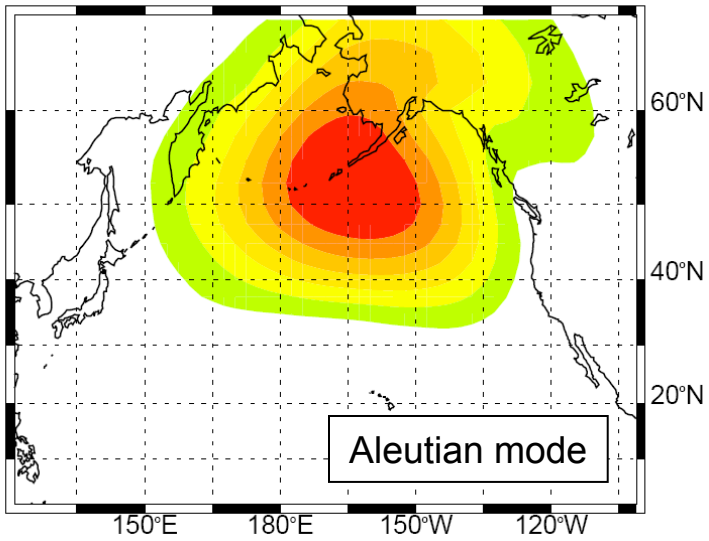

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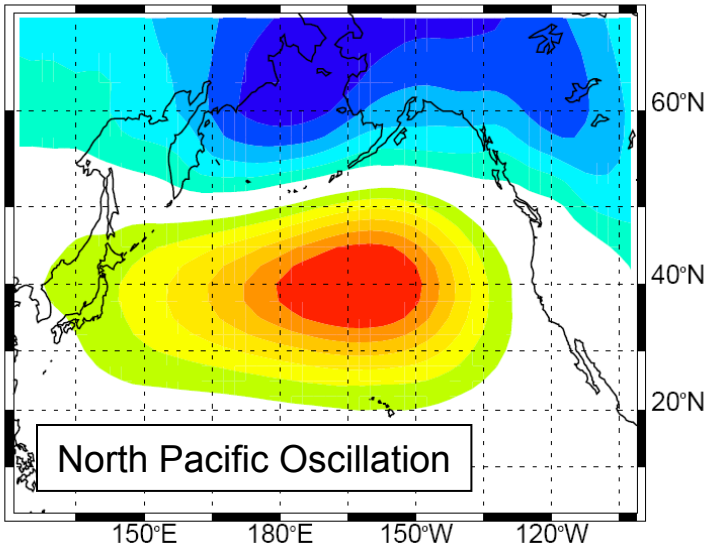
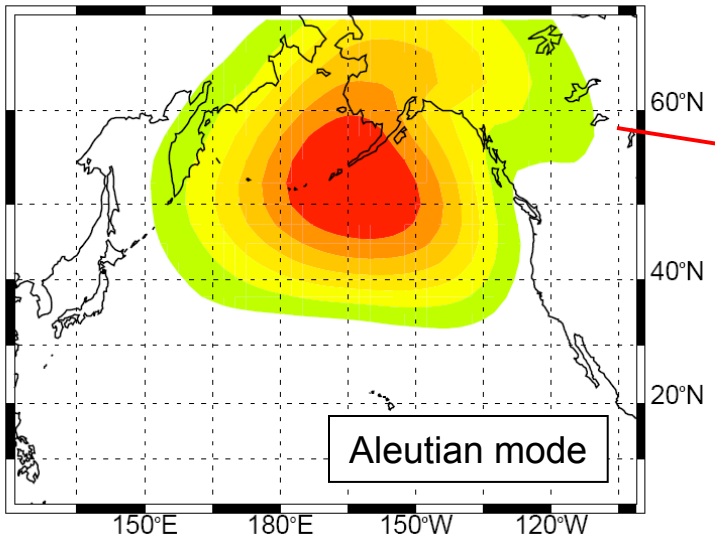


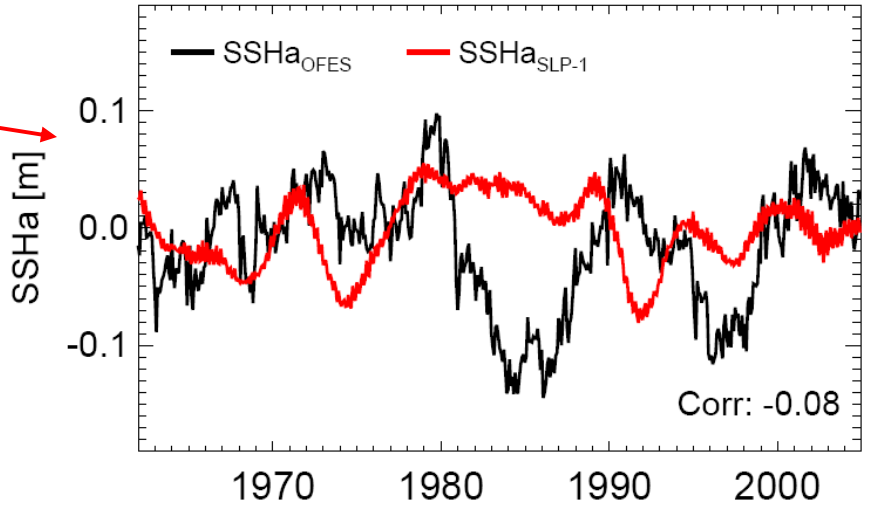
Method of analysis:

We decompose the wind stress field into the AL and NPO mode to drive Rossby Wave model

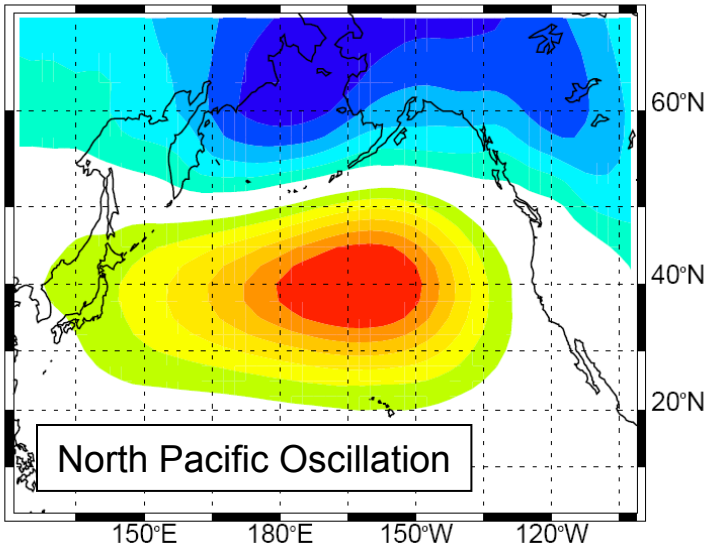
Modes of atmospheric variability

a) SLP EOF-1



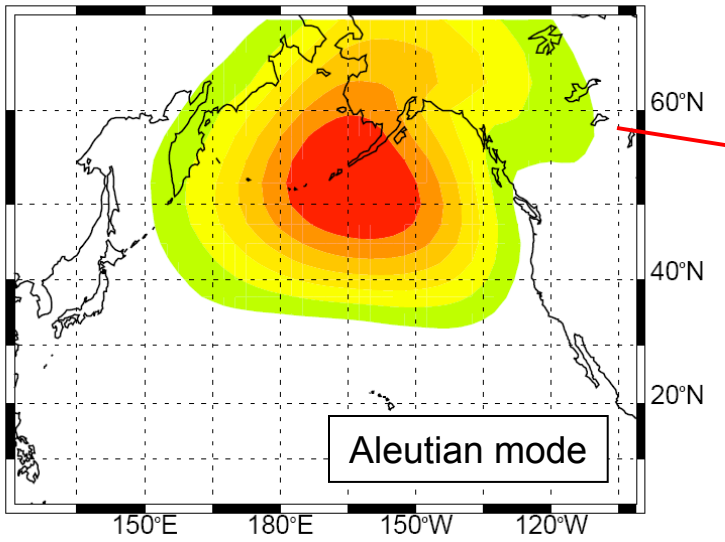


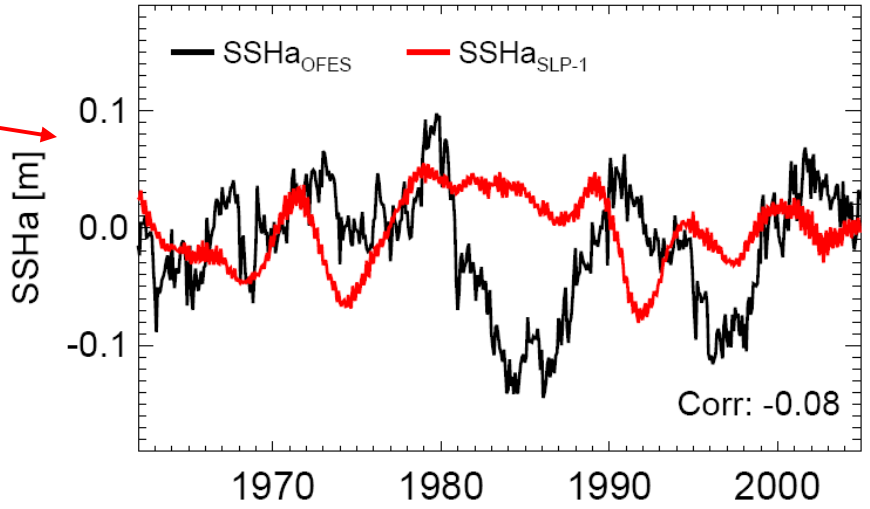
b) SLP EOF-2



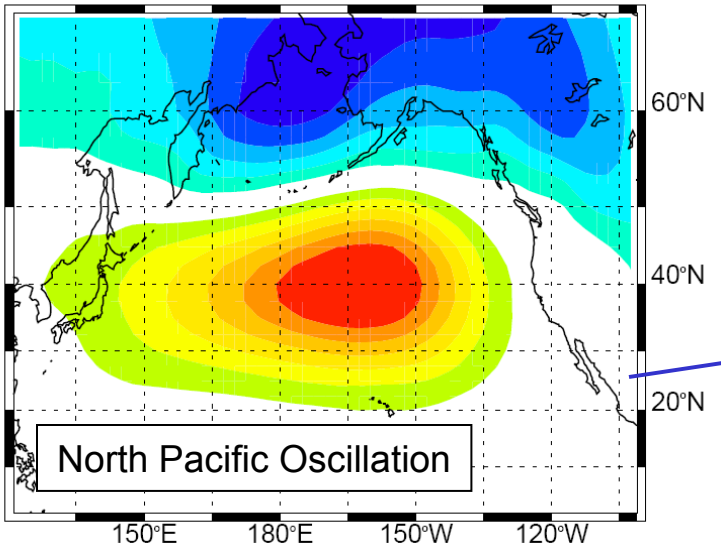
Modes of atmospheric variability

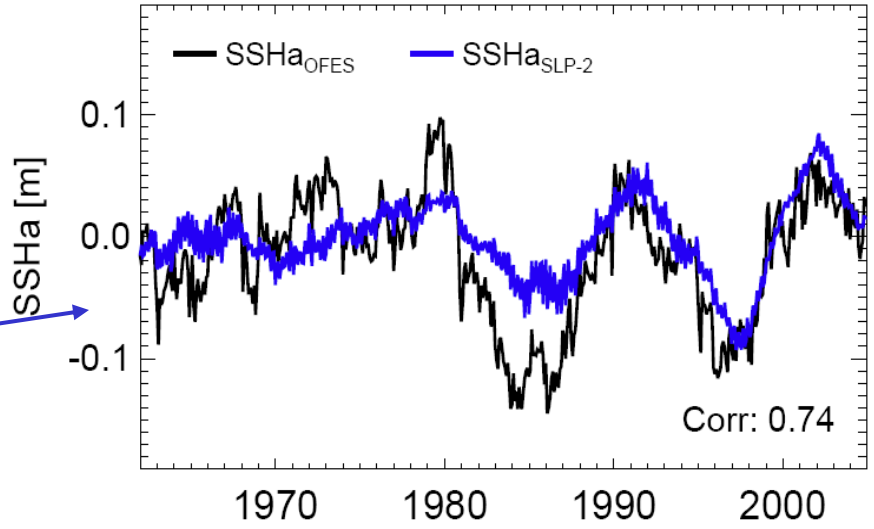
a) SLP EOF-1





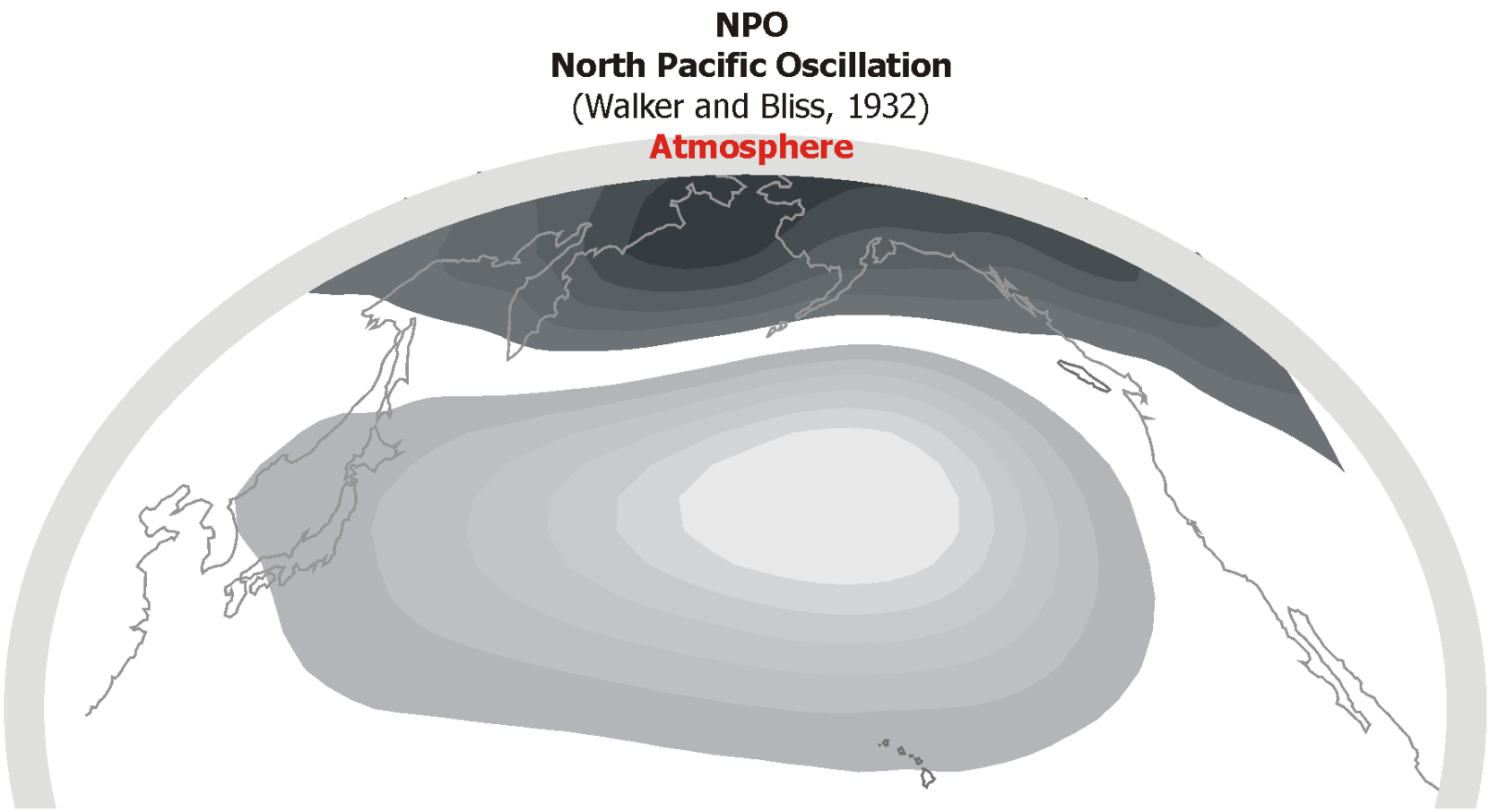
b) SLP EOF-2



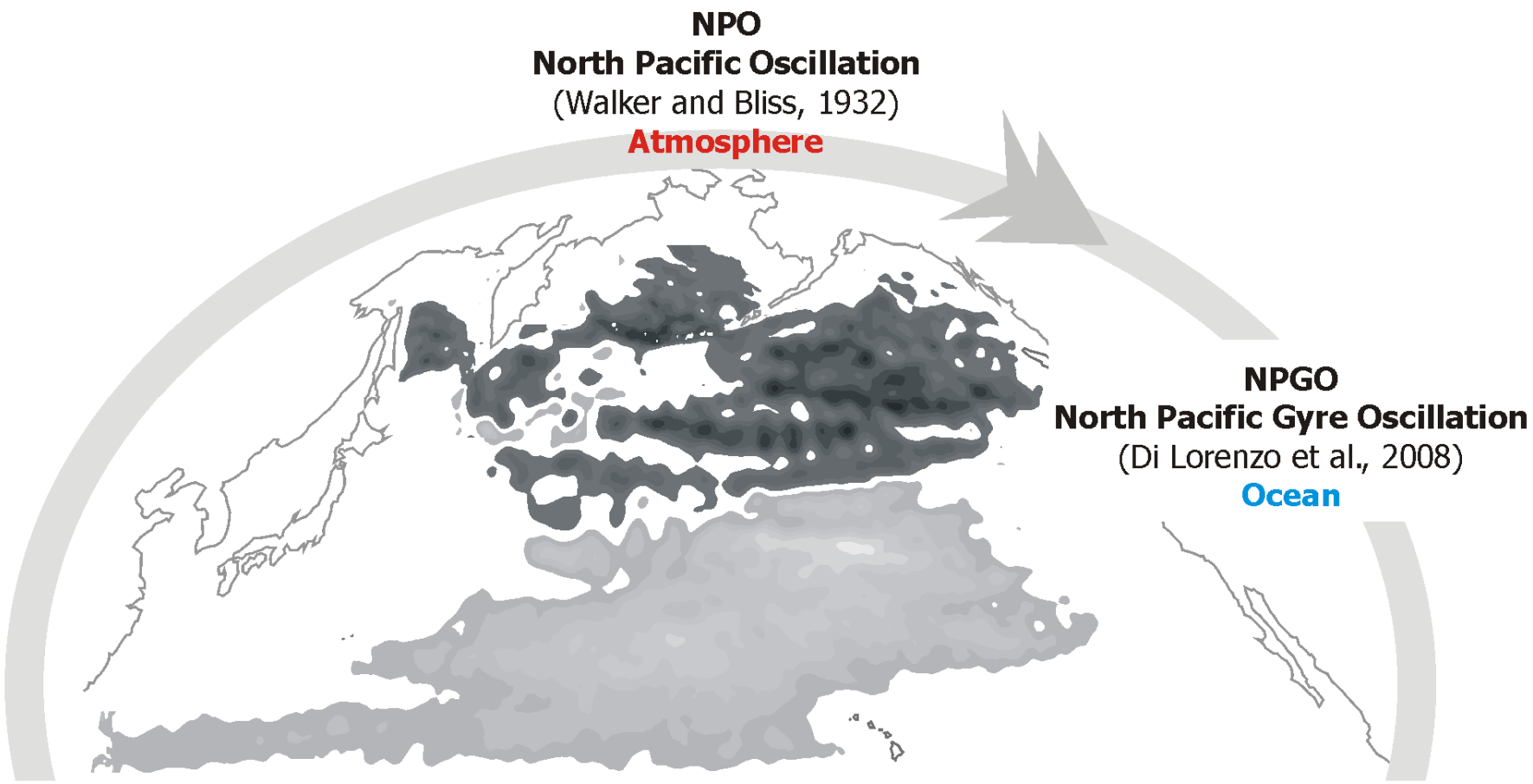


Summary

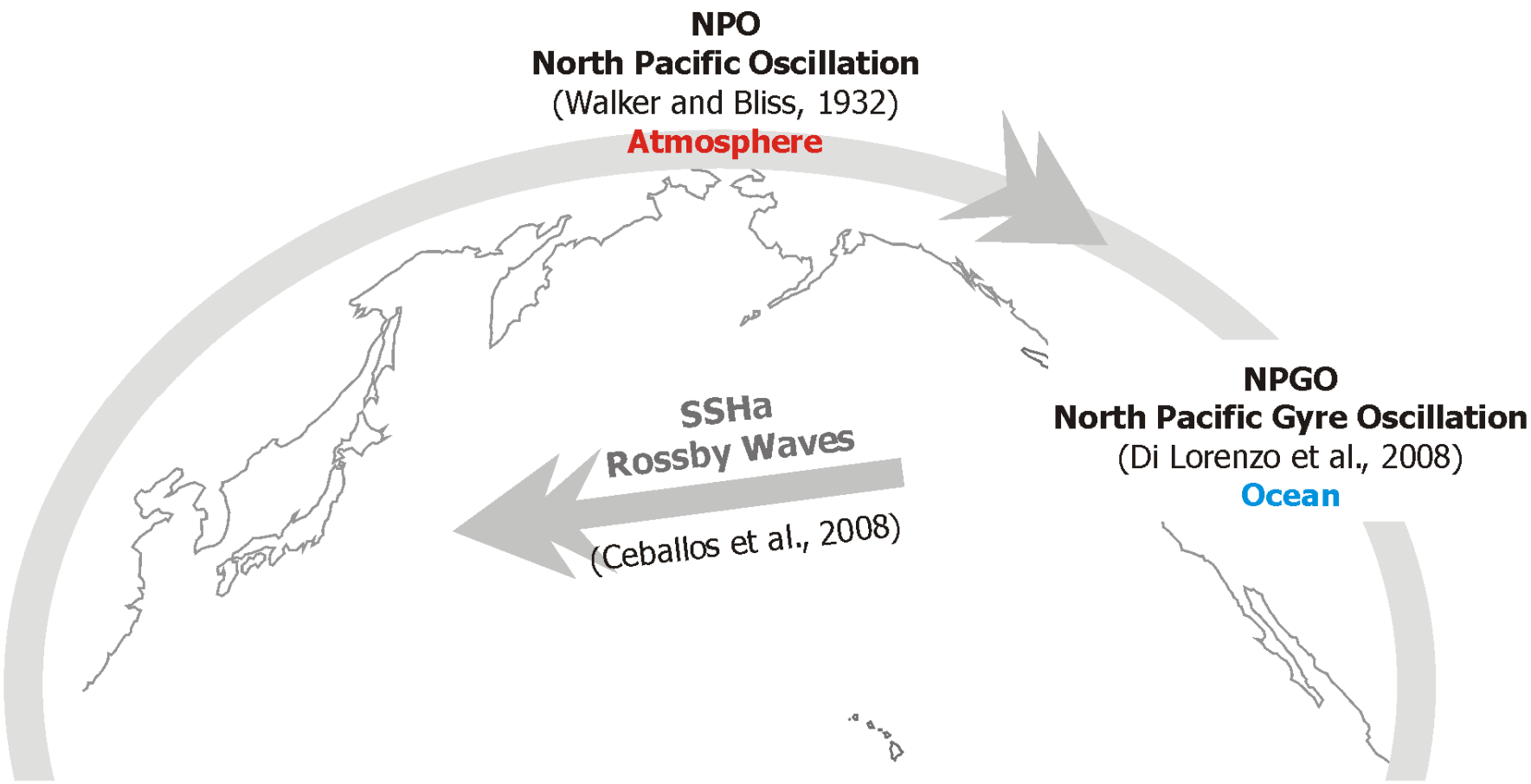
Summary


NPO
North Pacific Oscillation
(Walker and Bliss, 1932)
Atmosphere

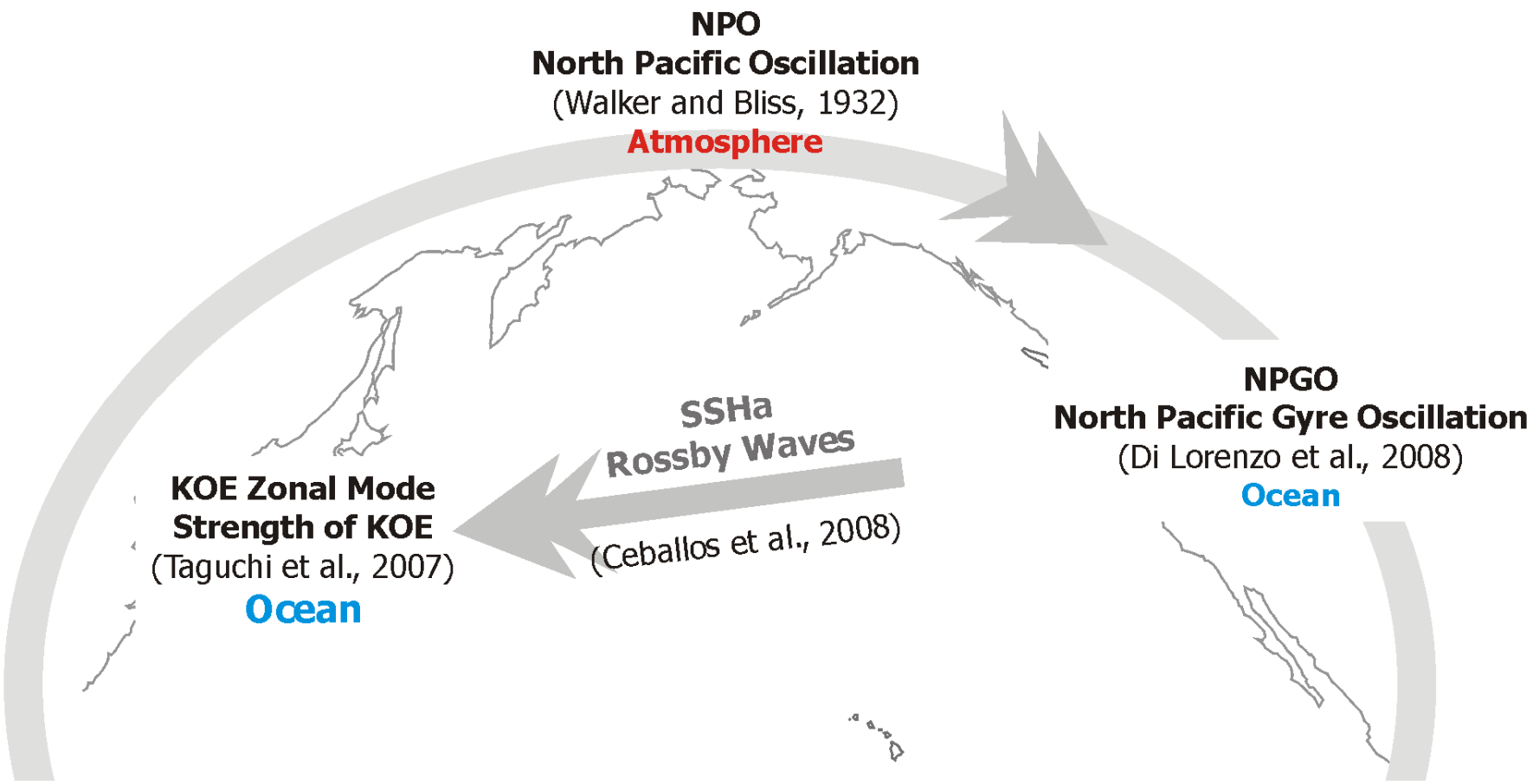
Summary


NPO
North Pacific Oscillation
(Walker and Bliss, 1932)
Atmosphere
NPGO
North Pacific Gyre Oscillation
(Di Lorenzo et al., 2008)
Ocean

Summary


NPO
North Pacific Oscillation
(Walker and Bliss, 1932)
Atmosphere
SSHa
Rossby Waves
(Ceballos et al., 2008)
NPGO
North Pacific Gyre Oscillation
(Di Lorenzo et al., 2008)
Ocean

Summary


NPO
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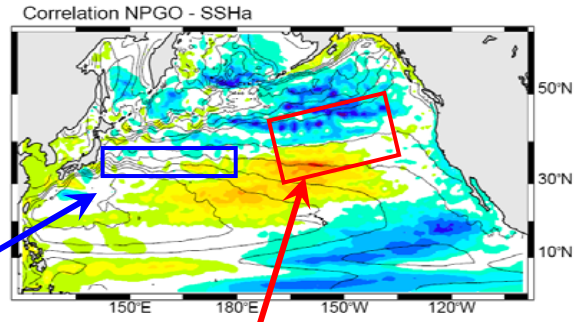
SSHa
Rossby Waves
(Ceballos et al., 2008)
KOE Zonal Mode
Strength of KOE
(Taguchi et al., 2007)
Ocean

Are NPGO and KOE related?

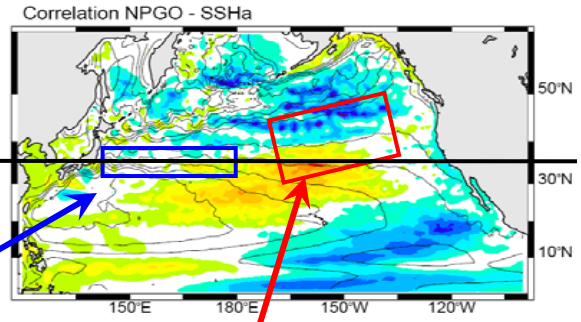


KOEmode 2: strength of the Kuroshio Jet

3 year lag

NPGO: strength of the central/eastern branch of subtropical gyre

Are NPGO and KOE related?



transect

35.25°N

KOEmode 2: strength of the Kuroshio Jet

3 year lag

NPGO: strength of the central/eastern branch of subtropical gyre

we perform a

Lagged correlation KOE mode 2 vs. SSHa