Shifting ENSO status-quo and beyond

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COLLEGE of AGRICULTURE and APPLIED SCIENCES
UtahStateUniversity

円相
えんそう

In Zen, ensō ("circle") is hand-drawn in one or two uninhibited brushstrokes to express a moment when the mind is free to let the body create.

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えんそう

In Zen, ensō ("circle") is hand-drawn in one or two uninhibited brushstrokes to express a moment when the mind is free to let the body create.

ENSO Diversit

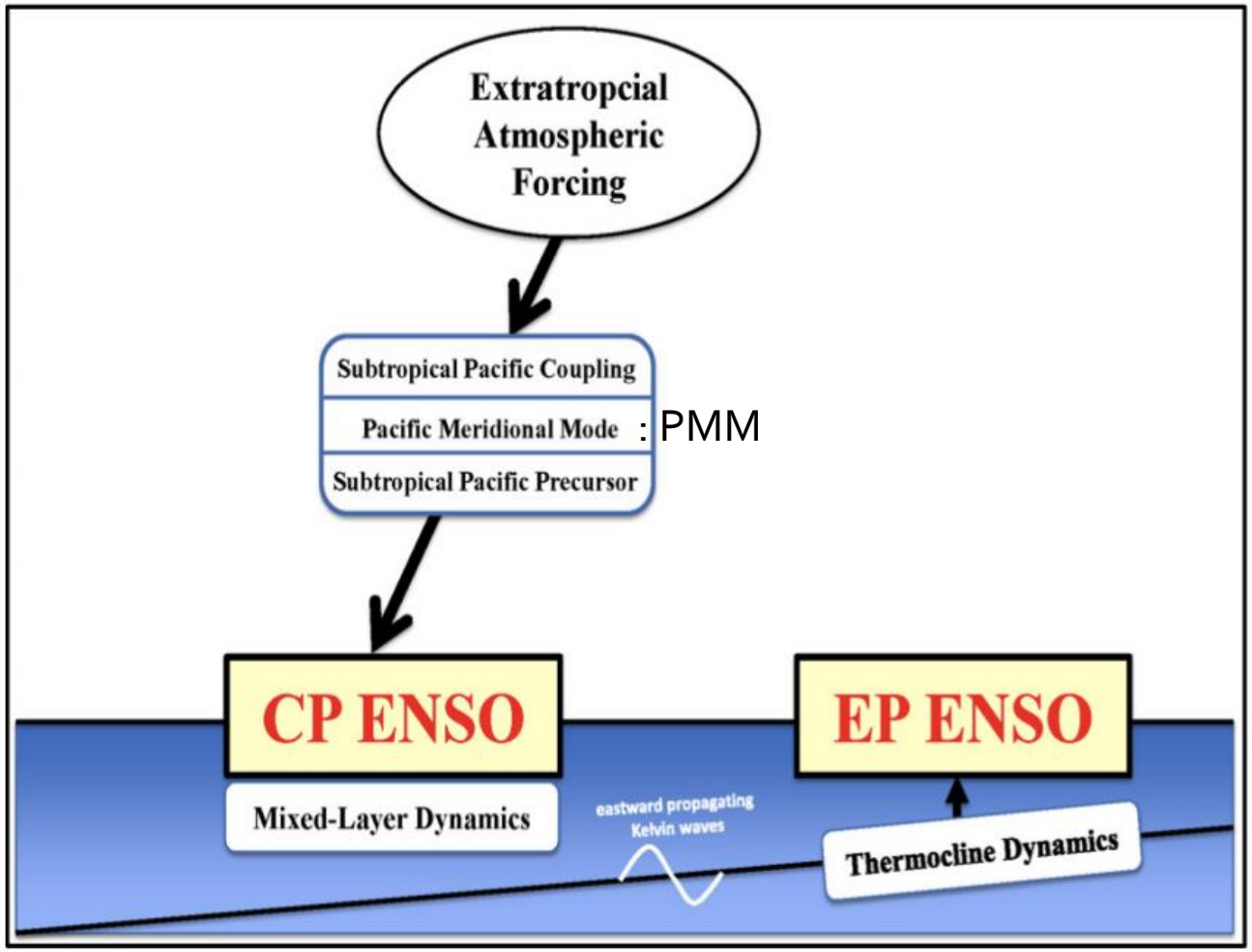
your state of mind

(the) moment when the mind is free to let the body create.

means the precursors to drawing a beautiful, round "enso"

Major ENSO precursors

outside the tropics



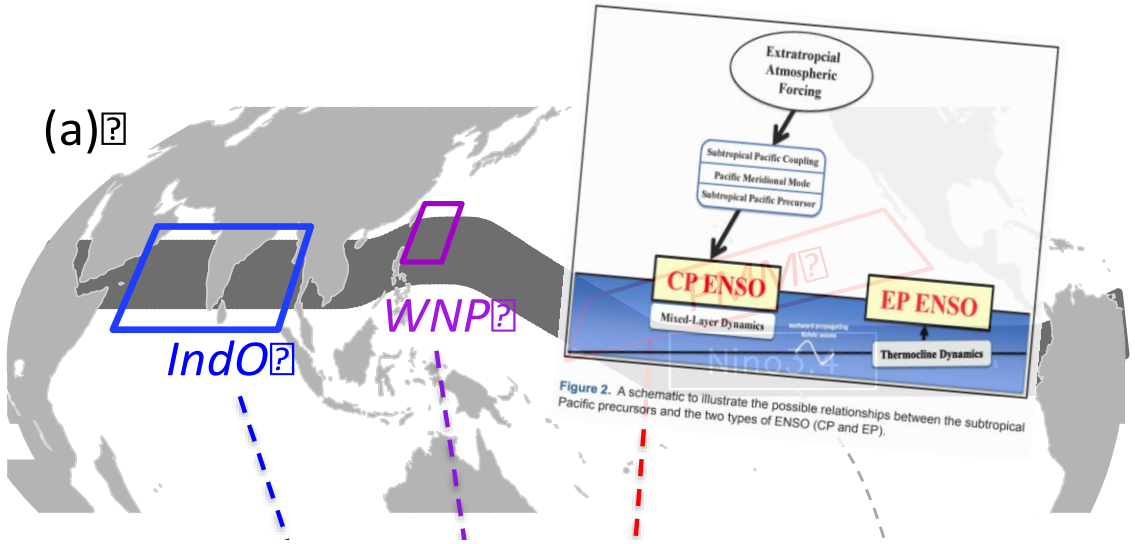
Precursors of ENSO beyond the tropical Pacific

Jin-Yi Yu and Houk Paek

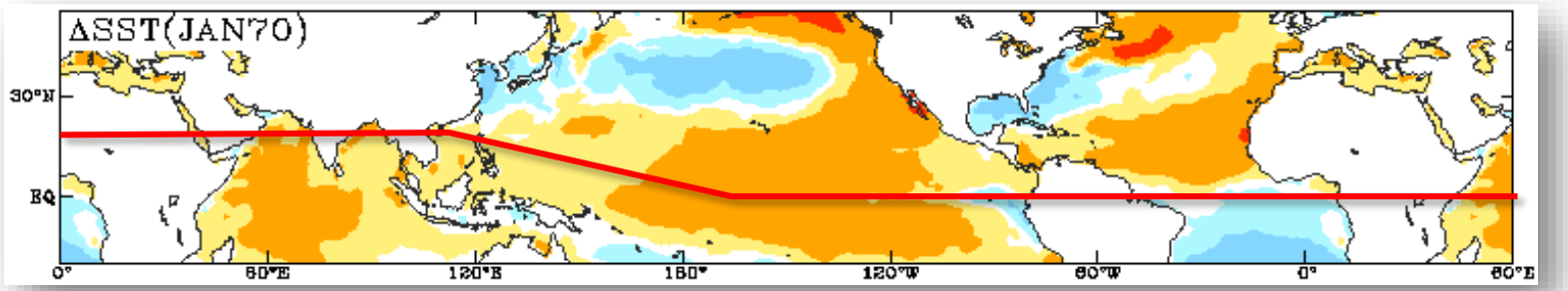
University of California, Irvine

Major ENSO precursors

excluding Atlantic



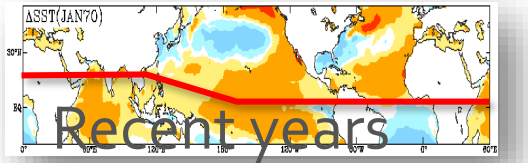
an overlooked pathway in how ENSO forms



SST evolution | 18-month bandpass filtered

an overlooked pathway in how ENSO forms

Earlier years



Recent years

⇓

⇓

⇓

Time-longitude evolution

⇓

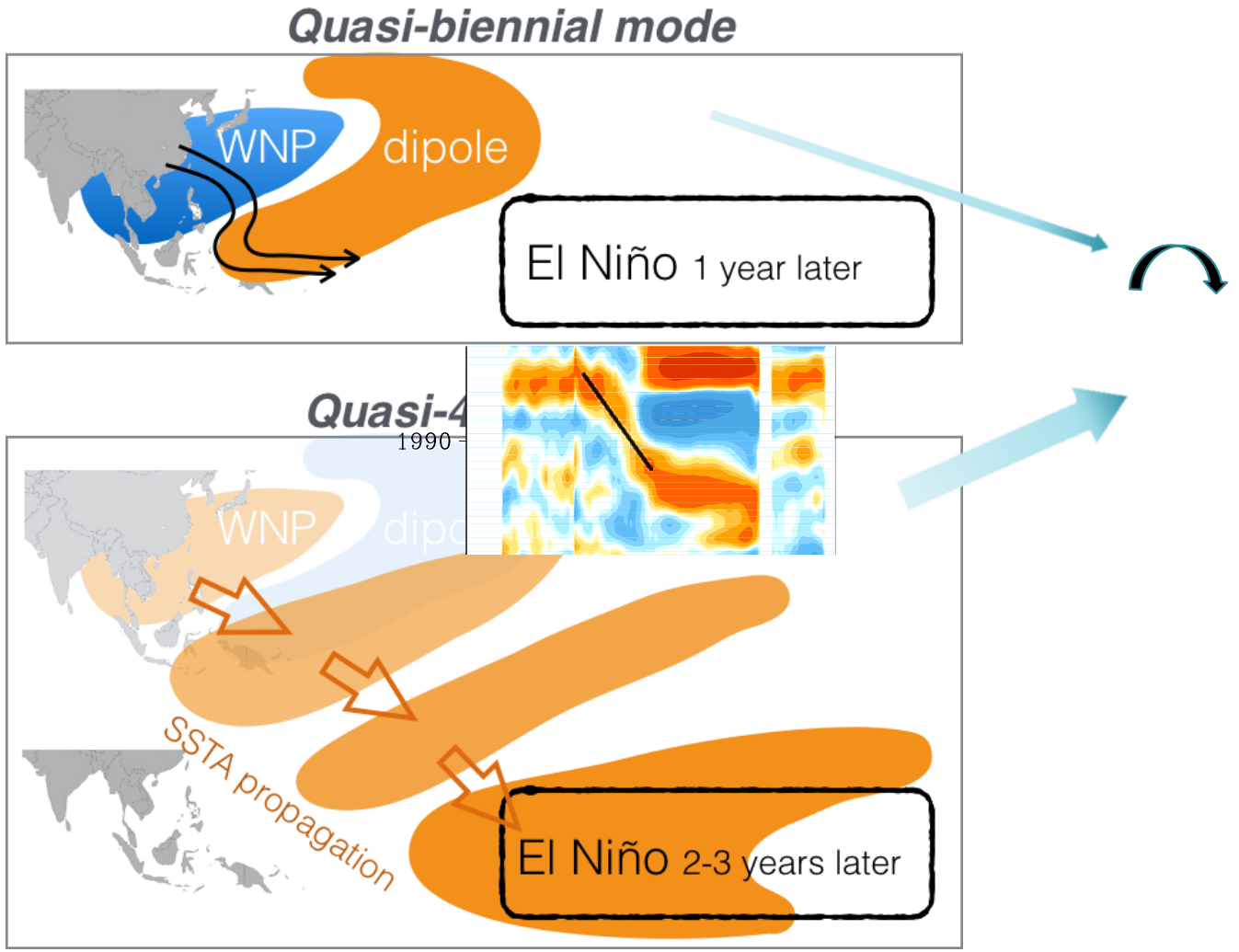
⇓

⇓

Consider that ENSO cycle has

two modes:

* biennial
* 4-6-year interannual



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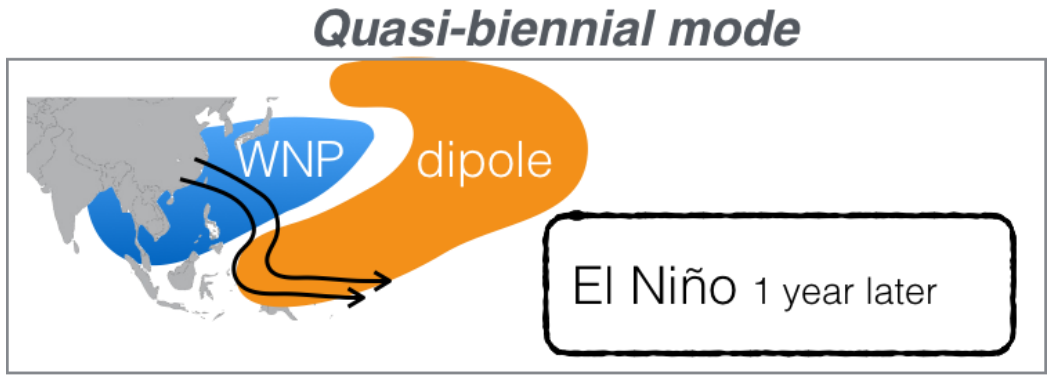

GRL | Geophysical Research Letters

doi:10.1029/2012GL050909, 2012

ENSO prediction one year in advance using western North Pacific sea surface temperatures

Shih-Yu Wang,[1] Michelle L'Heureux,[2] and Hsin-Hsing Chia[3]

Received 10 January 2012; revised 10 February 2012; accepted 12 February 2012; published 8 March 2012.

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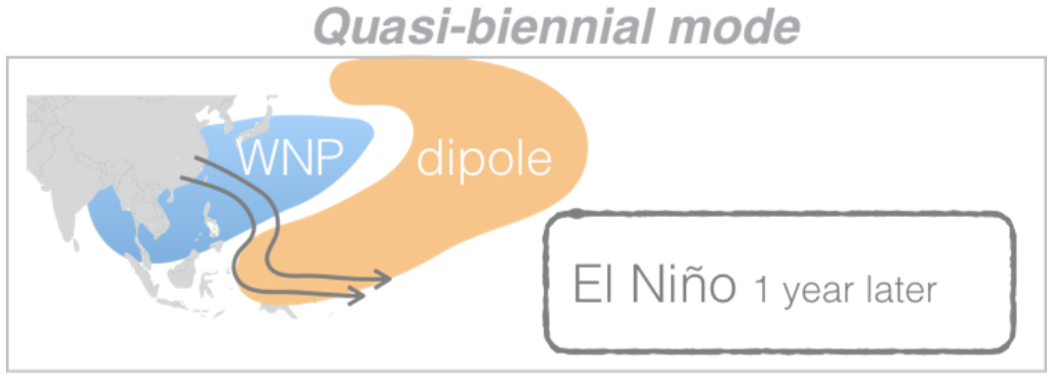
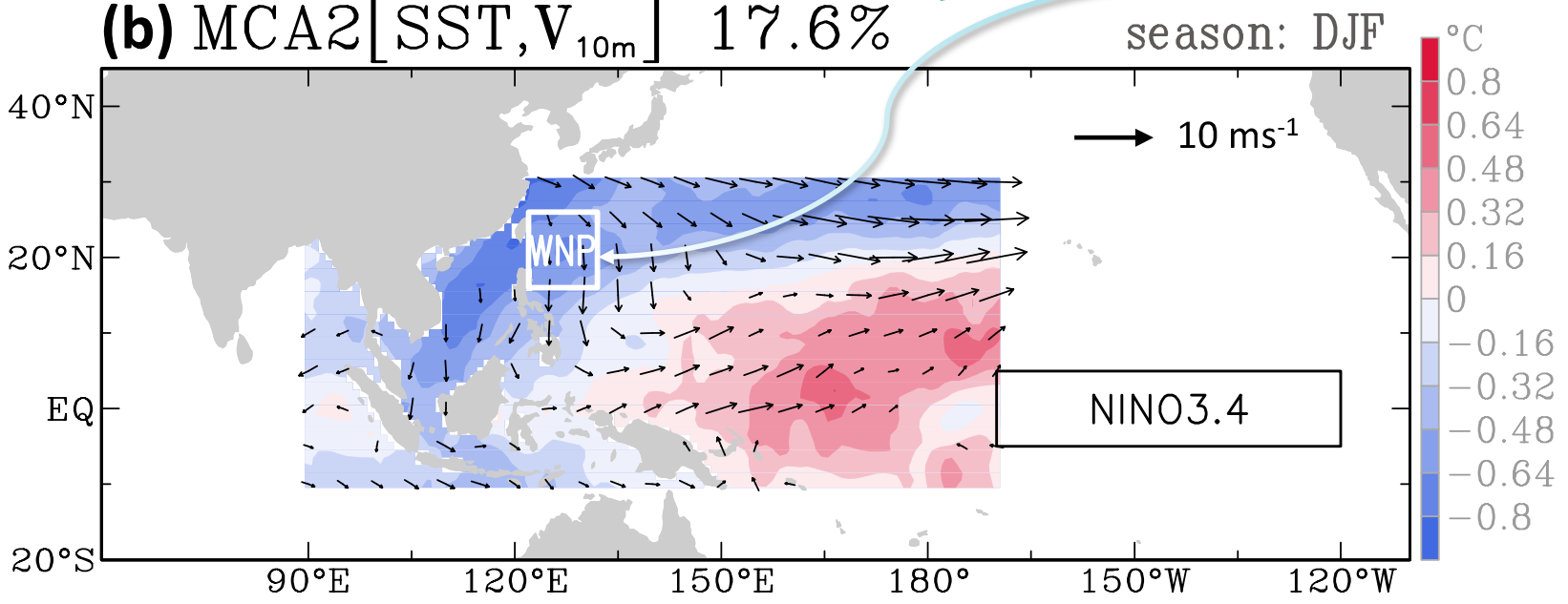


has to be detrended!



Impact of Changjiang River Discharge on Sea Surface Temperature in the East China Sea

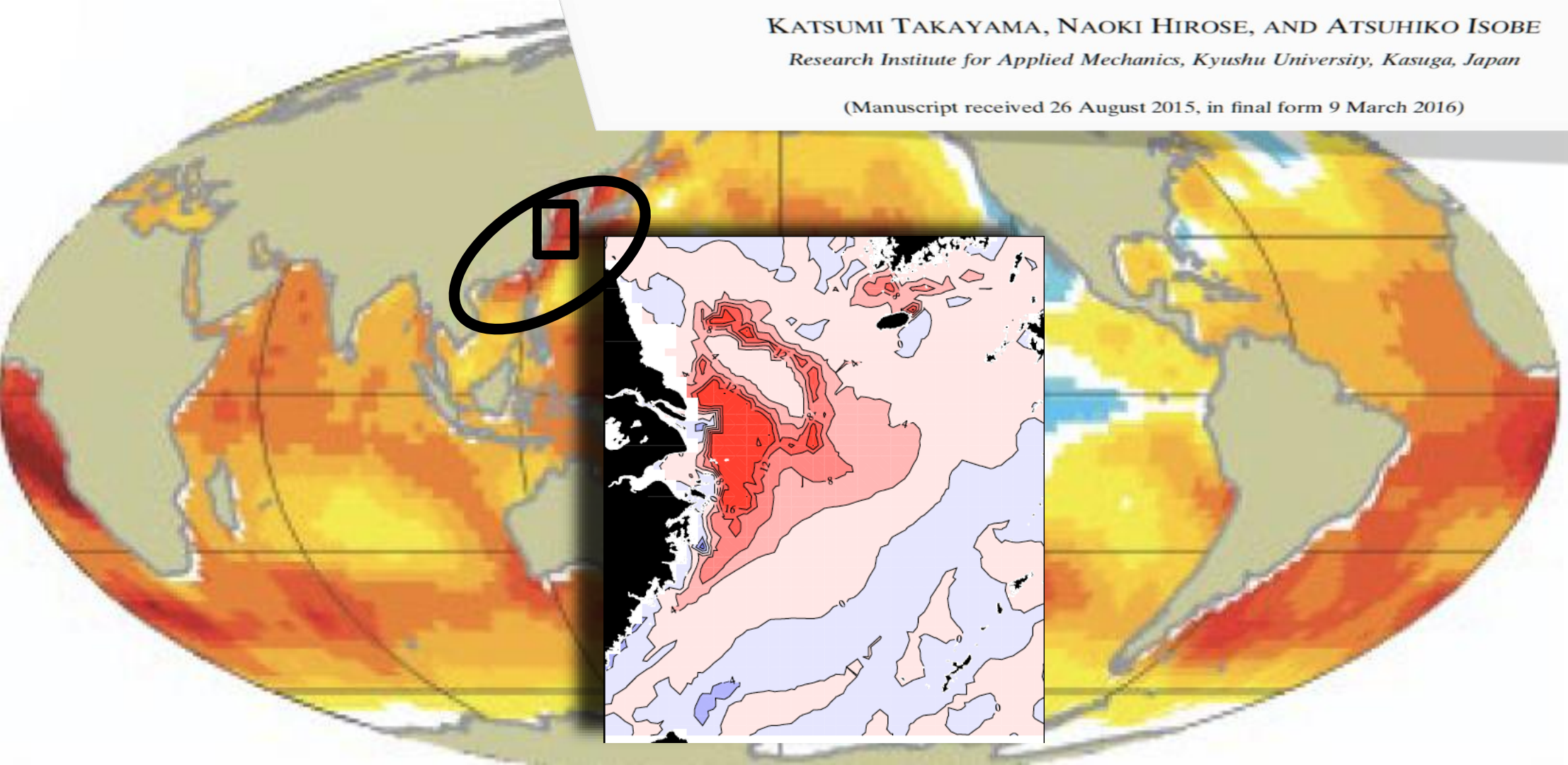
SHIN'ICHIRO KAKO AND TOMOFUMI NAKAGAWA

Graduate School of Science and Technology, Department of Ocean Civil Engineering, Kagoshima University, Kagoshima, Japan

KATSUMI TAKAYAMA, NAOKI HIROSE, AND ATSUHIKO ISOBE

Research Institute for Applied Mechanics, Kyushu University, Kasuga, Japan

(Manuscript received 26 August 2015, in final form 9 March 2016)



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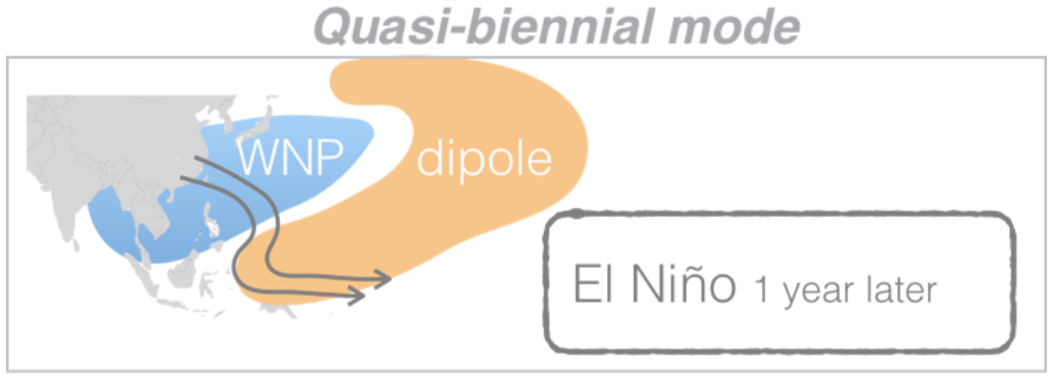

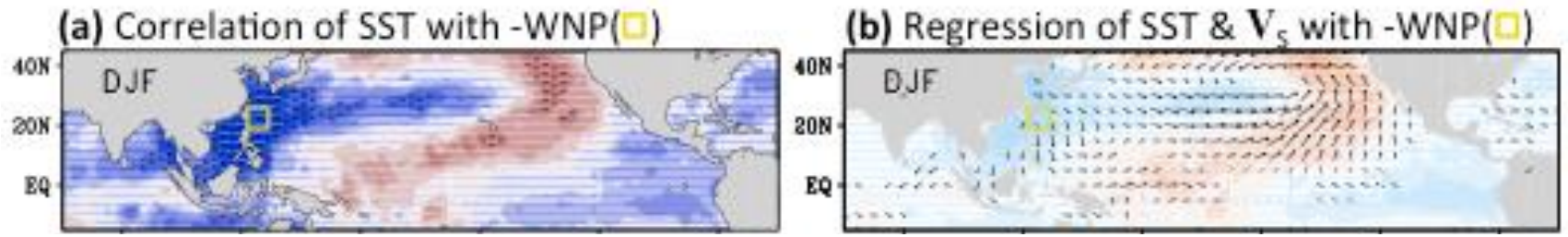

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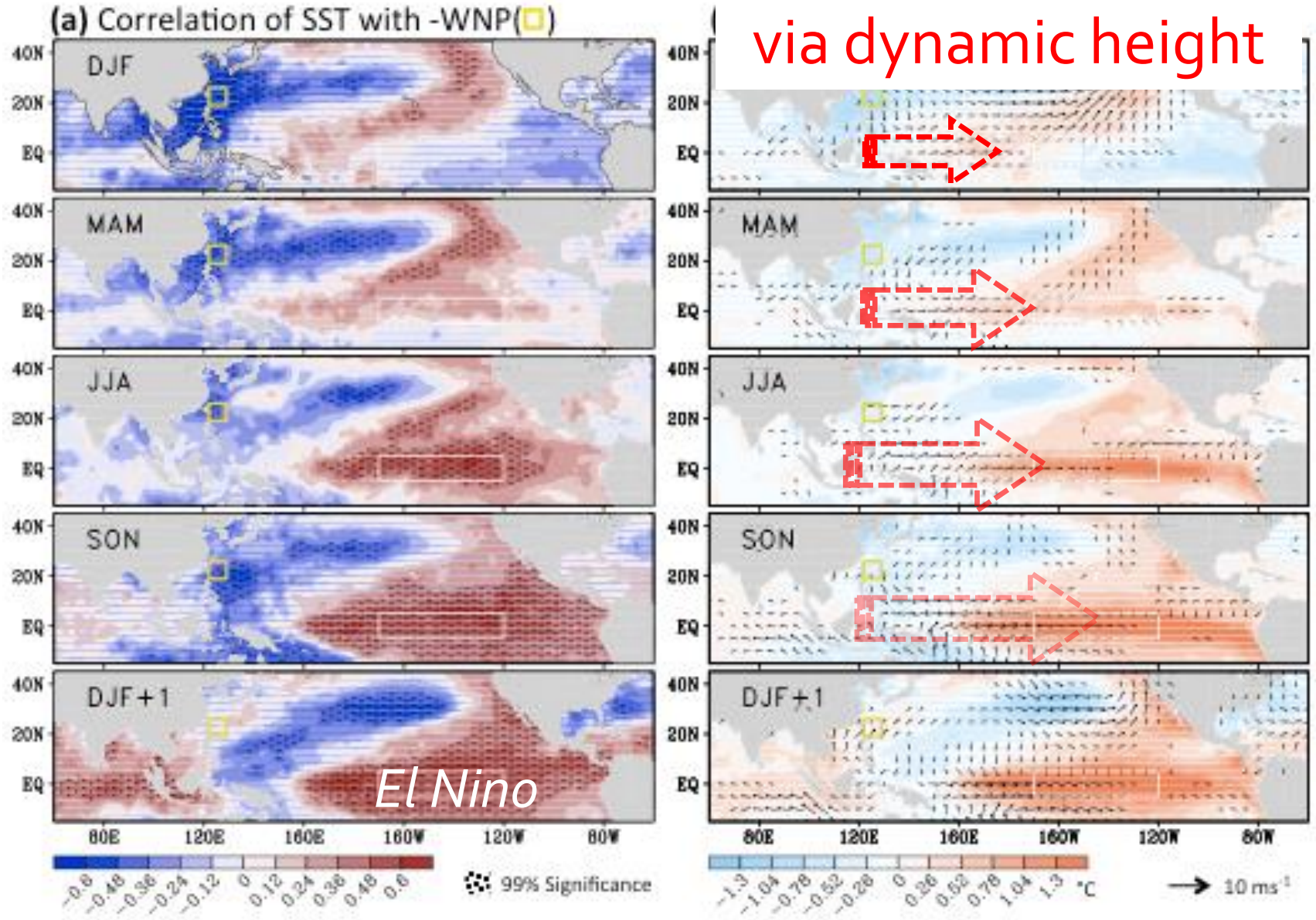

Oceanic Kelvin wave via dynamic height

Consider that ENSO cycle has

two modes:

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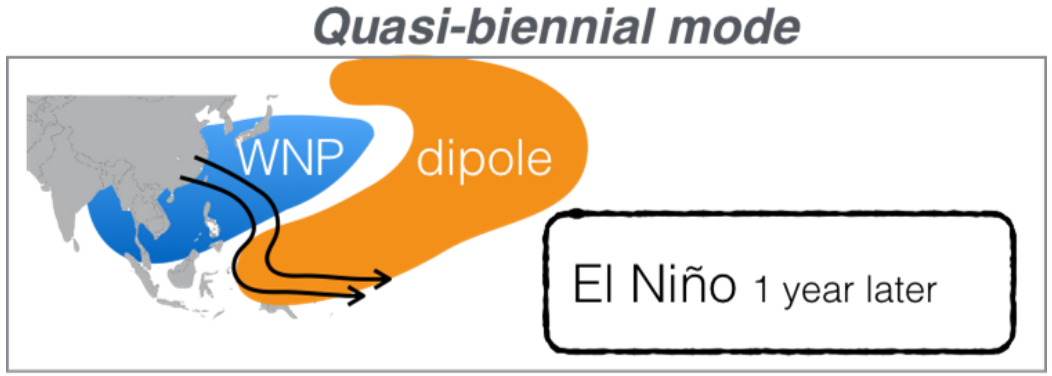

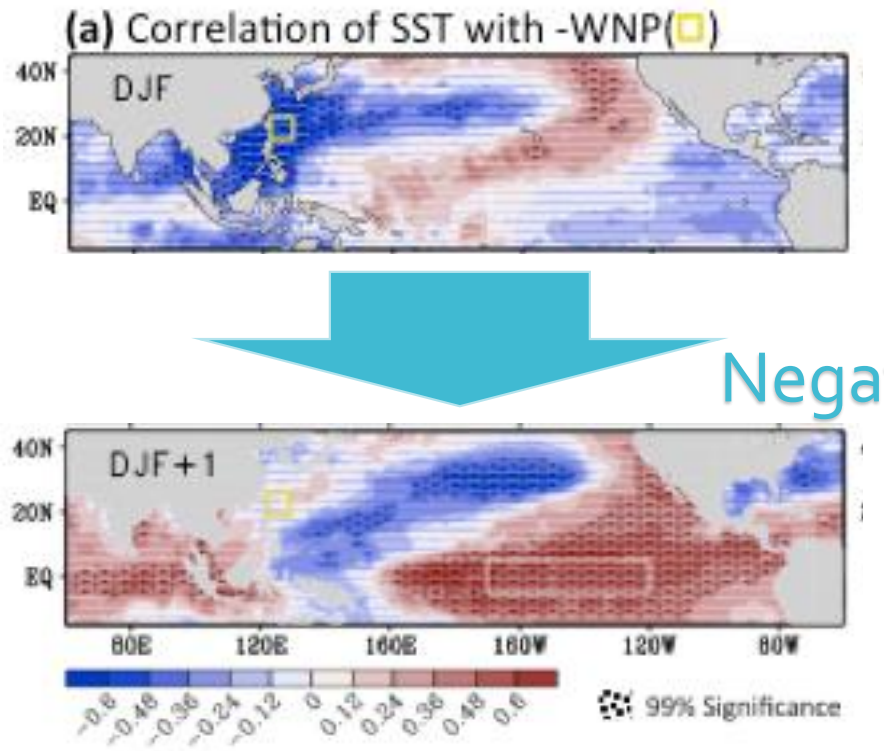

Negative WNP → positive ENSO

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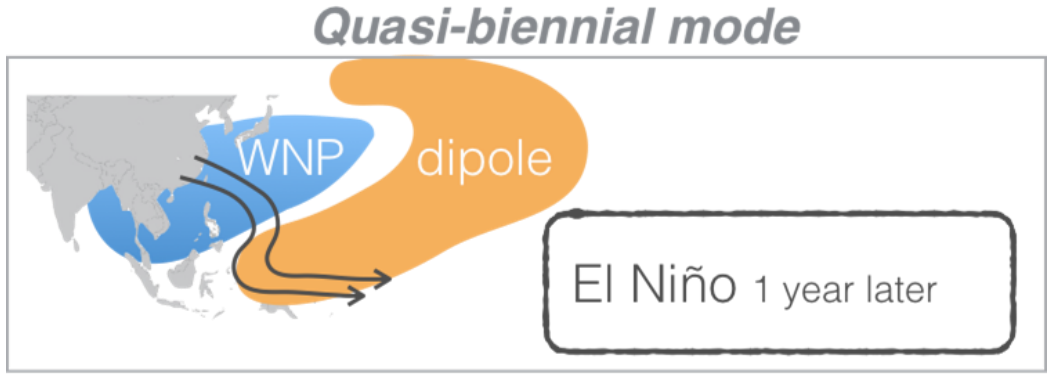
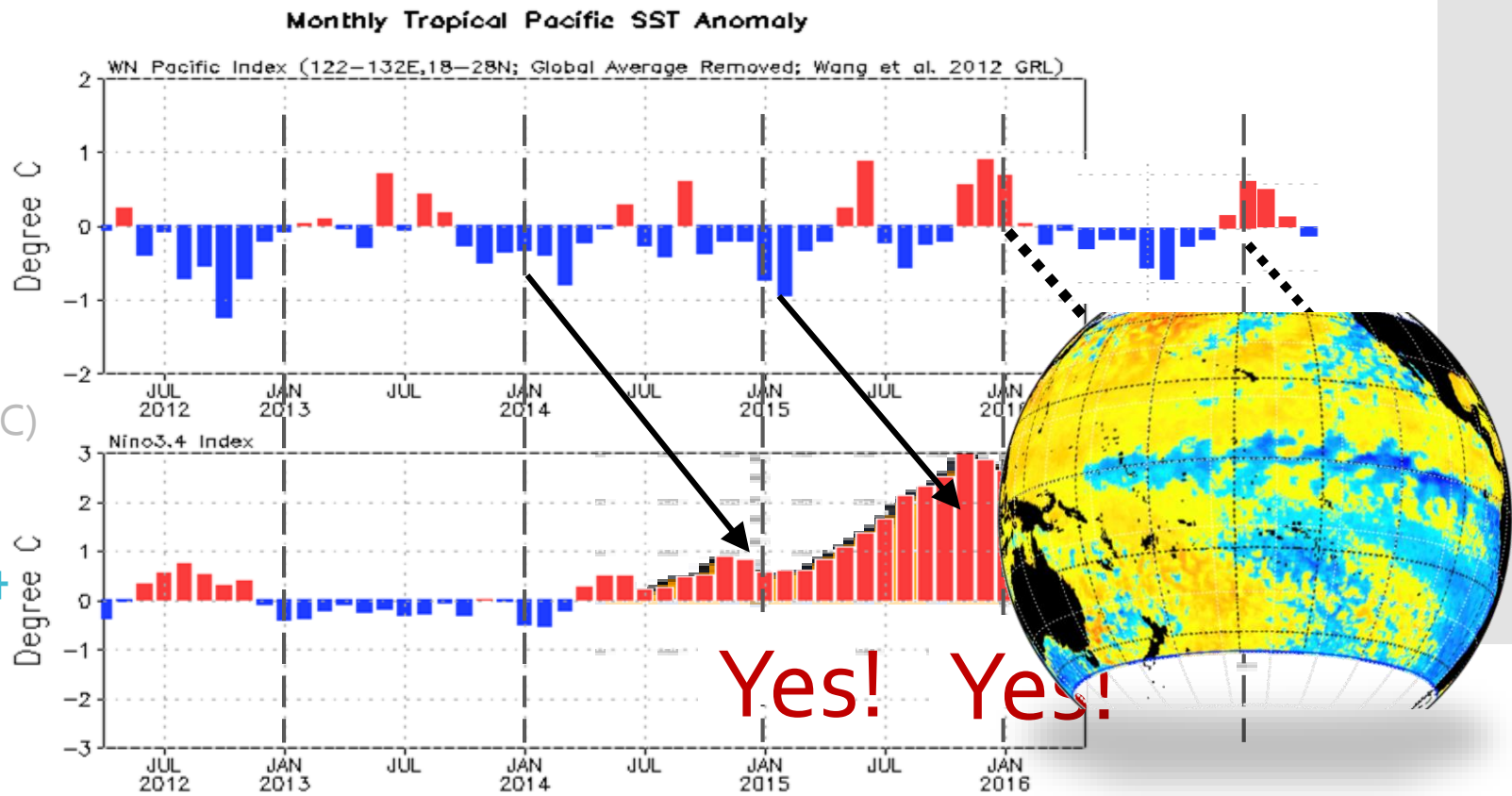


WNP index

Z-Z Hu (CPC)

Nino3.4 index



SSTA propagation

Consider that ENSO cycle has two modes:

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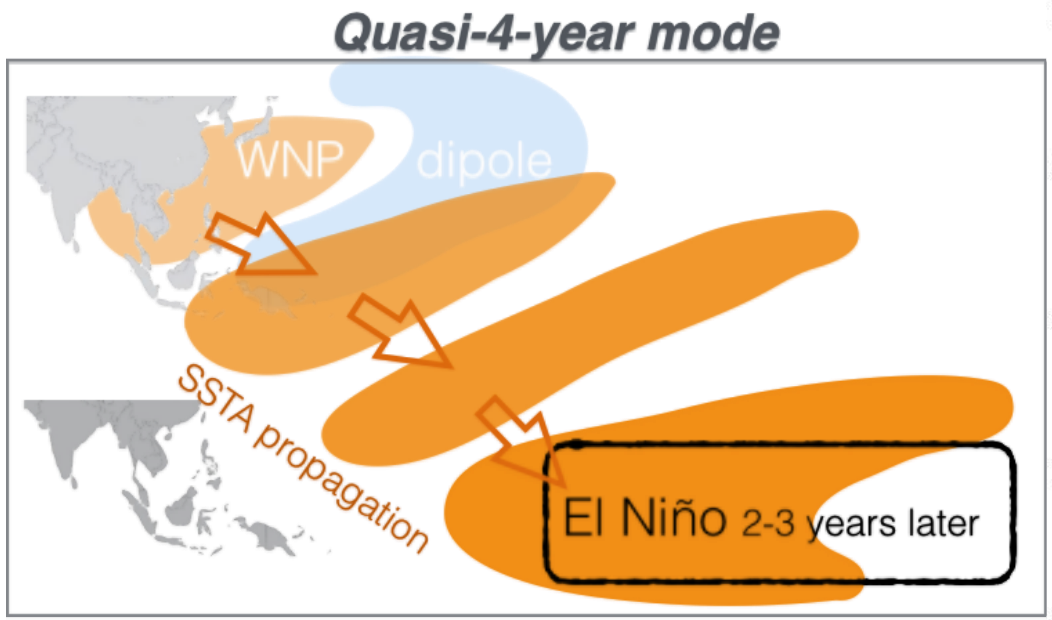
*** 4-6-year interannual**

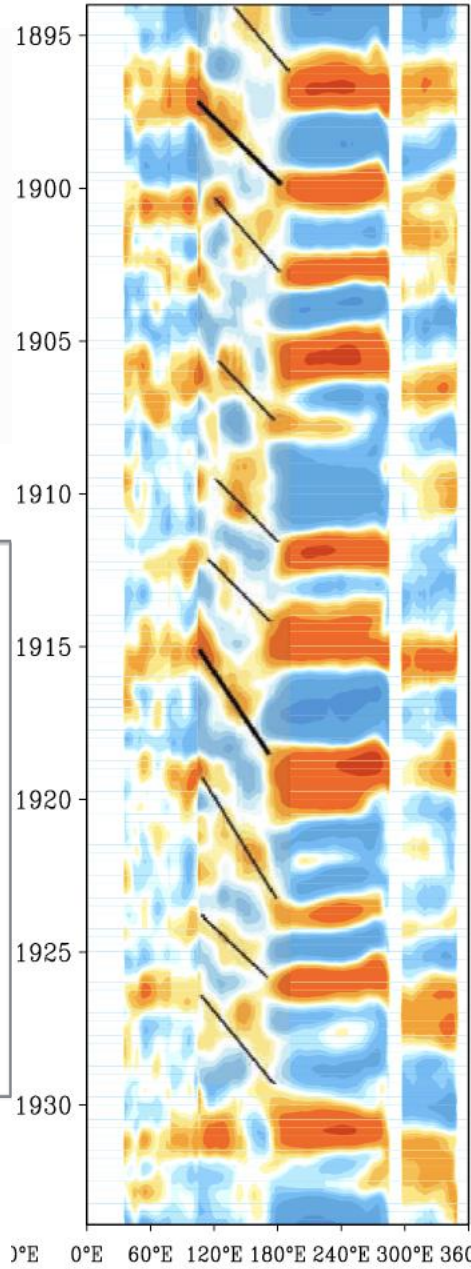
Climate Dynamics
May 2015, Volume 44, Issue 9–10, pp 2825–2837 | Cite as

Global eastward propagation signals associated with the 4–5-year ENSO cycle

Authors | Authors and affiliations

S.-Y. Simon Wang, Xianan Jiang, Boniface Fosu





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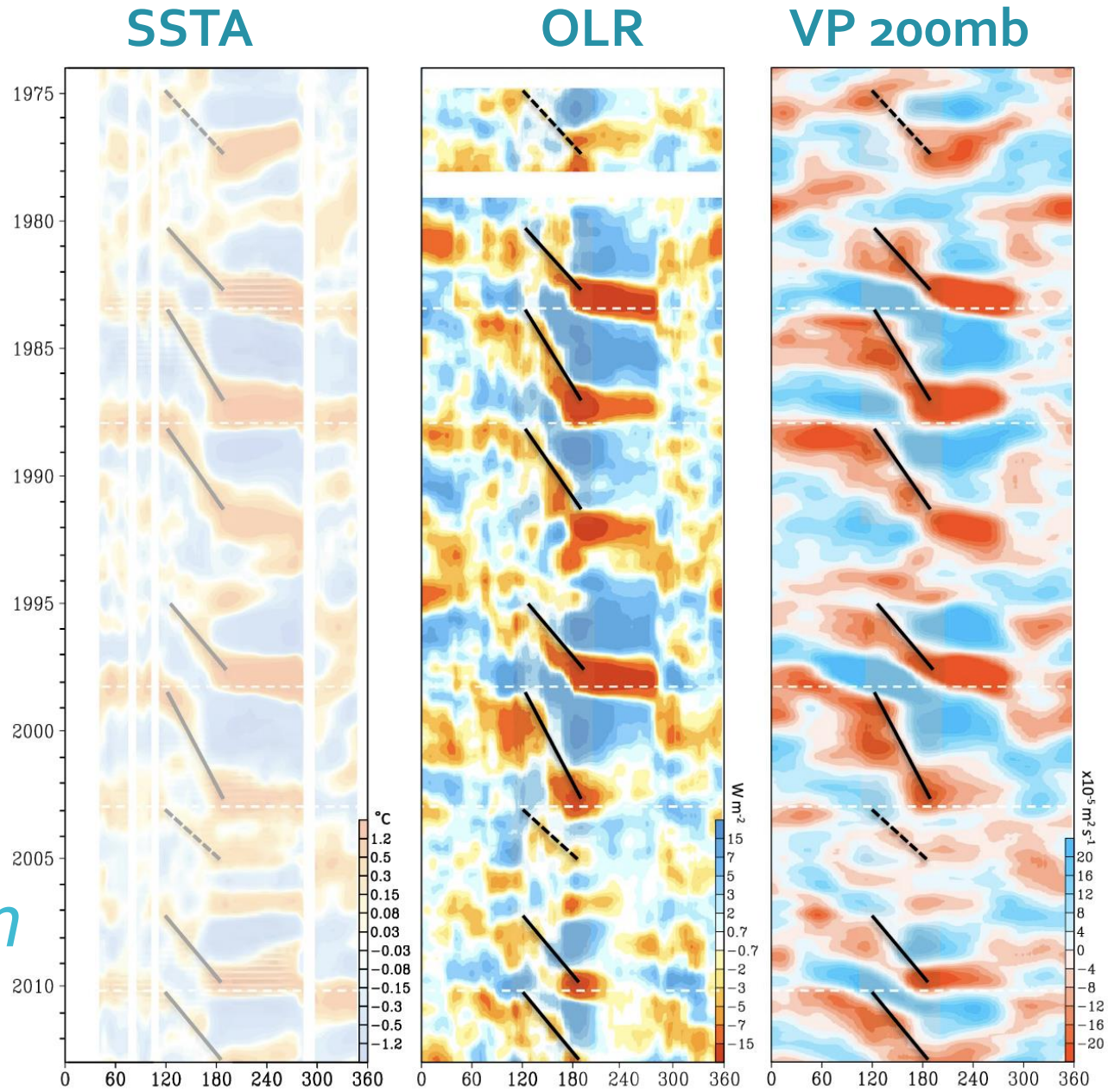
→ *A coupled system*



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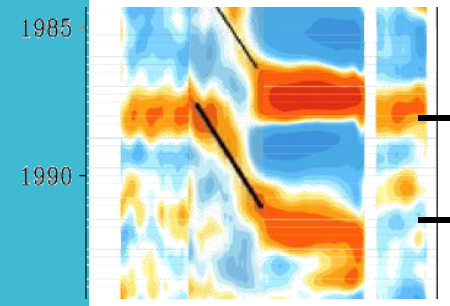

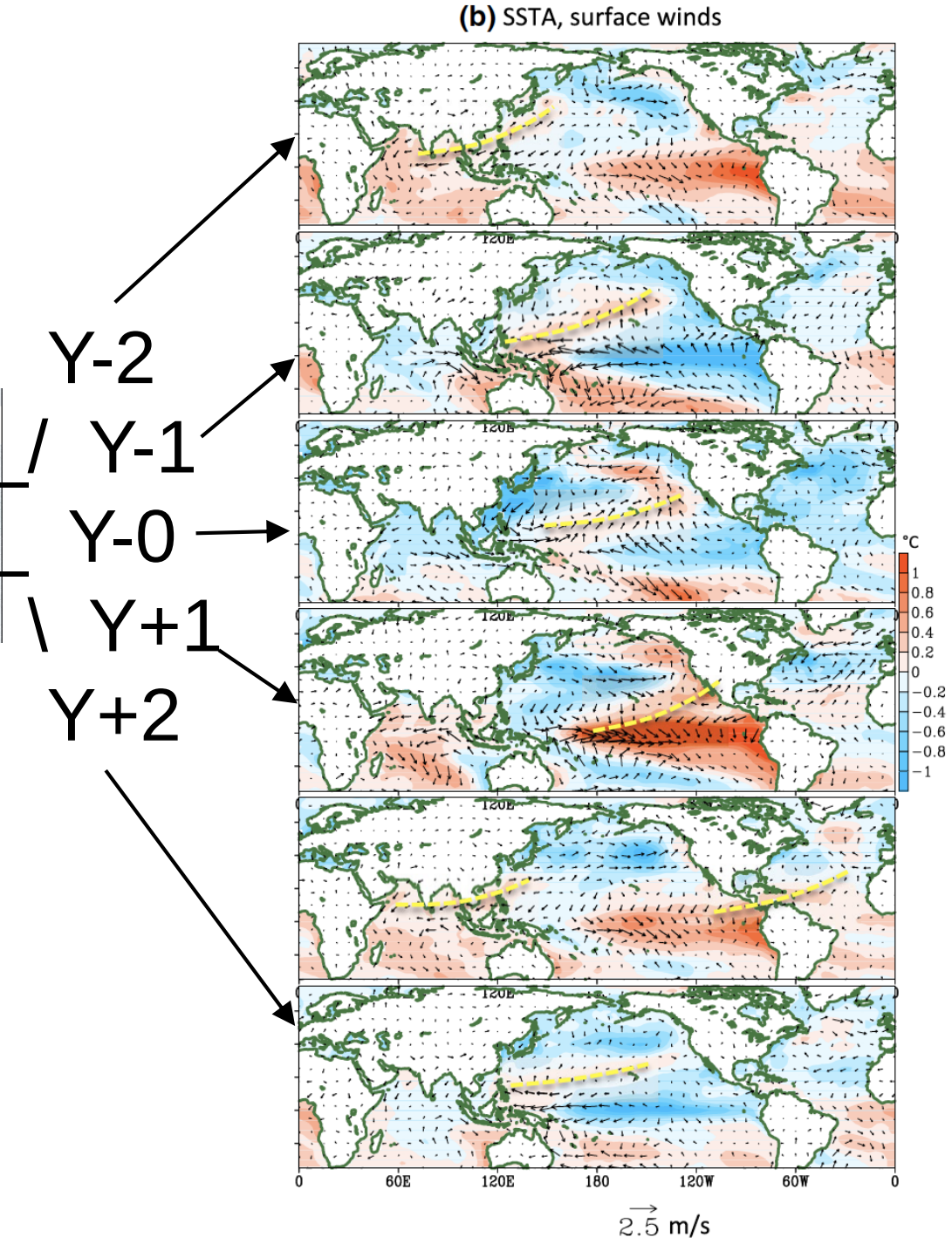

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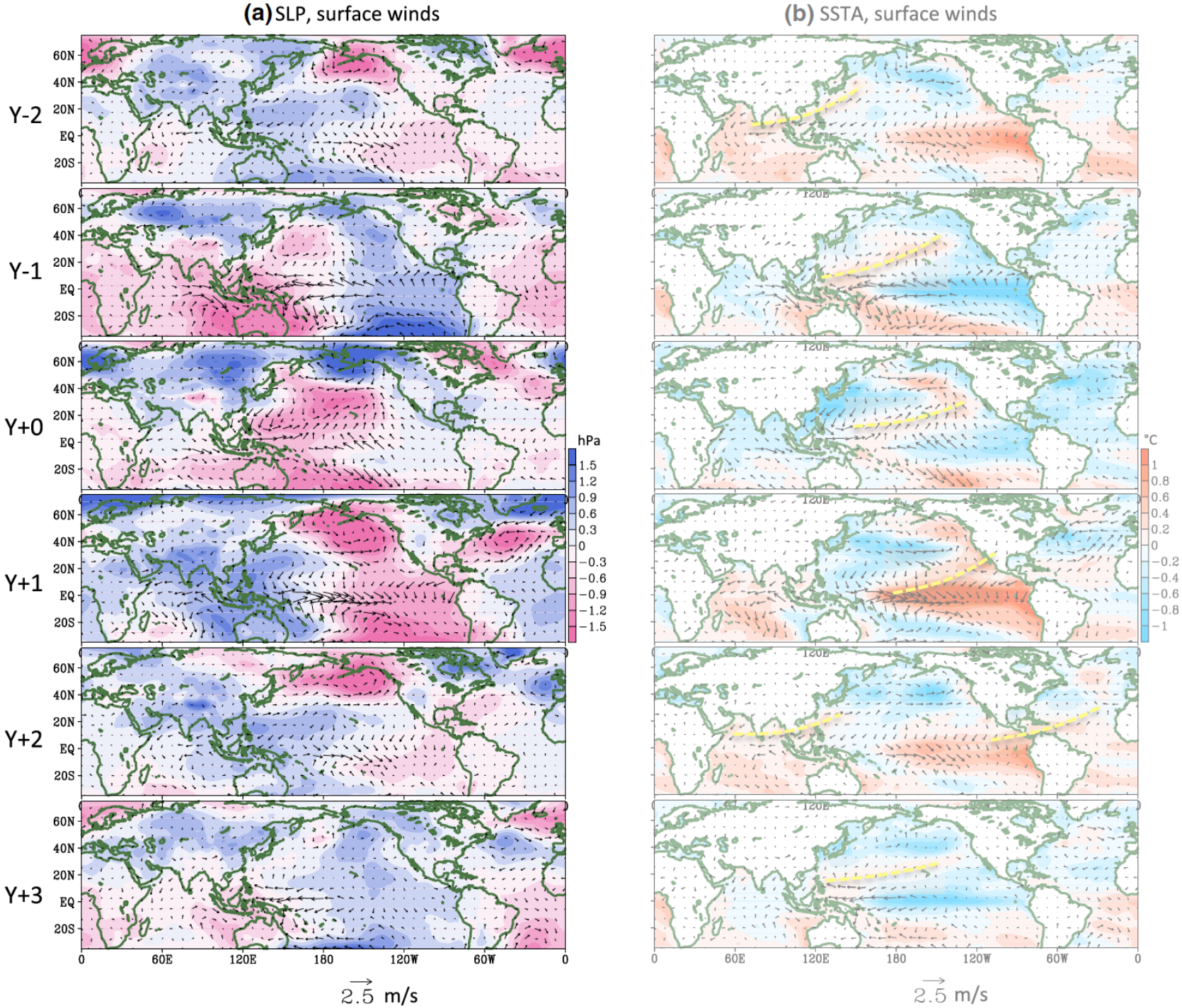

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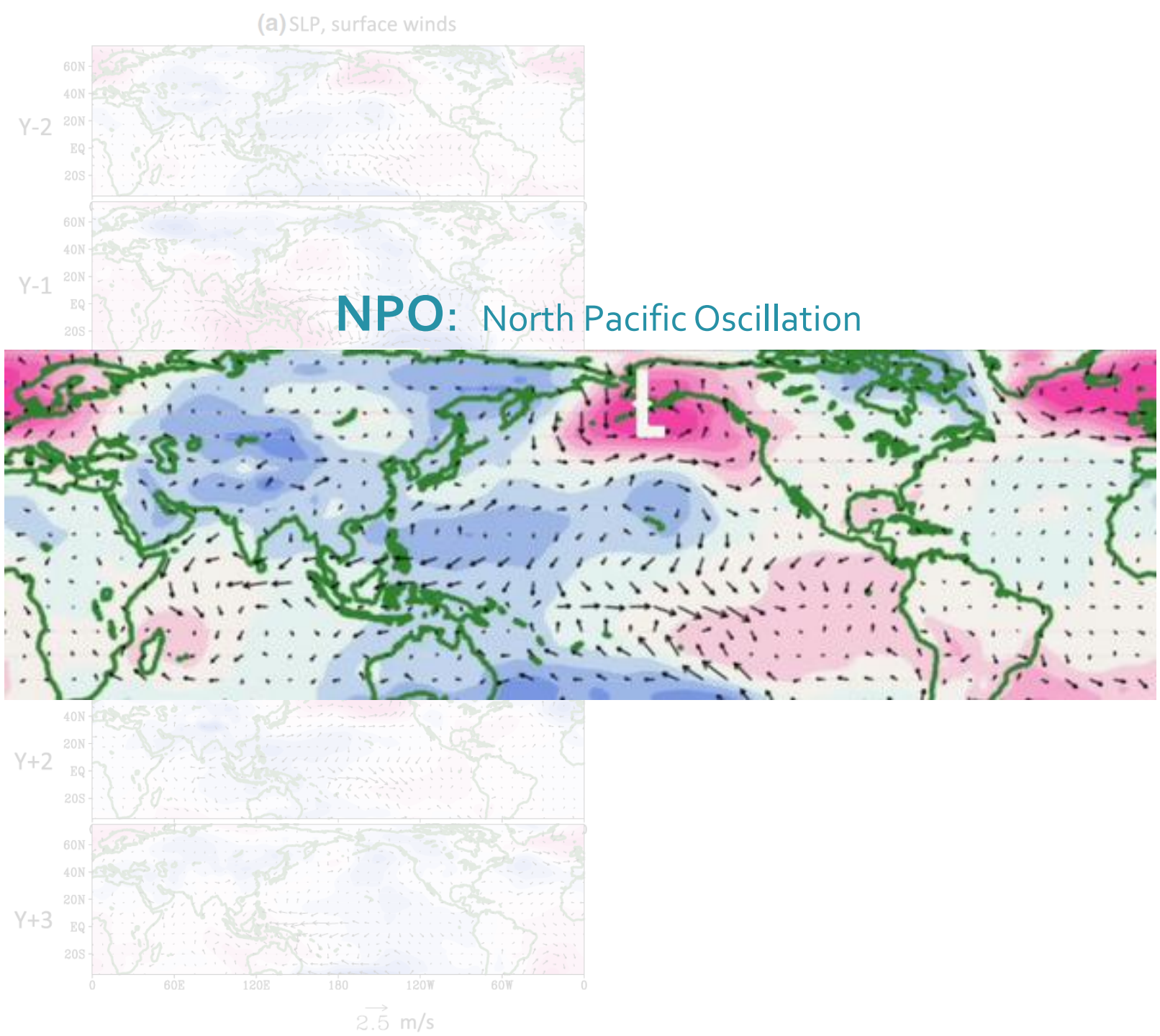

NPO: North Pacific Oscillation

Consider that ENSO cycle has two modes:

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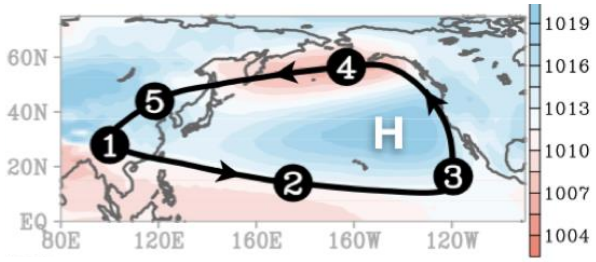
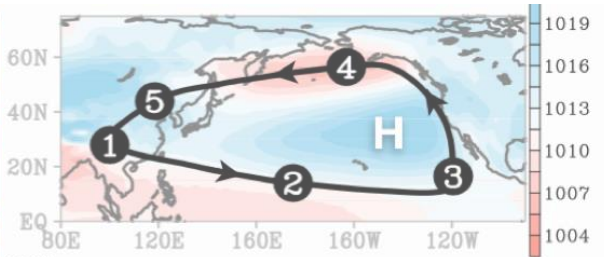
NPO: North Pacific Oscillation



↑ winter-mean SLP

← SLP revolution

NPO rotational evolution?



Consider that ENSO cycle has two modes:

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*** 4-6-year interannual**

"…probabilistic predictions of ENSO following a positive or negative NPO event are generally less reliable than when the NPO is not active."

- *Pegion and Alexander (2013 CliDy)*

Consider that ENSO cycle has

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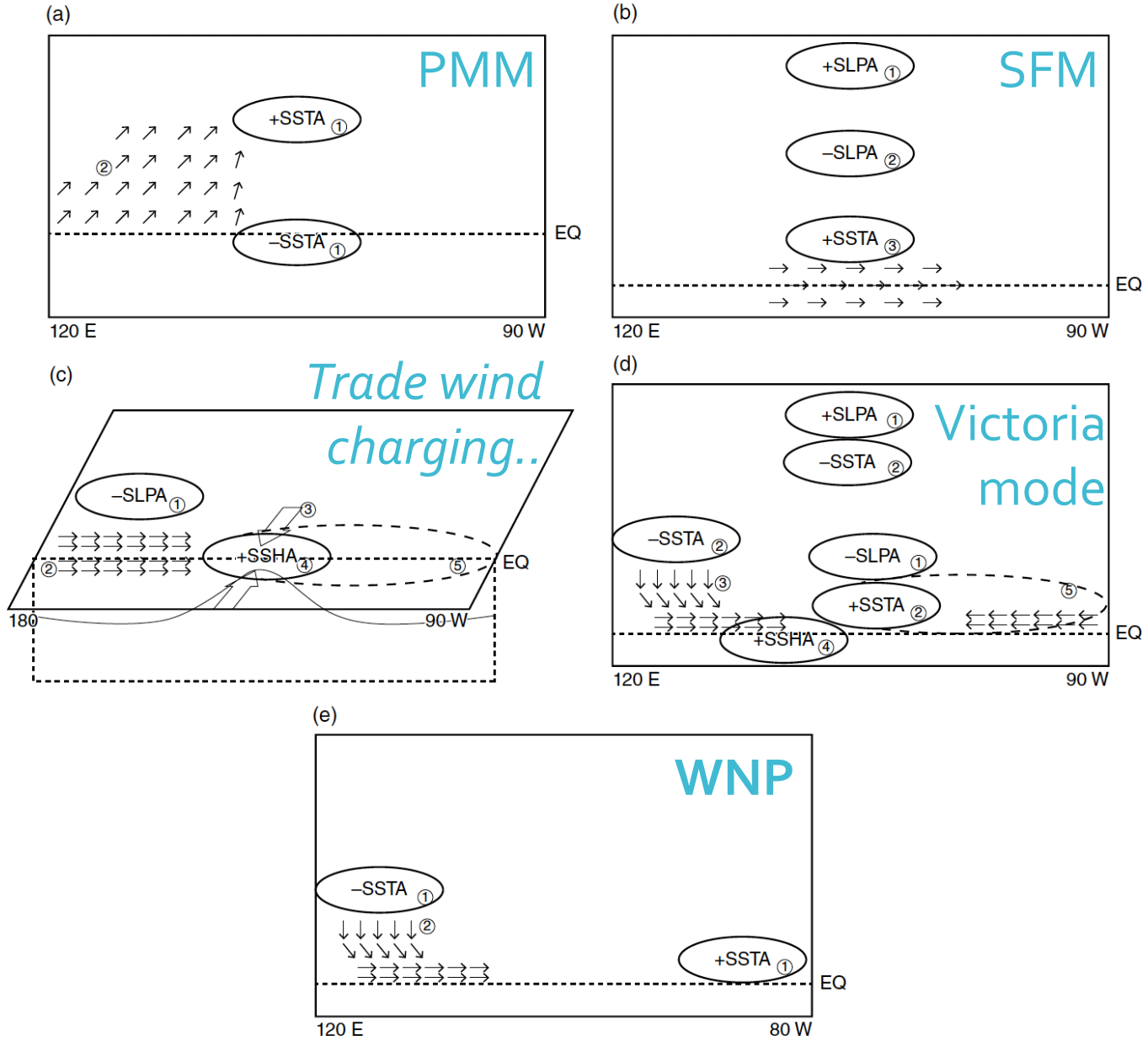
* biennial
* 4-6-year interannual
* **extratropical** precursors

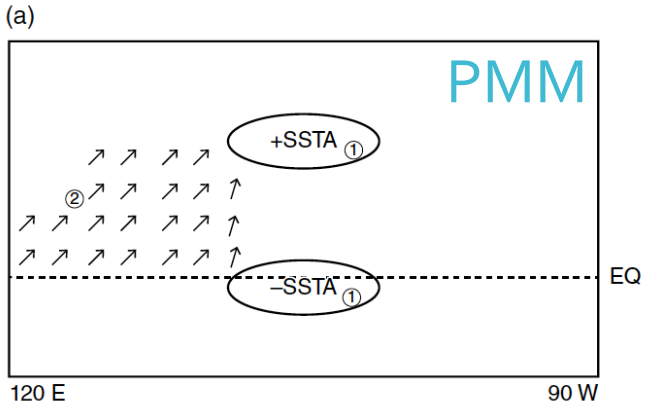


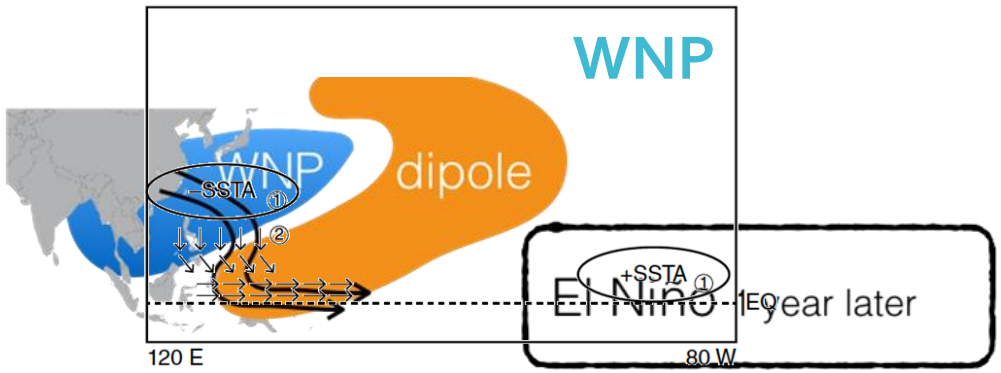
Extratropical Precursors of the El Niño–Southern Oscillation

2017 **Kathy V. Pegion and Christopher Selman**

Implications of the *WNP*:

Winter monsoon vs. Taiwan weather

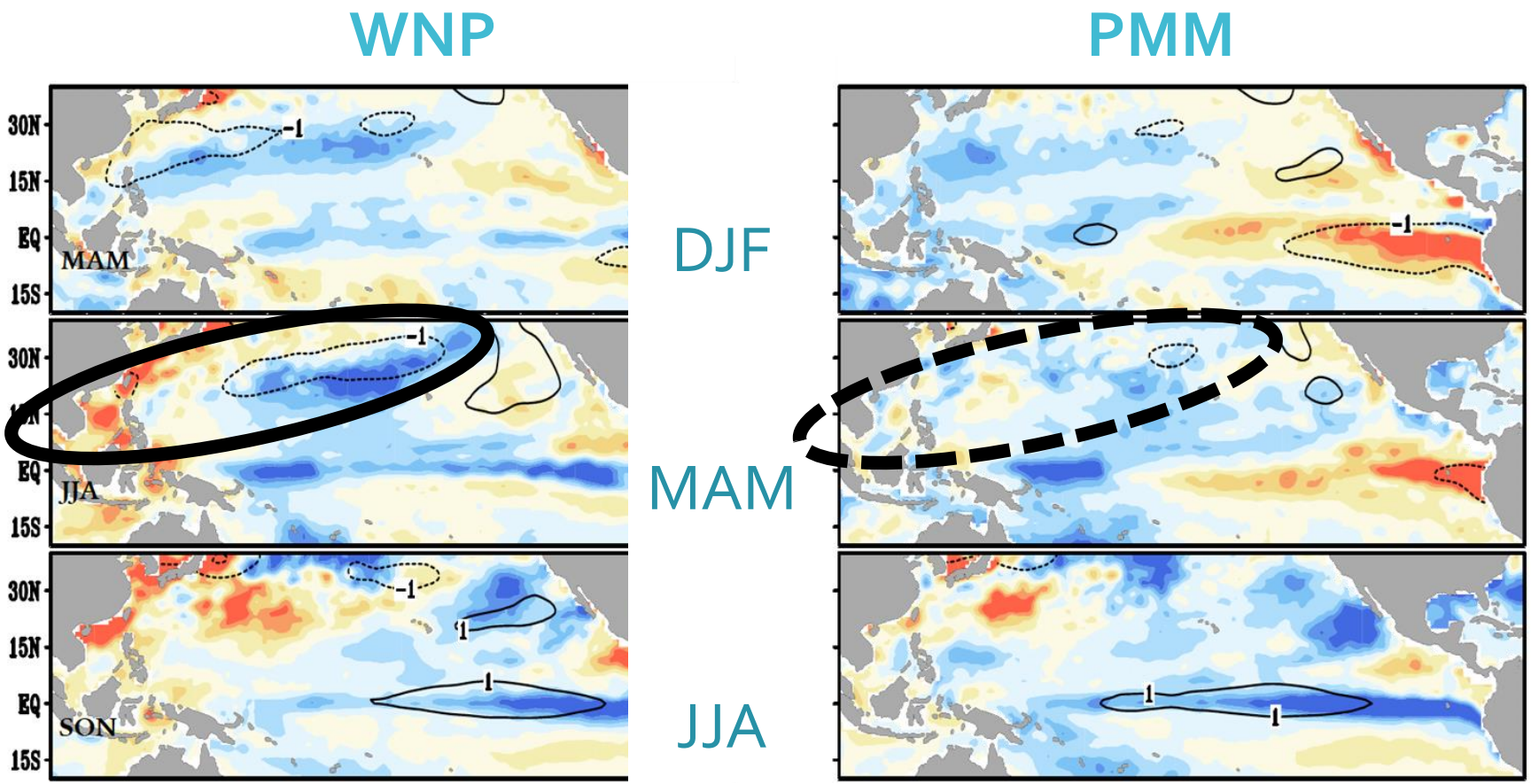




Implications of the *WNP*:

Winter monsoon vs. Taiwan weather

regressed on Air-sea (heat) fluxes - shading



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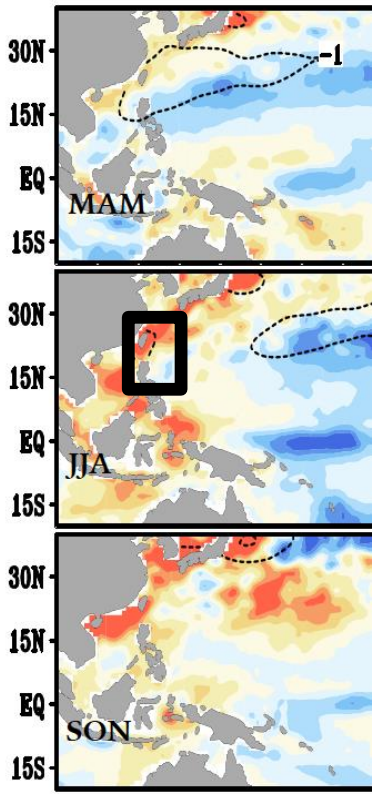
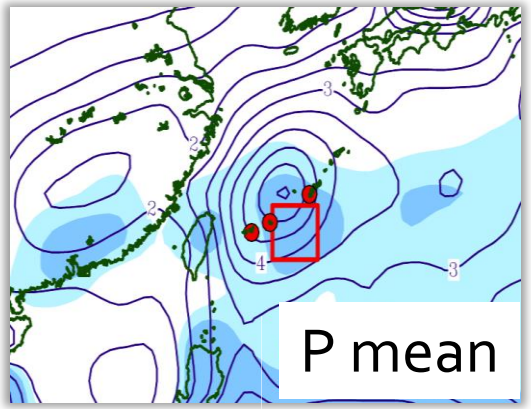
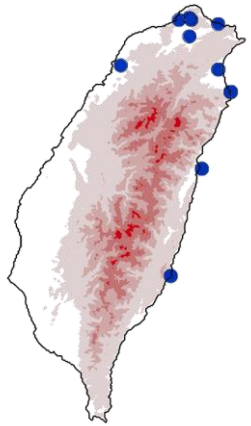


WNP

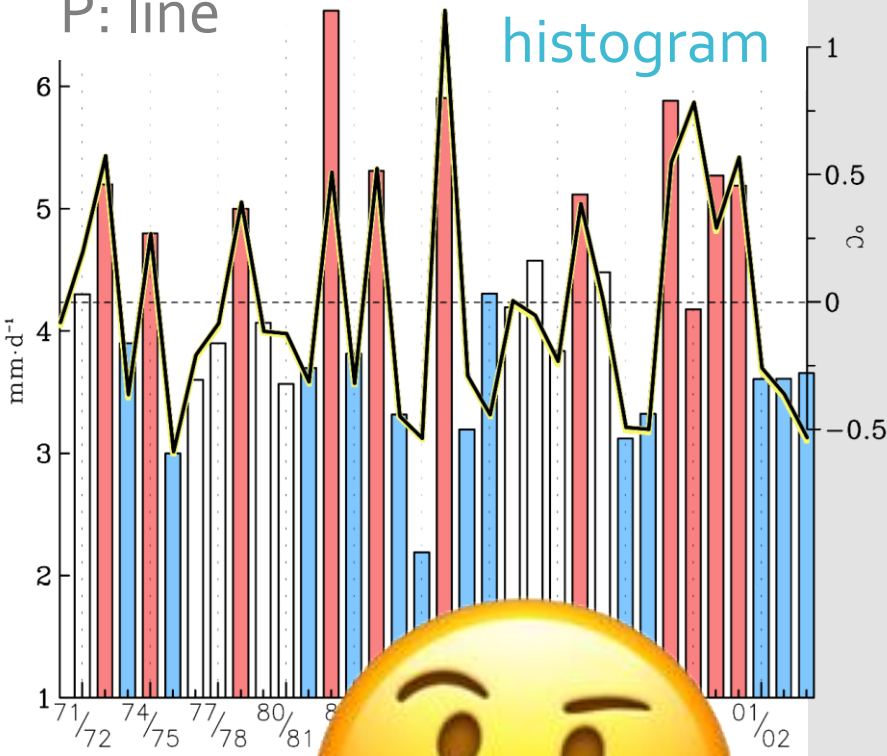


CWB stations

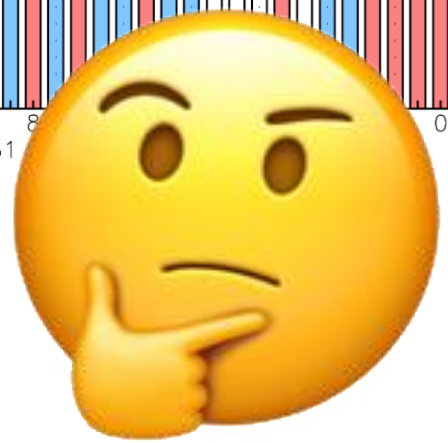


P: line

SST(WNP): histogram



r=0.84!



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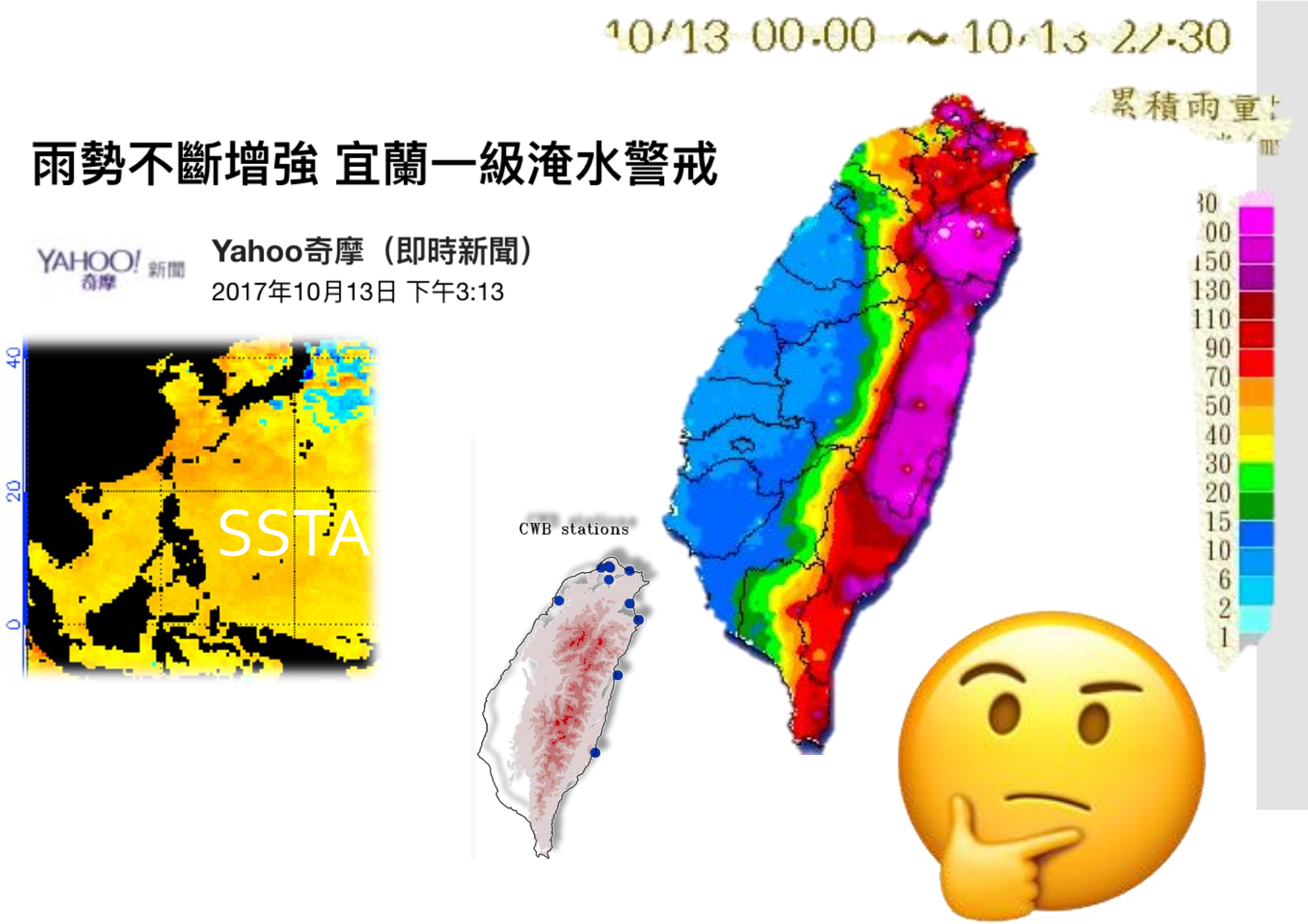
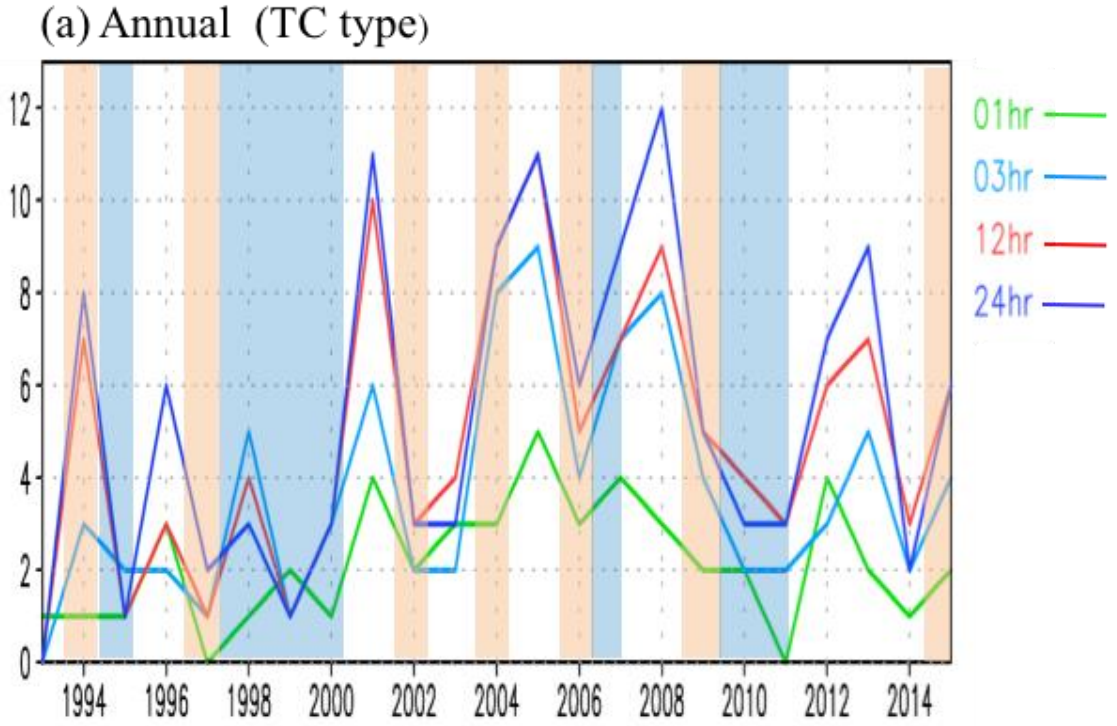
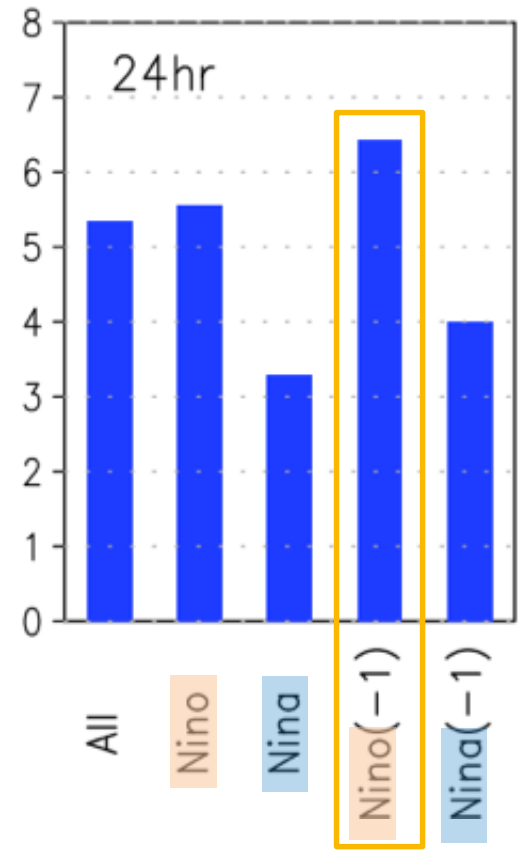


Implications of the *WNP*:

Winter monsoon vs. Taiwan weather

Taiwan 24-h extreme precipitation *events* due to tropical cyclones





Y-C Wu et al. (NCDR)

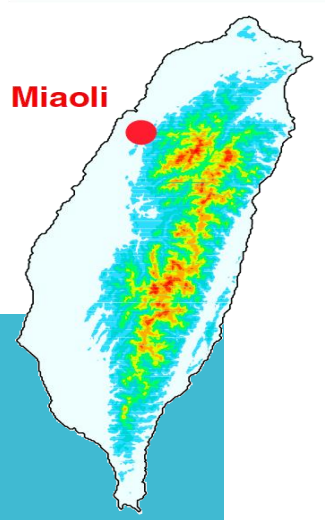
INTERNATIONAL JOURNAL OF CLIMATOLOGY
Int. J. Climatol. (2017)
Published online in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/joc.5194

RMetS
Royal Meteorological Society

A seasonal prediction for the wet–cold spells leading to winter crop damage in northwestern Taiwan with a combined empirical–dynamical approach

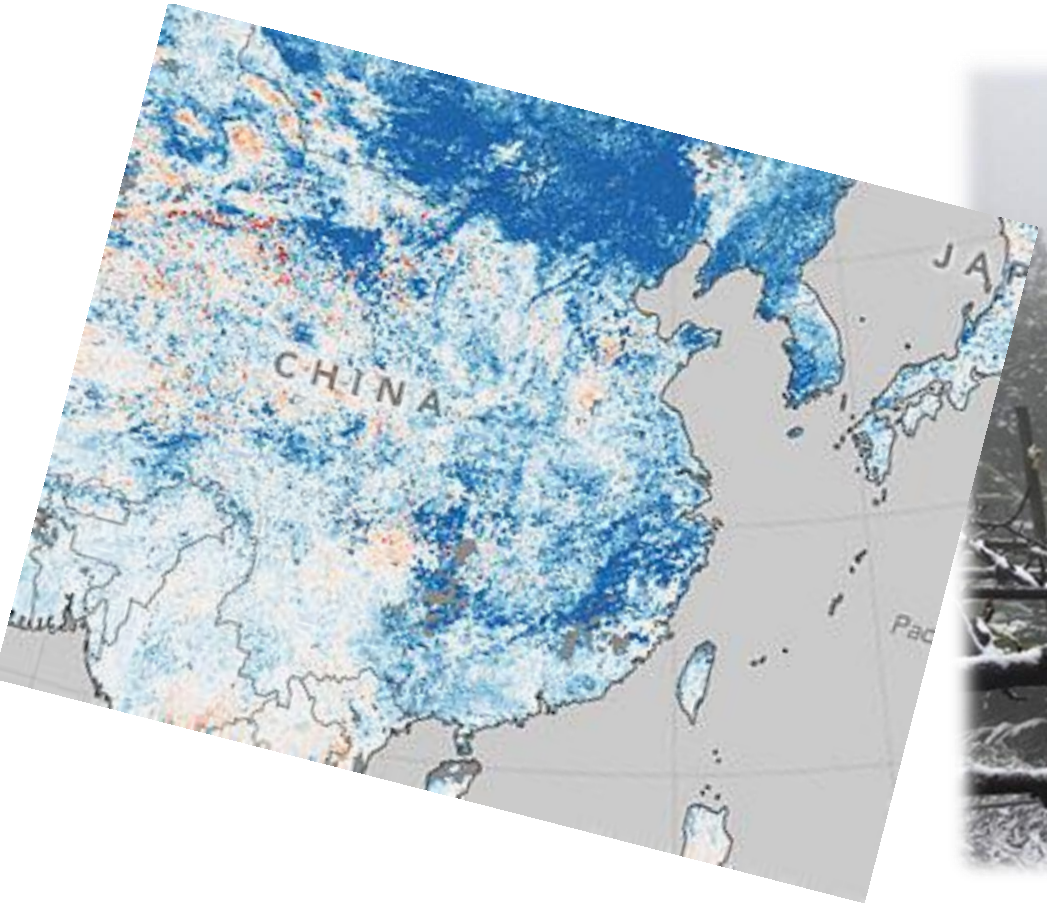
Parichart Promchote,[a]* S.-Y. Simon Wang,[a,b] Yuan Shen,[c] Paul G. Johnson[a] and Ming-Hwi Yao[d]

[a] *Department of Plants, Soils, and Climate, Utah State University, Logan, Utah, USA*
[b] *Utah Climate Center, Utah State University, Logan, Utah, USA*
[c] *Department of Soil and Environmental Sciences, National Chung Hsing University, Taichung, Taiwan*
[d] *Agricultural Engineering Division, Agricultural Research Institute, Taichung, Taiwan*

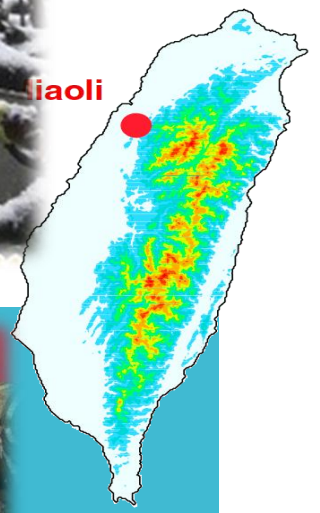


Implications of the *WNP*:

Application of S2S forecasting



2016 “King”Cold Surge



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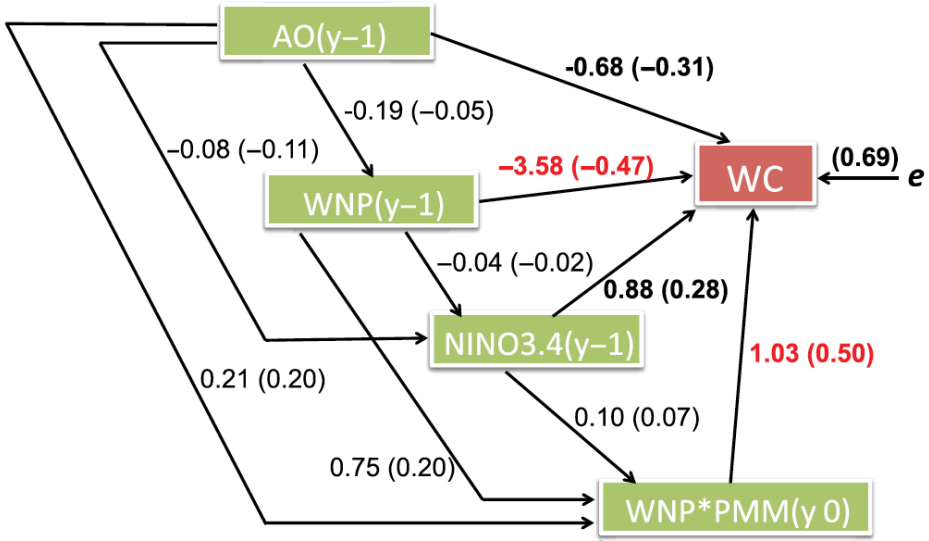
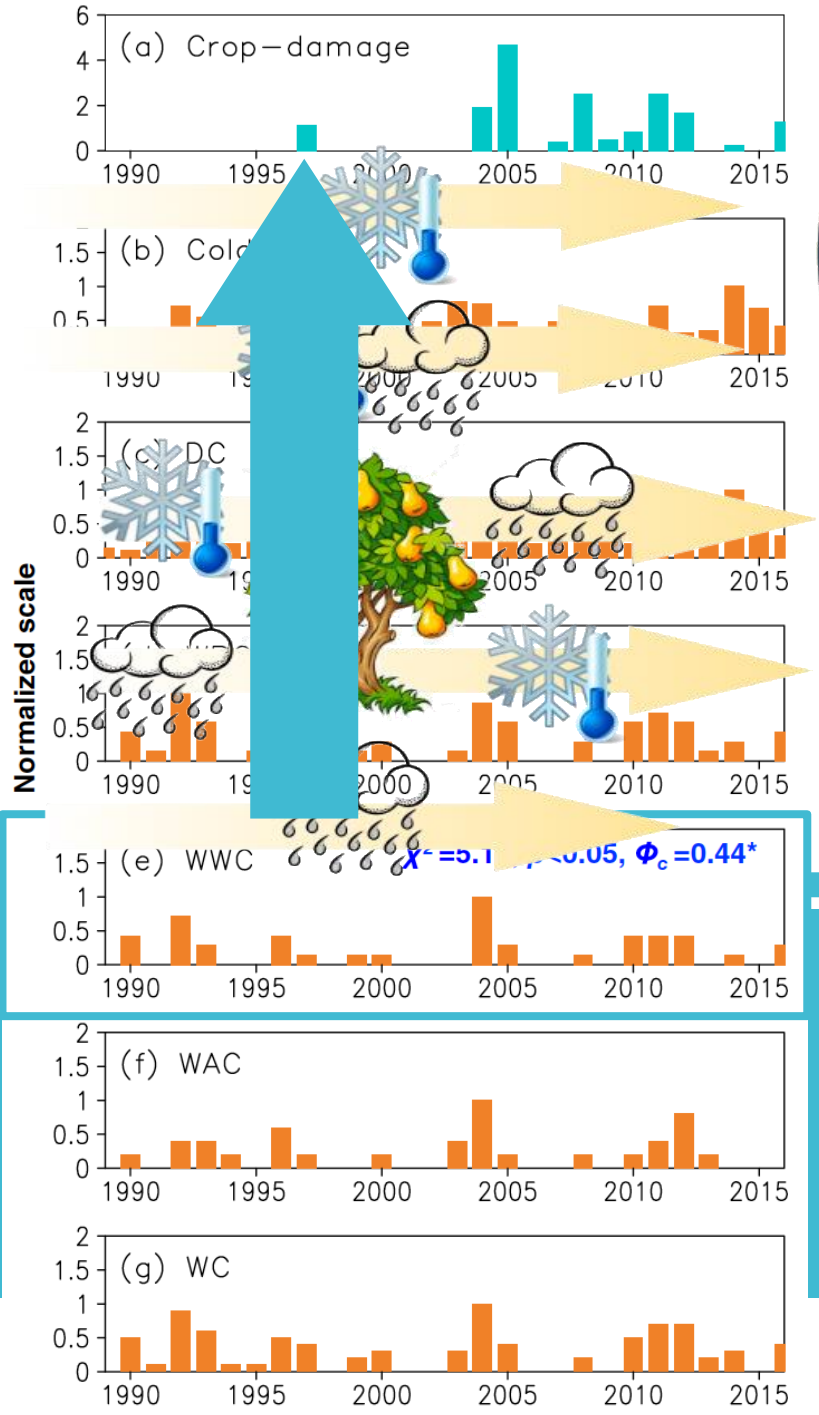
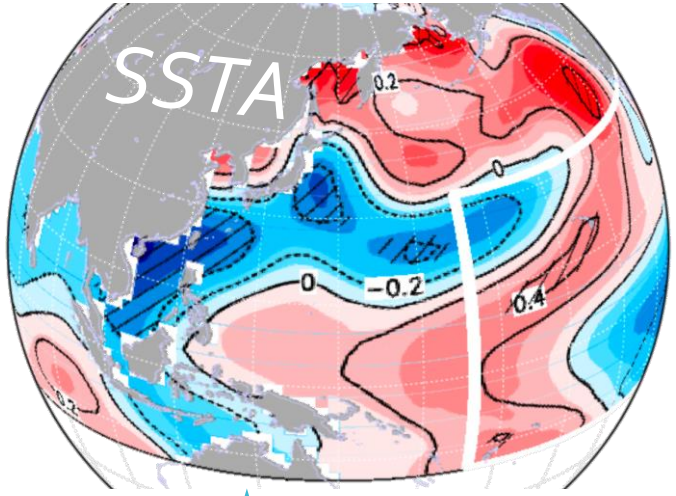
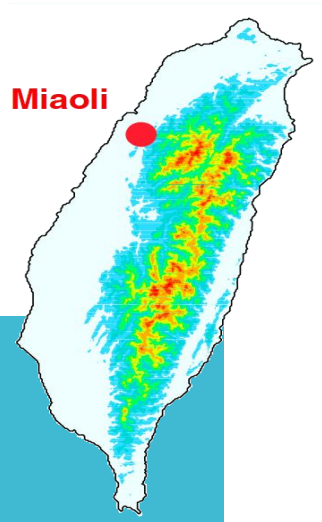


Figure 9. Unstandardized and standardized (numbers in parentheses) regression coefficients among climate indices determined the wet-cold precipitation ≥5 mm either before, during, or after the cold day







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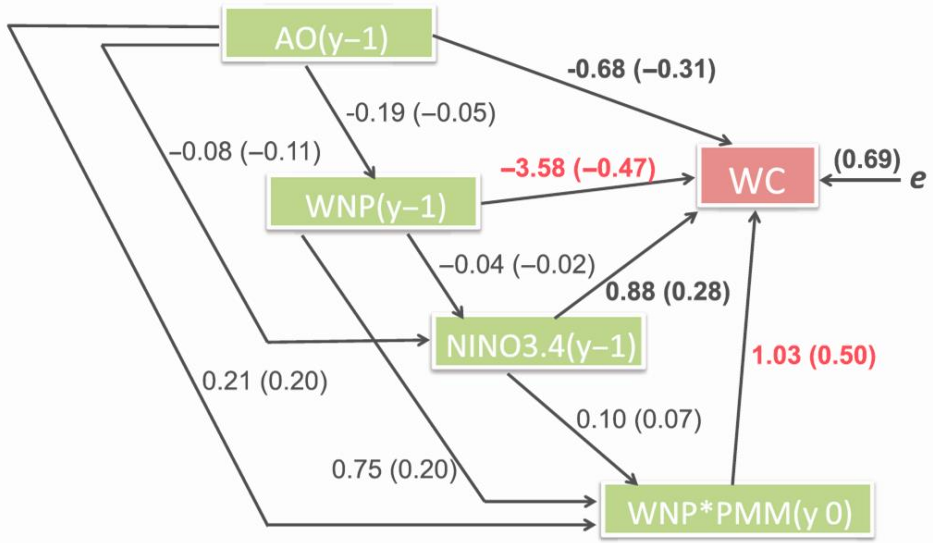
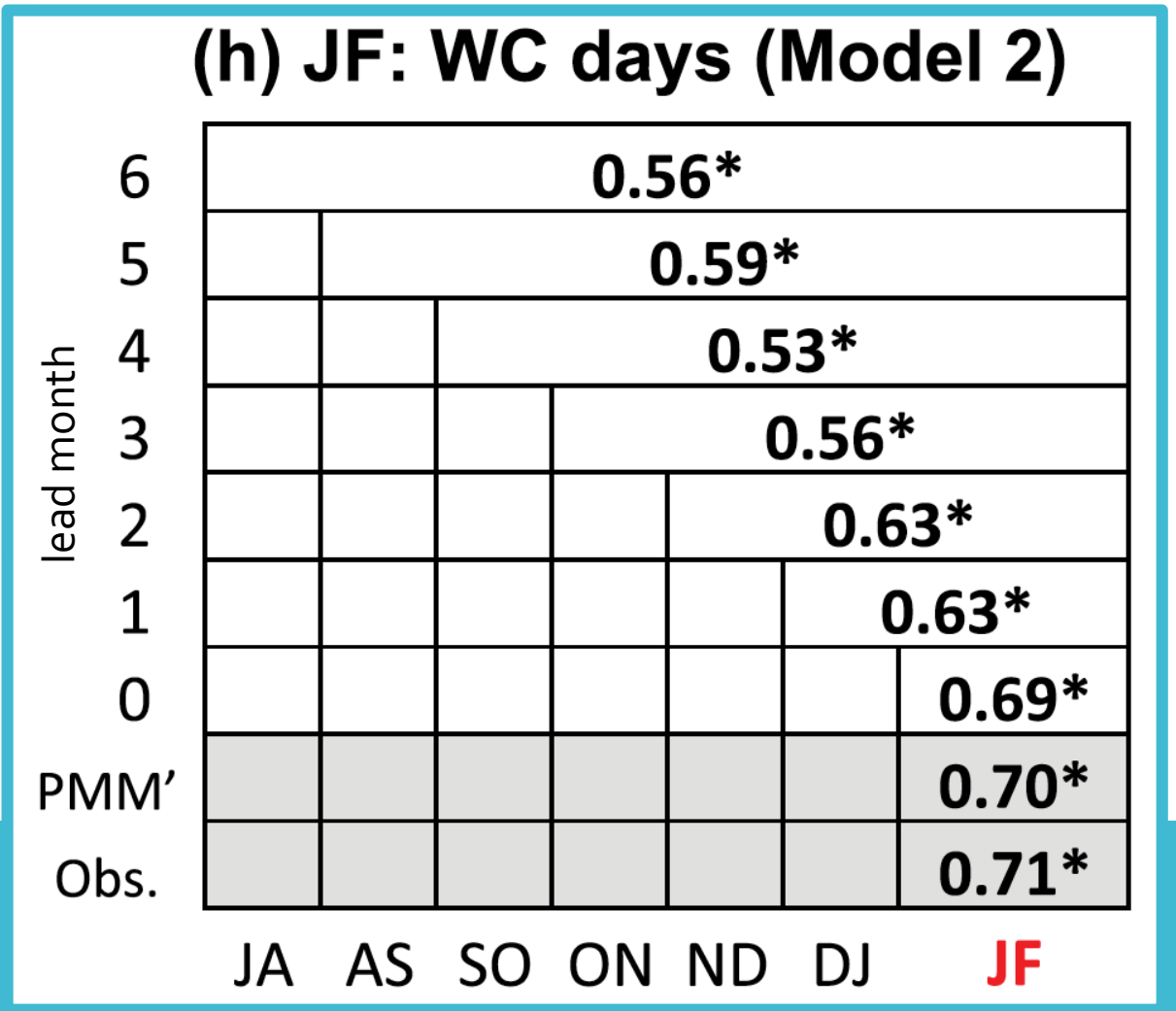
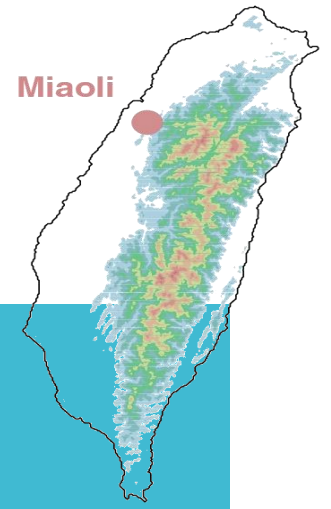






Implications of the *WNP*:

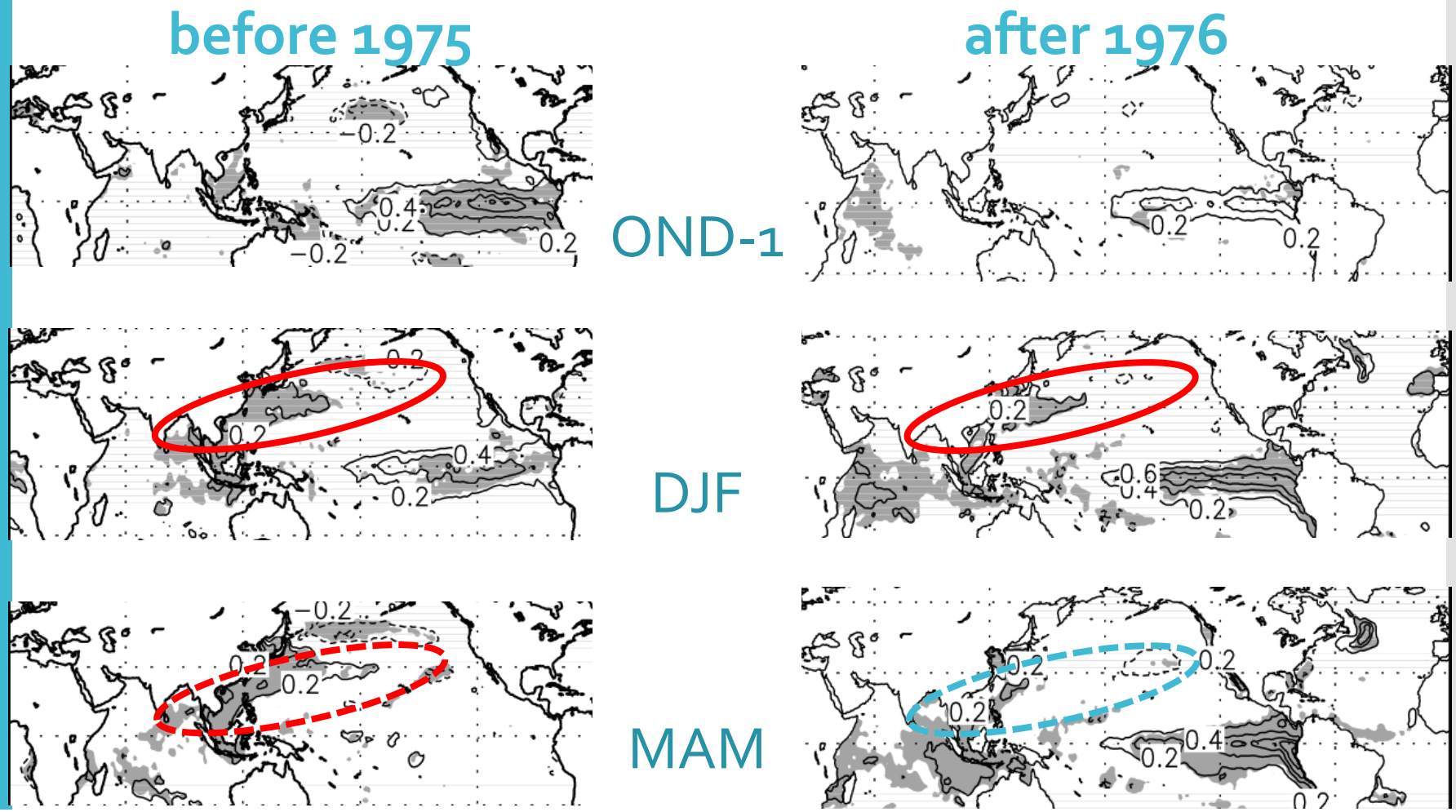
Application of S2S forecasting

Int. J. Climatol. (2017)

Implications of the *NPO*

on the WNP

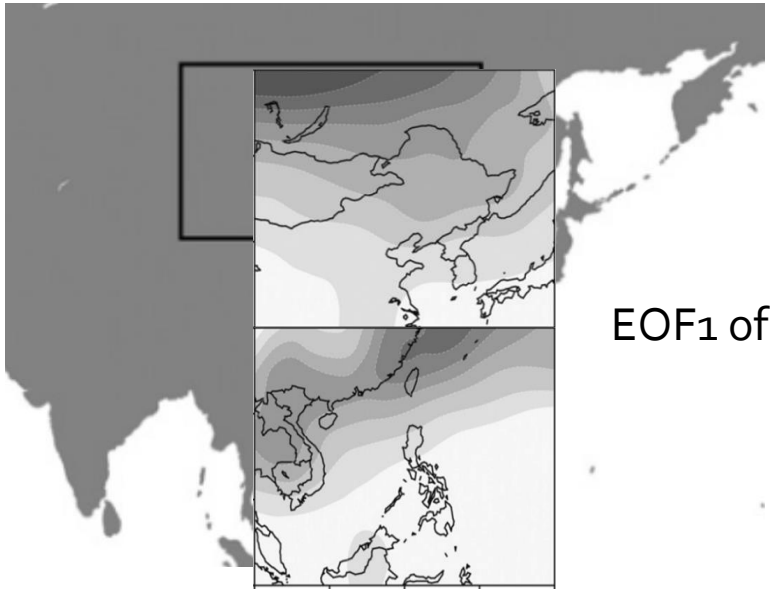
B.Wang et al. (2007) ***SST regr. on NPO***



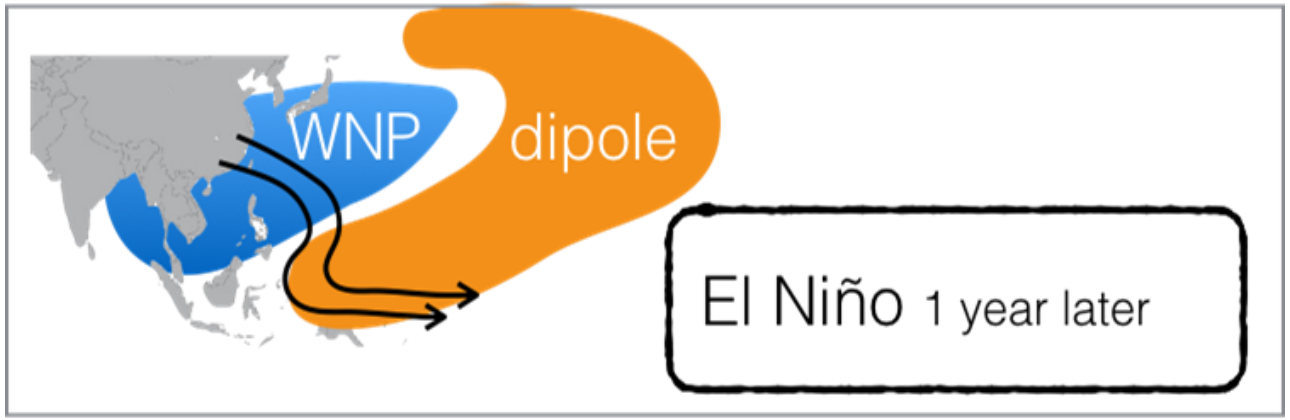
Relationship between EAWM and

the WNP

B.Wang et al. (2010) ***Two modes of***



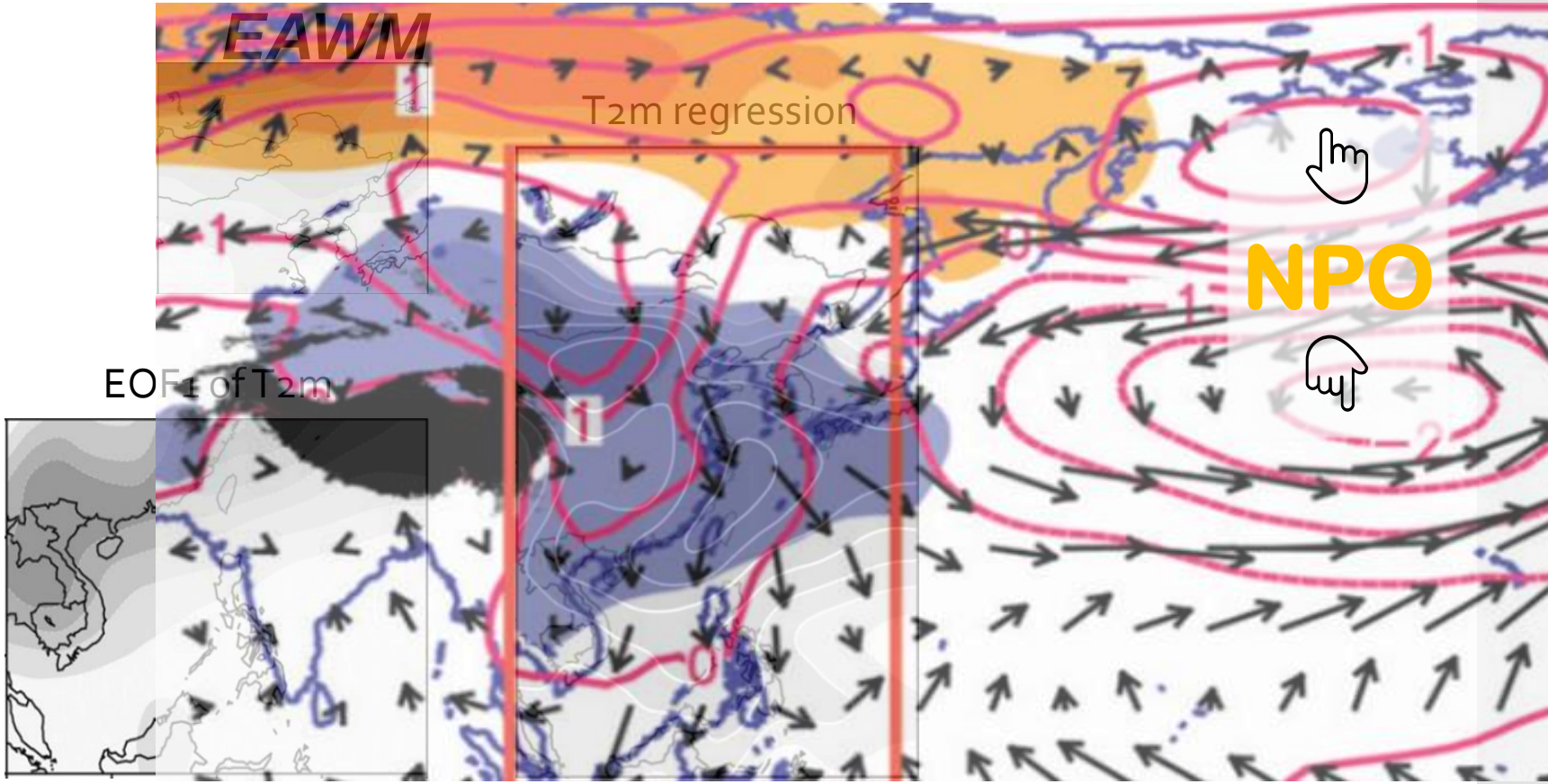
EOF1 of T2m



Relationship between EAWM and

the WNP

B.Wang et al. (2010) ***Two modes of***



SLP (contours, hPa), Ts (color shadings, °C), and surface winds (vectors, m s^{-1})

EAWM

|

PMM

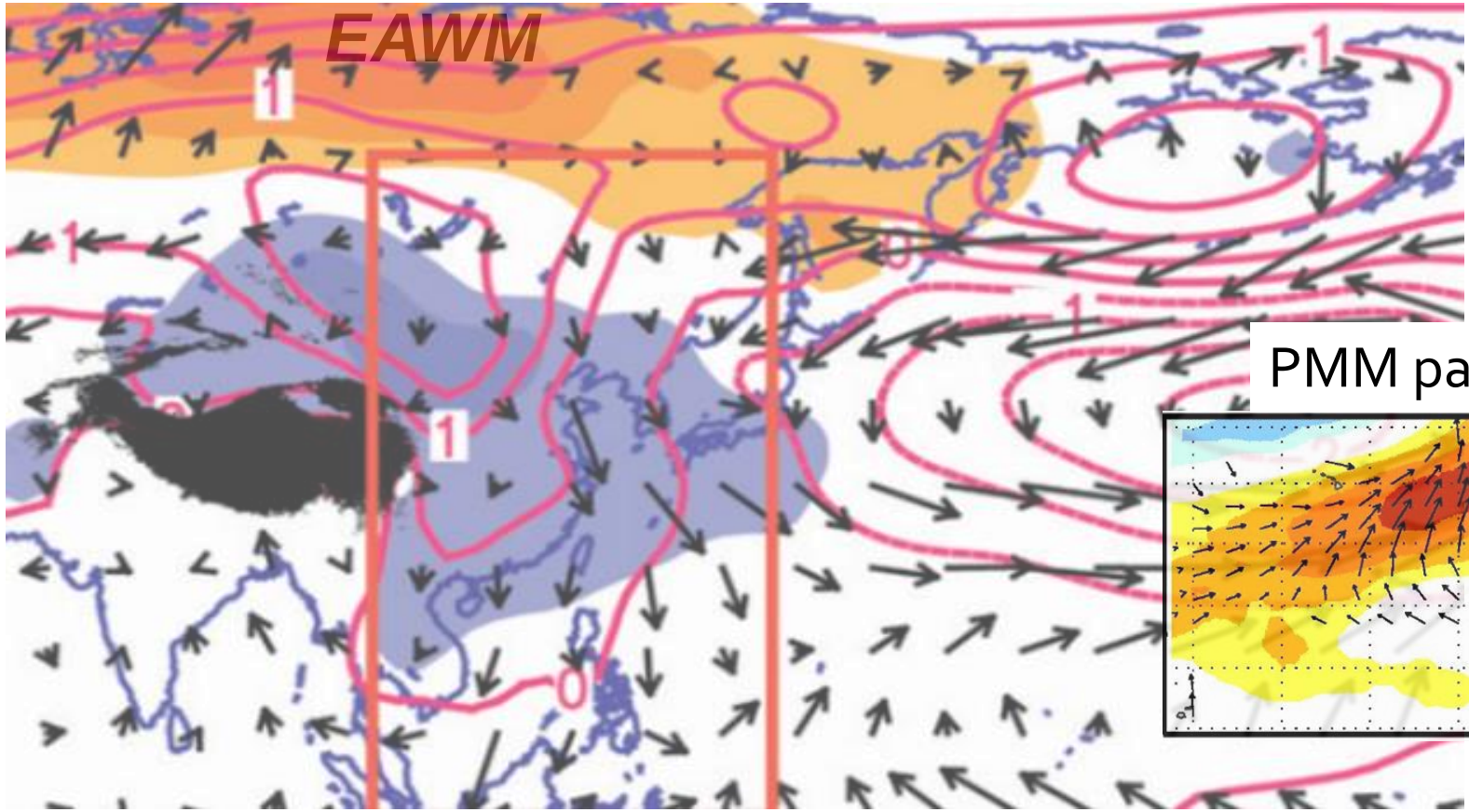
|

NPO

|

…WNP

B.Wang et al. (2010) ***Two modes of EAWM***

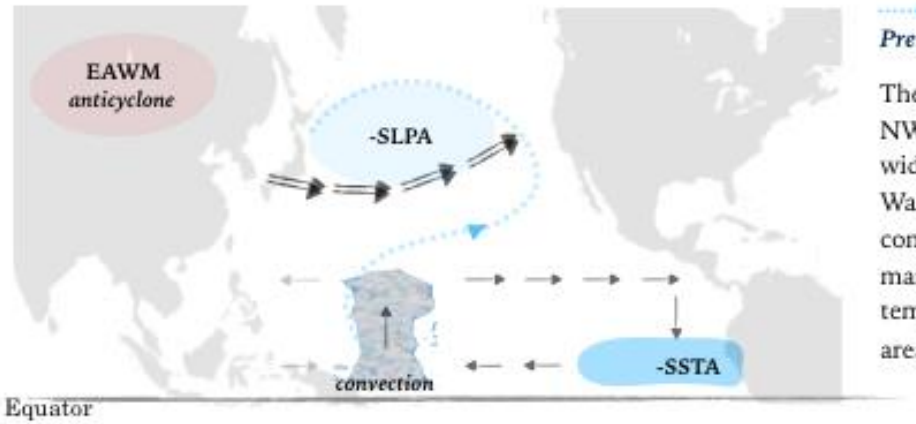


PMM pattern

Ongoing research

by Ph.D. student, Boniface Fosu

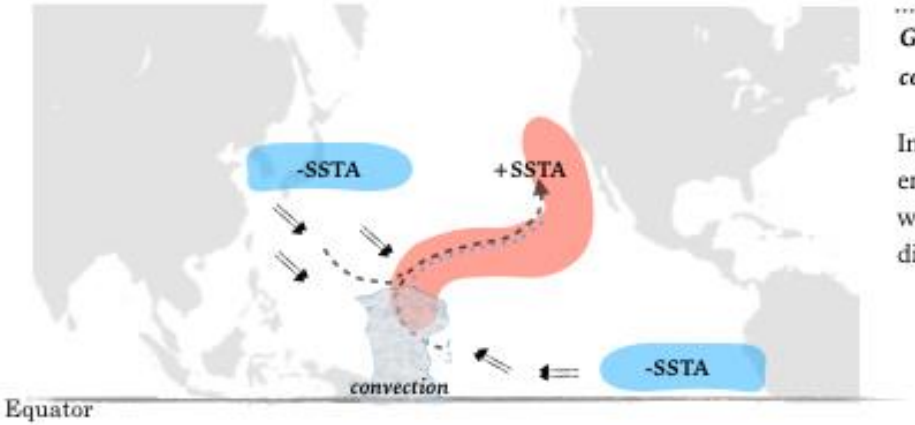
?



Pressure pattern and streamline

The EAWM is characterized by strong NW winds resulting in basin wide-wide NP low. Together with the Pacific Walker circulation, which has a convection center around the maritime continent, a north-south temperature gradient between the two areas is created.

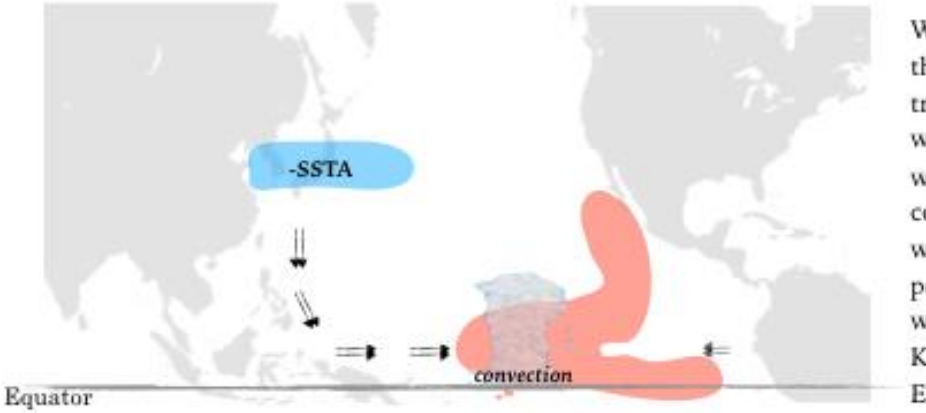
(note: c



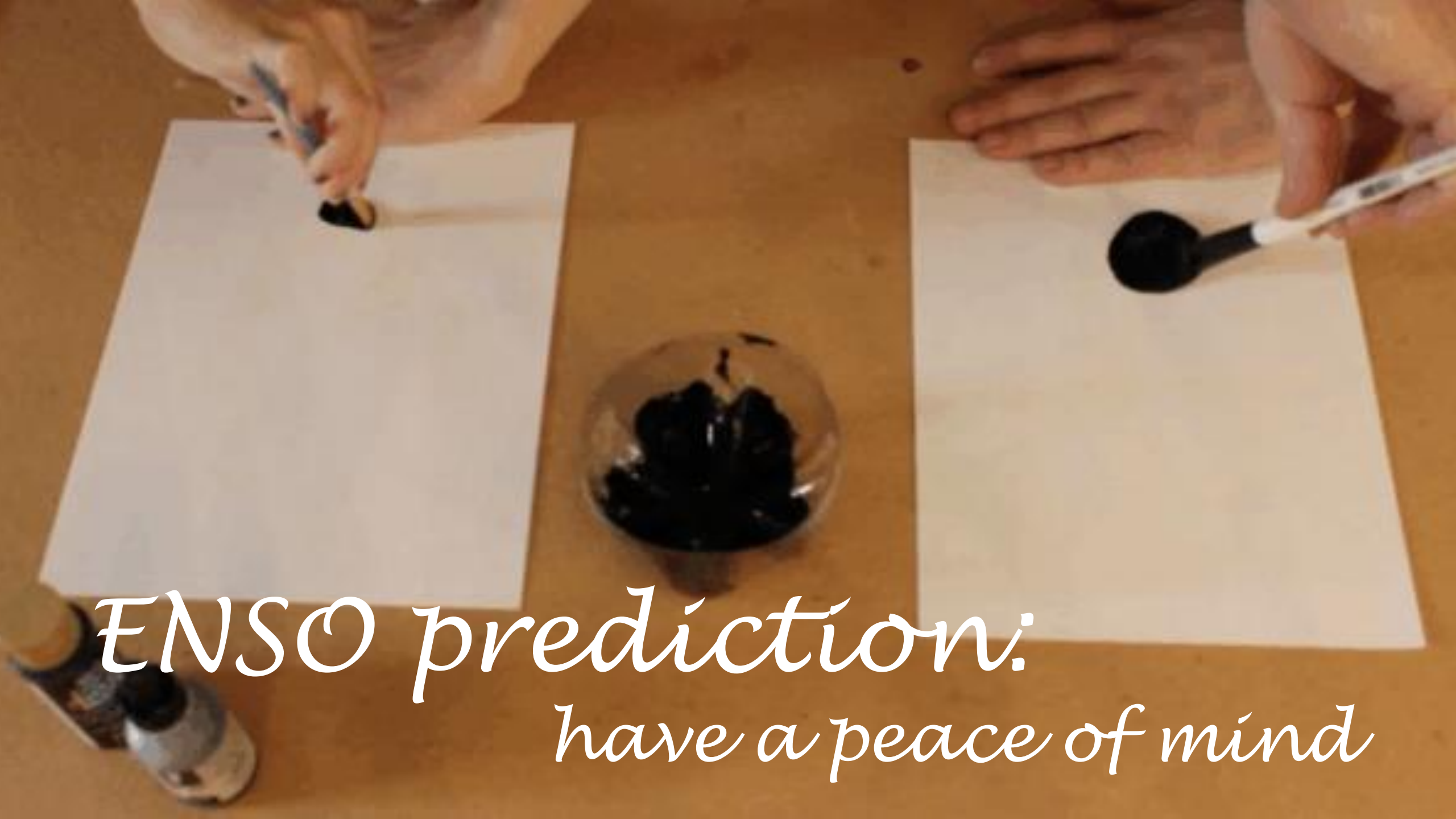
General wind direction and convergence zone (....)

In response, cold air advection is enhanced in the WNP region along with the development of an SST dipole.

Conv



Wind vectors are then directed from the cold WNP region to the warm tropical region.The persistent westerlies triggers equatorial Kelvin waves that pushes the tropical convection centre and the tropical warm water volume eastward.The persistent westerlies feeds back to weaken the trades and generate more Kelvin waves, eventually leading to an El Nino.



ENSO prediction:

have a peace of mind