Decadal Variations of Tropical Cyclone Intensity over the western North Pacific

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Outline

I. *Motivation*

II. *Data and Methodology*

III. *Numerical Simulation*

IV. *Contributions of factors*

V. *An possible mechanism*

VI. *Summary*

I. Motivation

➢ Decadal variations in TC activity

1. TC frequency----20-year period (central/eastern Pacific SST)

(Yumoto and Matsuura 2001; Matsuura et al. 2003; Yumoto et al. 2003)

2. TC track

Ho et al. (2004) ----interdecadal variability

Liu and Chan (2008) ----decadal variability

Wu and wang (2008) ----significant westward shift over the past four decades

3. TC intensity

Chan (2008)---Cat45 TC frequency ---16-32-year period

➢Uncertainty in TC intensity records

1.Cat45 TCs frequency over the WNP increase since the 1970s

(Webster et al. 2005; Elsner et al. 2008)

2.The upward trend -----a part of interdecadal variations

(Chan 2006)

3.The upward trend only detected in JTWC, not in RSMC and STI

(Wu et al. 2006; Yu et al. 2007; Song et al. 2010; Ren et al. 2011;Wu and Zhao 2012)

Does it really exist ?

or

is it just a result of uncertainty in TC records?

Objectives

1) *To verify the TC intensity variations in the WNP basin on the interdecadal and decadal time scales over the period 1948-2010*

2) *To examine the possible mechanisms associated with these variations*

Recently, Wu and Zhao (2012; *J.Climate*)

1. Assessing historical TC intensity datasets with a TC intensity model---- Coupled Hurricane Intensity Prediction System(CHIPS) (Emanuel 2006; Emanuel et al. 2008)

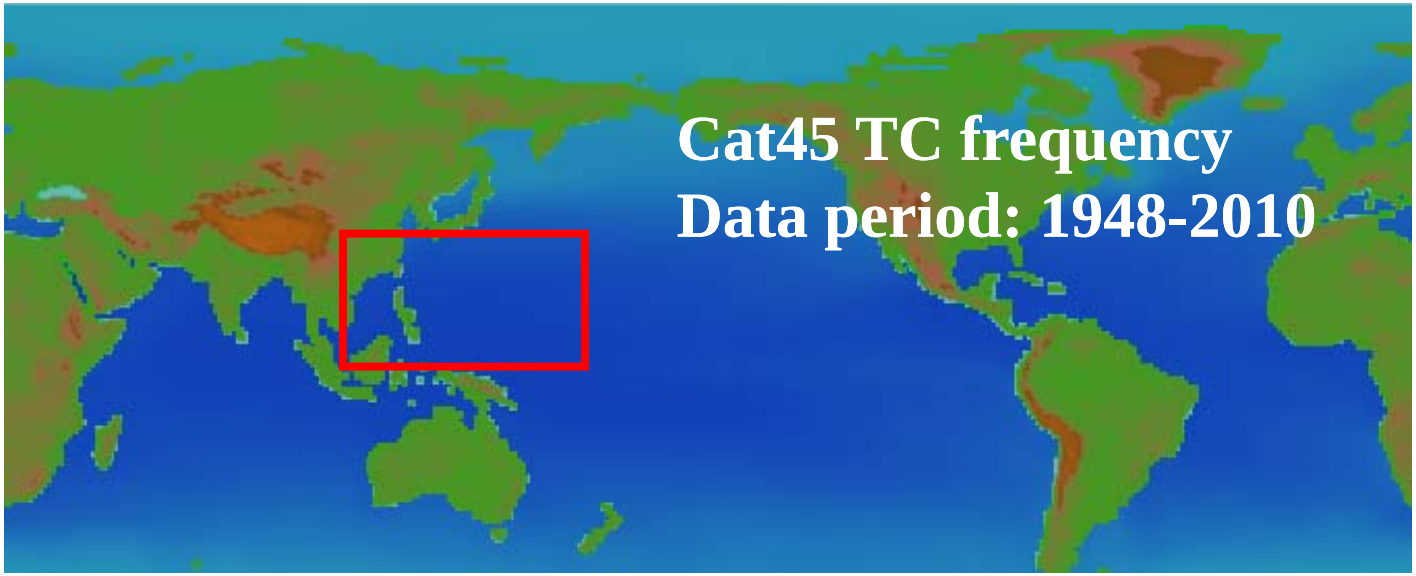
2. Reproducing the evolution of the basin-wide TC intensity in the JTWC best track dataset over the period of 1975-2007

3. Cat45 TC number is a most sensitive and reliable index
----in response to changes in the vertical wind shear and SST.

II. Data and Methodology

- TC data from JTWC
- Extended reconstructed SST (Version 3**)** from NOAA
- Monthly wind field from NCEP/NCAR reanalysis
- Coupled Hurricane Intensity Prediction System CHIPS)

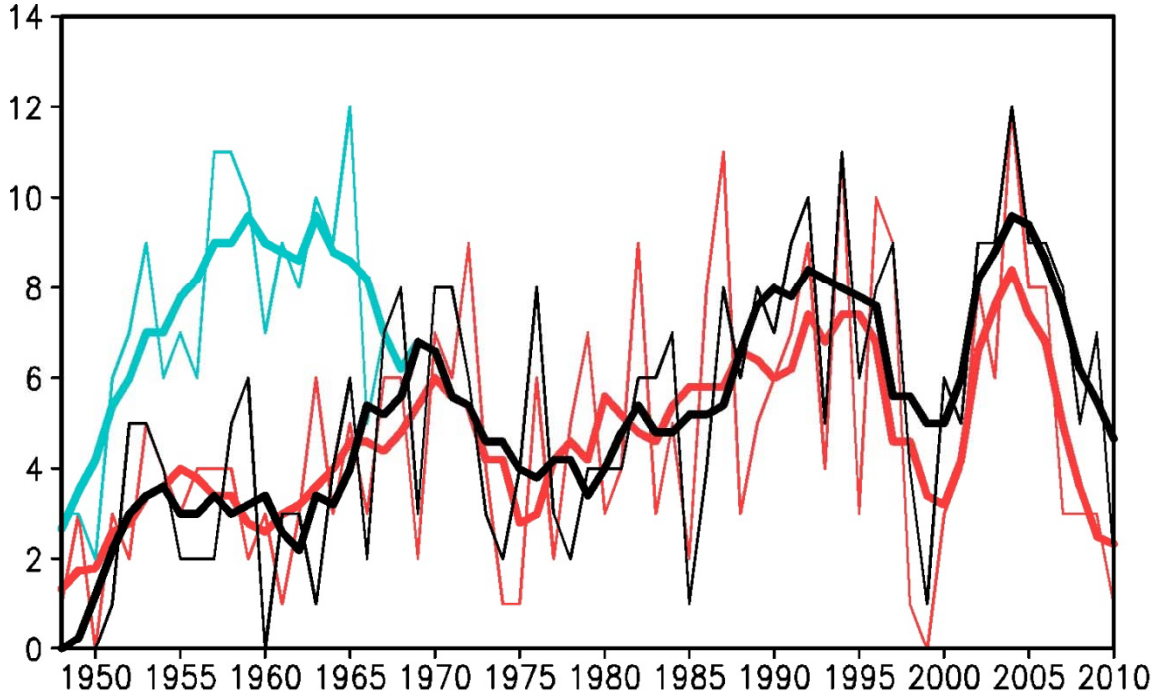
(Emanuel 2006; Emanuel et al. 2008)



III. Numerical Simulation

Experiments	*Simulation Description*
CTRL	**Both of SST and vertical wind shear are observed from 1948 to 2010.**

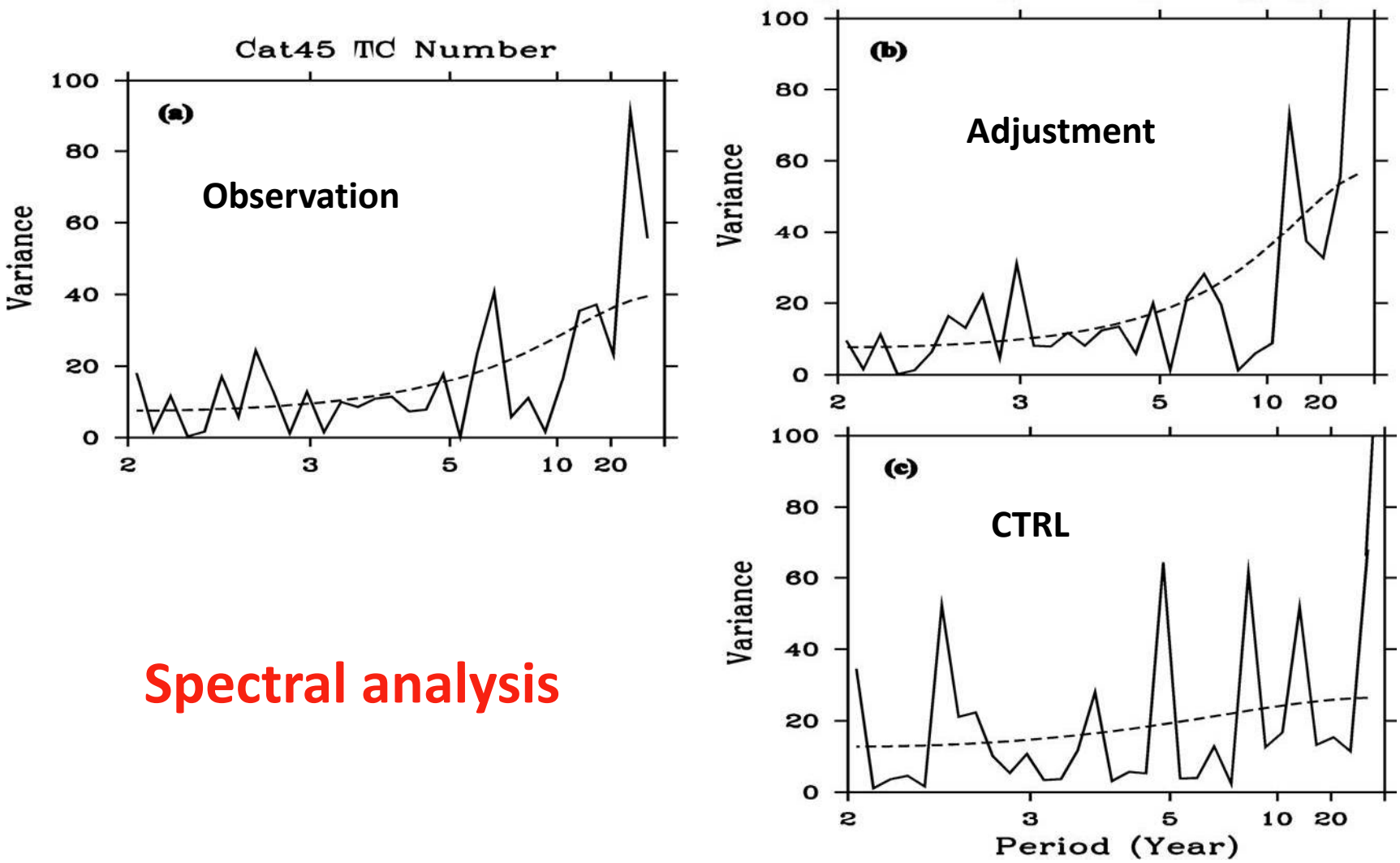
III. Numerical Simulation



Red-CTRL

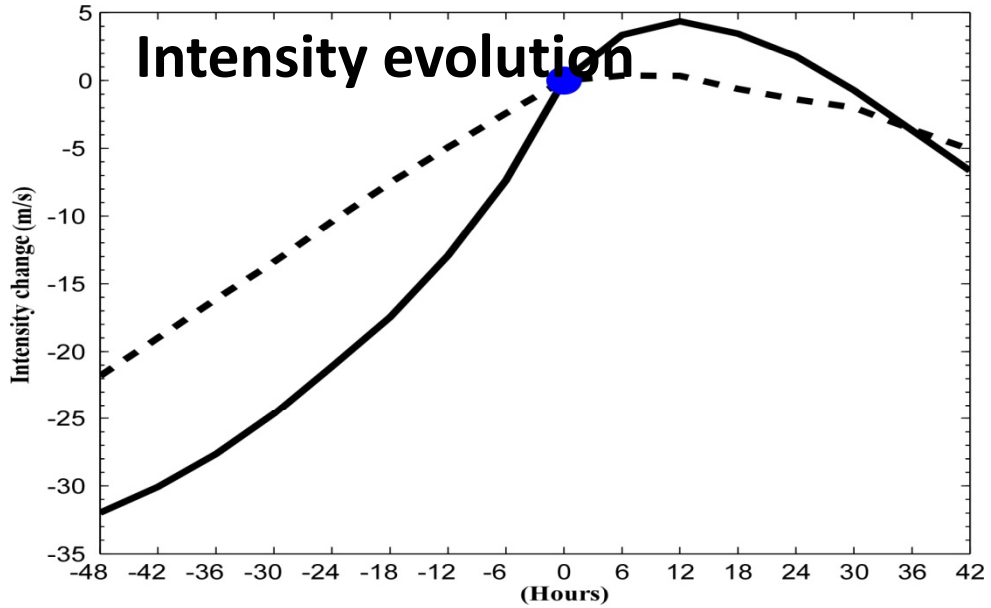
Green-observation

Black-adjustment-----(Emanuel(2005))



Spectral analysis

Periods	Mean time for a TC to achieve Cat45	Total lifetime Cat45
1948-1964	2.61 days	6.68 days
1965-1972	3.13 days	8.25 days
1973-2010	3.30 days	8.84 days

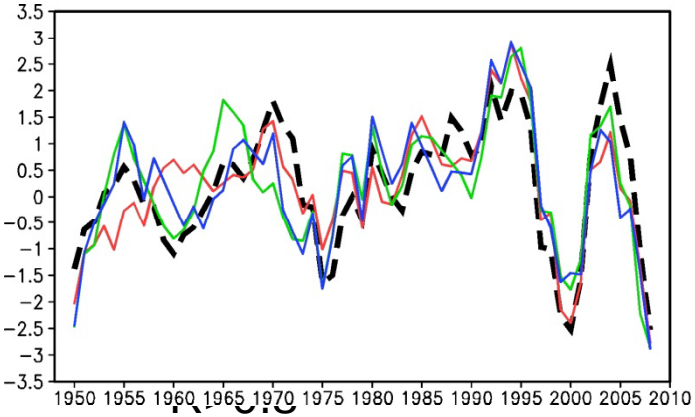


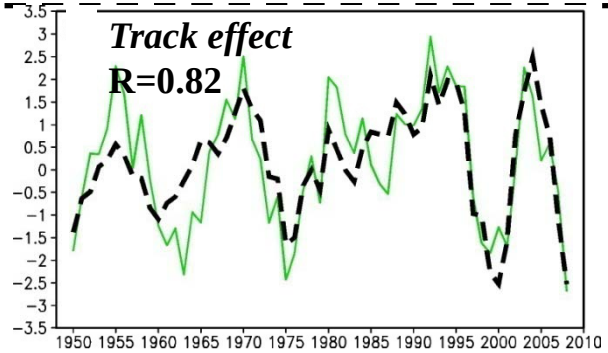
IV. Contributions of SST, Shear and TC tracks

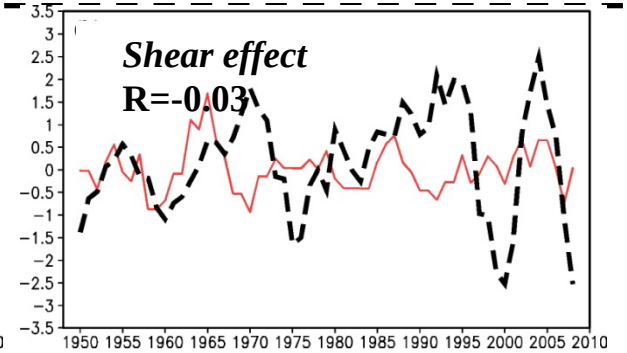
Experiments	*Simulation Description*
CTRL	Both of SST and vertical wind shear are observed from 1948 to 2010.
T65	SST is observed in 1965, but vertical wind shear changes with the observation from 1965 to 2010.
V65	Shear is observed in 1965, but SST changes with the observation from 1965 to 2010.
VT65	Both of SST and vertical wind shear are set to be those observed in 1965.

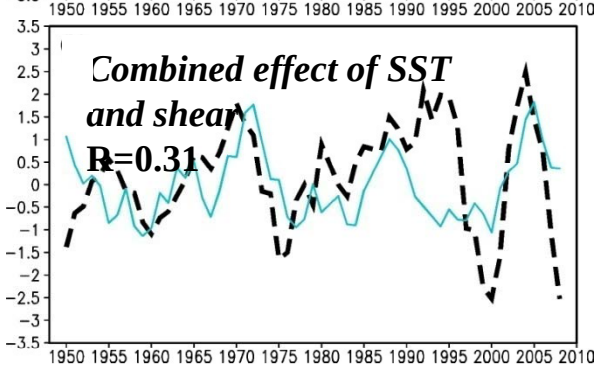
IV. Contributions of SST, Shear and TC tracks

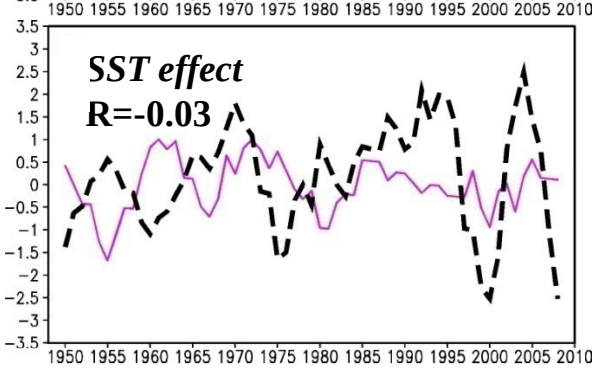
CTRL (black)
VT65 (blue)
V65(green)
T65(red)





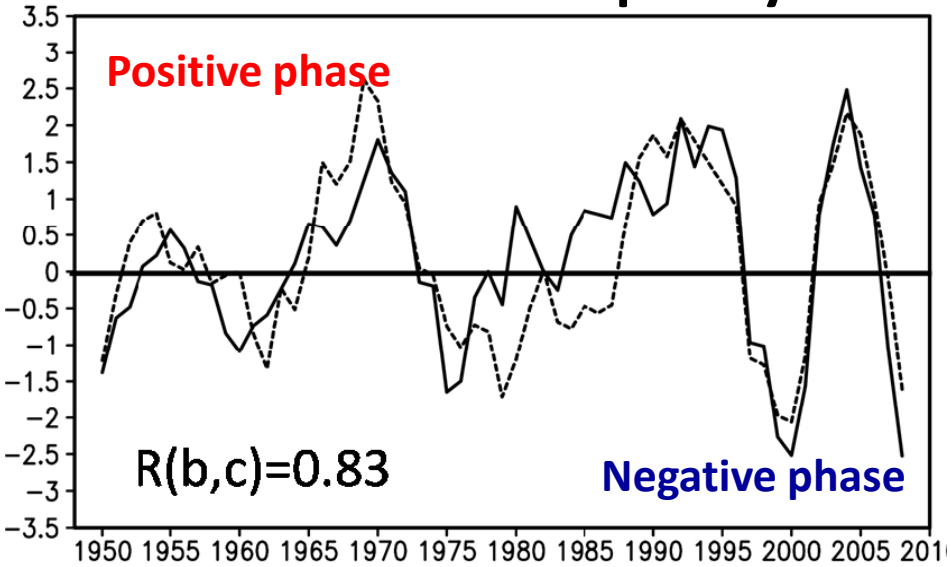






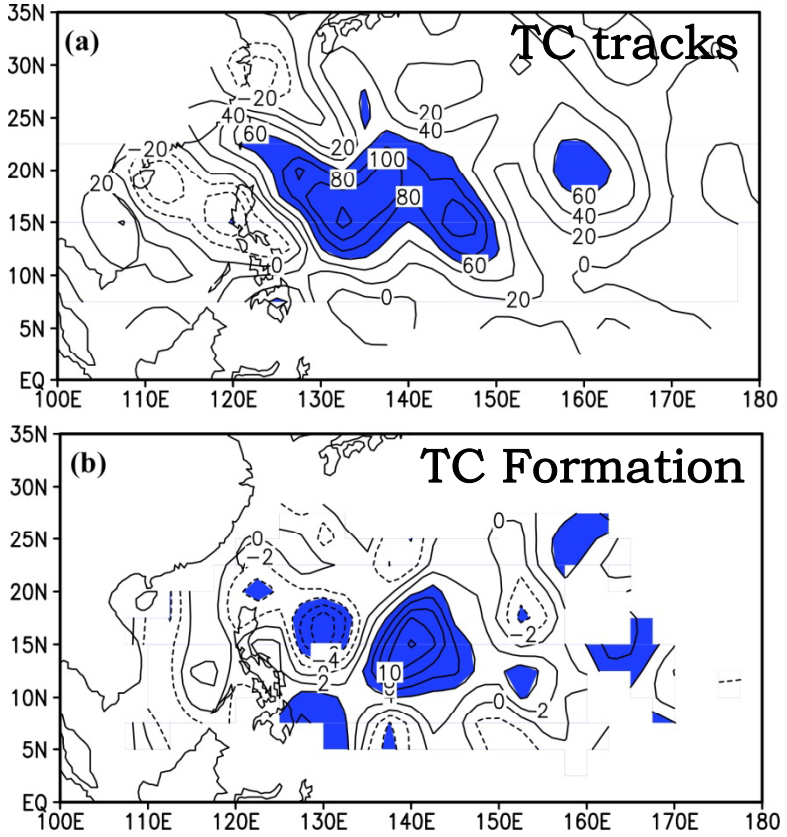
V. A possible mechanism-Observational analysis

Cat 45 TC frequency



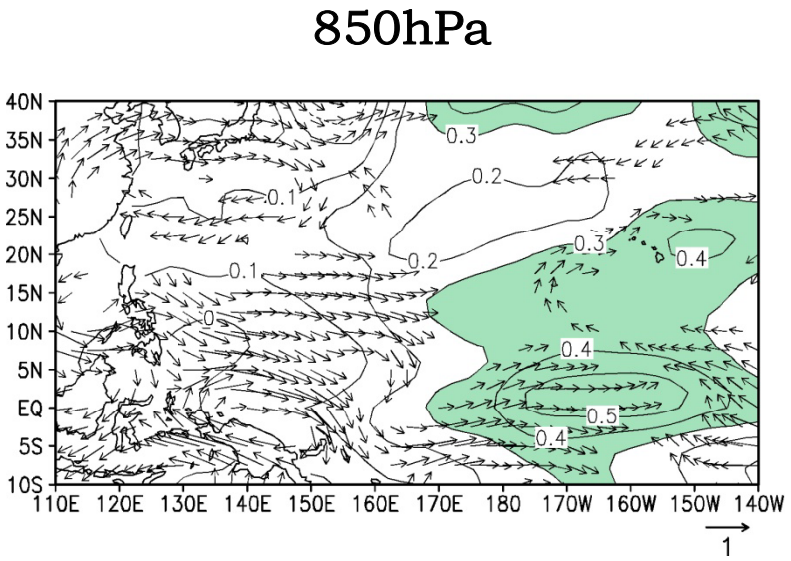
Dashed line-Observation

Solid line-CTRL



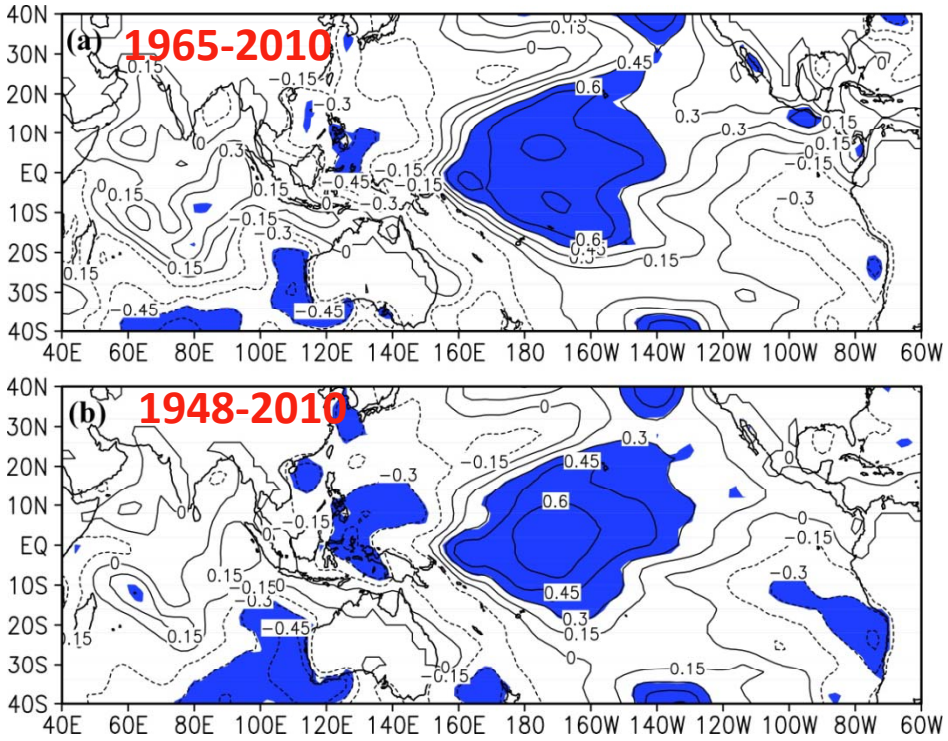
Positive phase –Negative phase

V. A possible mechanism-Observational analysis



Positive phase –Negative phase

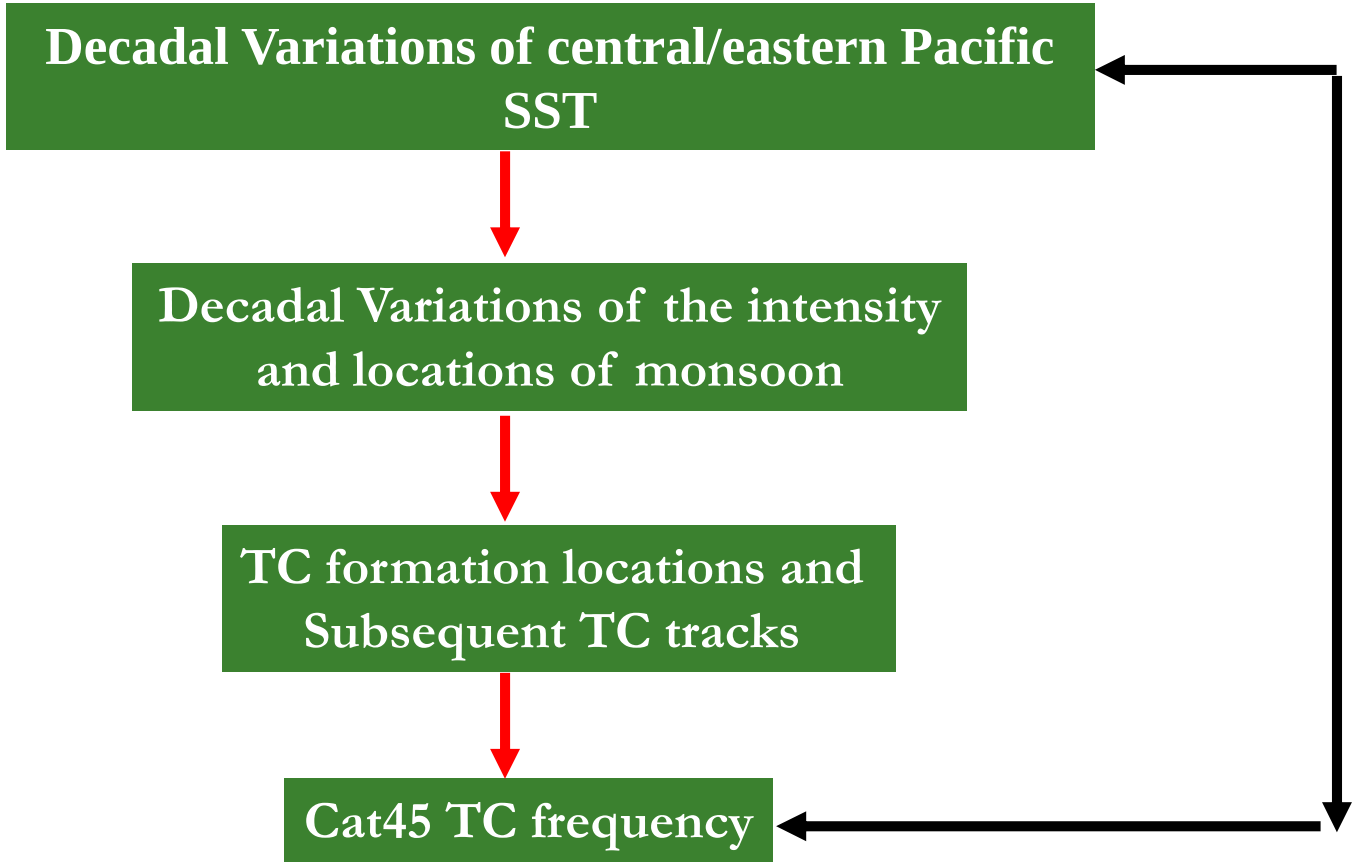
Shading: SST



Correlation

between Cat45 TC frequency and global SST

VI. Summary


Decadal Variations of central/eastern Pacific SST
Decadal Variations of the intensity and locations of monsoon
TC formation locations and Subsequent TC tracks
Cat45 TC frequency

Thanks for your attention!