October 19, 2011
PICES-2011 Annual Meeting, Khabarovsk, Russia

Interannual surface salinity variability in the Yellow and East China Seas in response to ENSO

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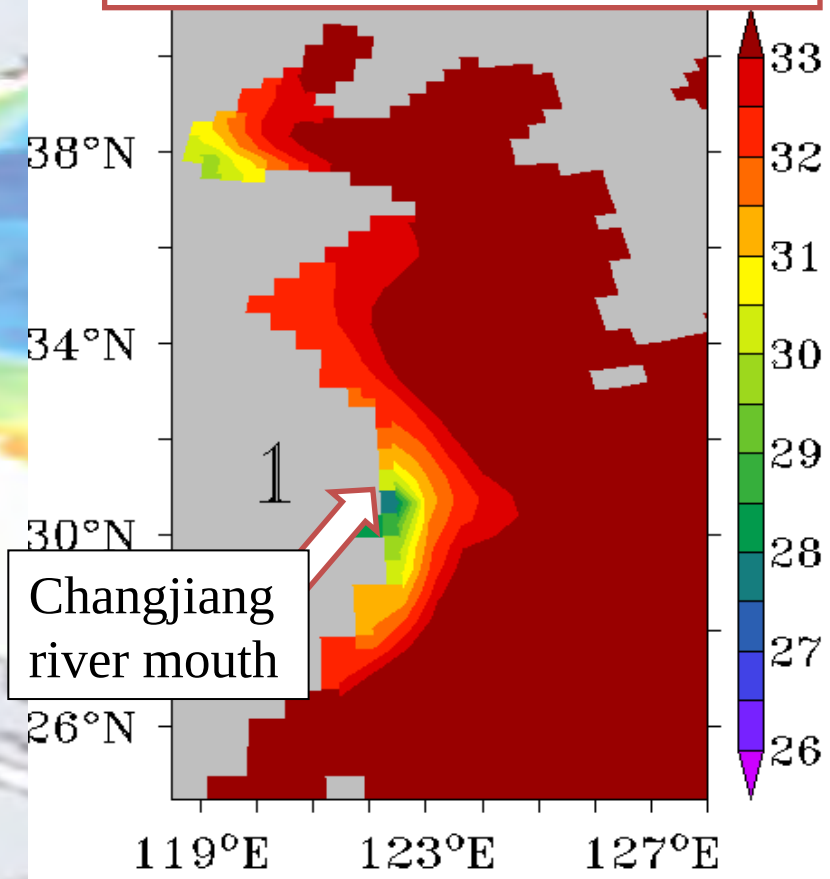
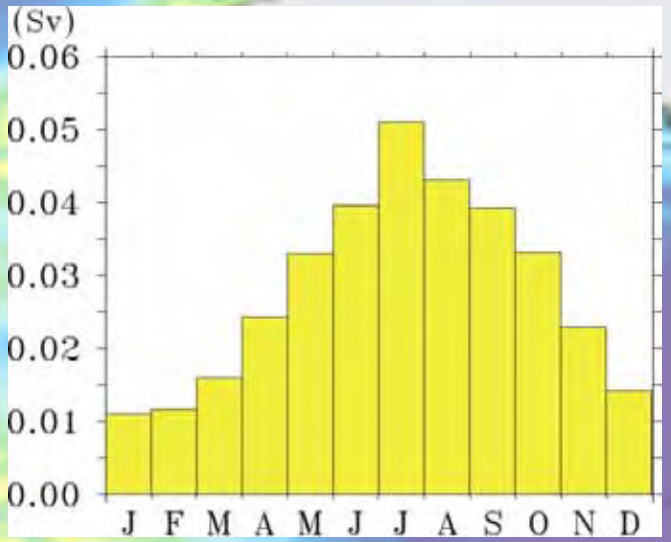
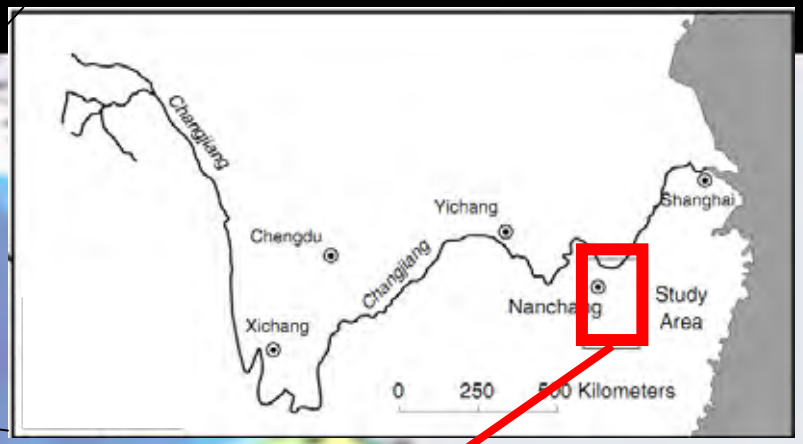
Surface salinity (model)

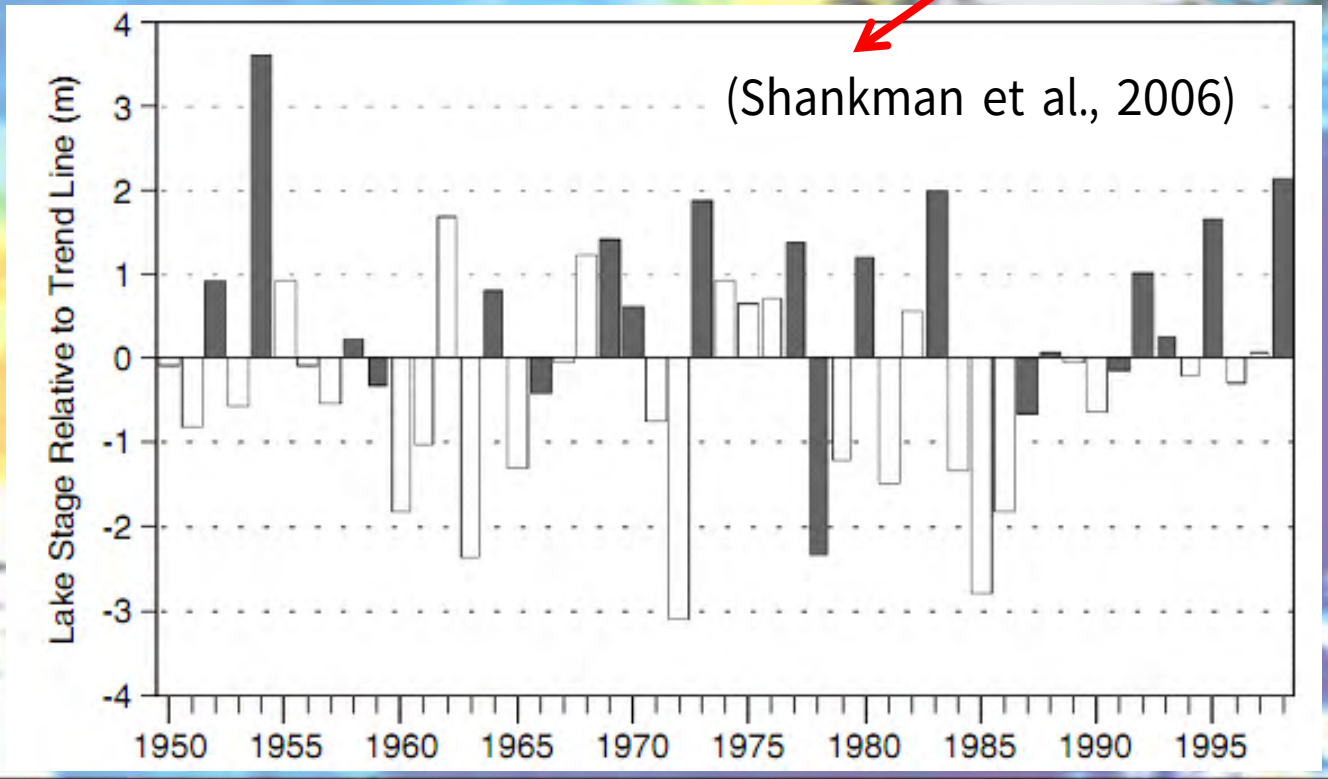


Changjiang river discharge




RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
Yangtze R.
East China Sea
INDIA
MYANMAR
TAIWAN
South China Sea


Changjiang
Chengdu
Yichang
Changjiang
Shanghai
Xichang
Nanchang
Study Area
0
250
Kilometers

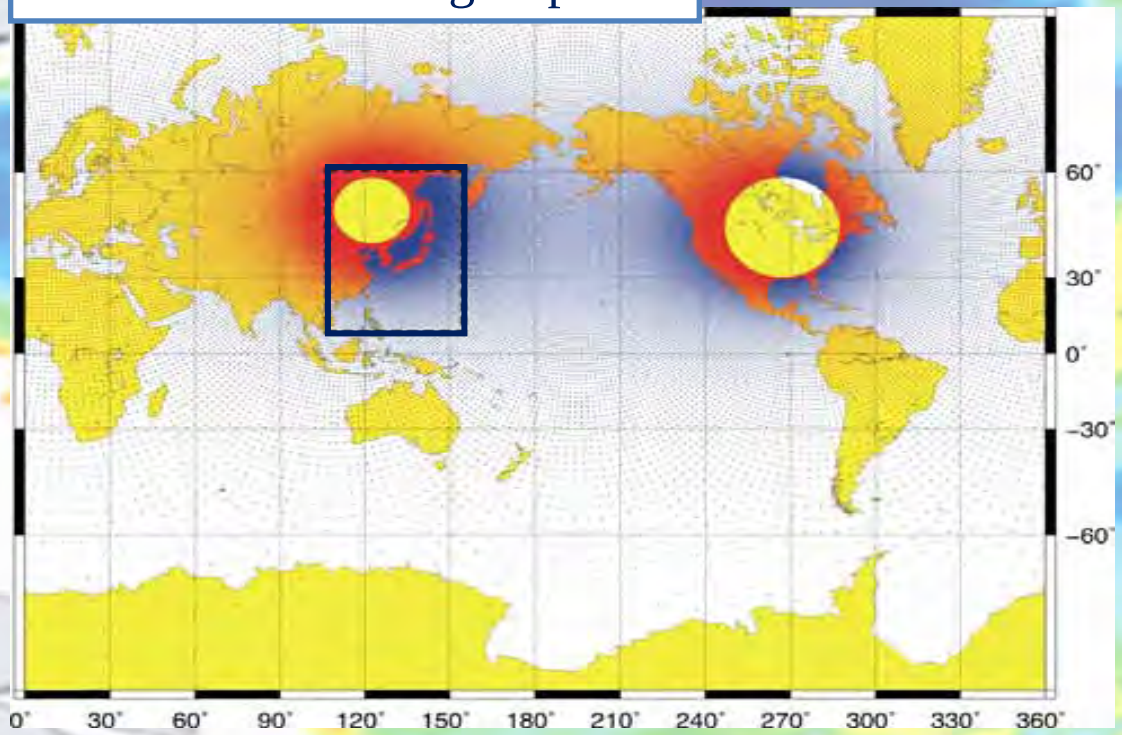

(Shankman et al., 2006)
Lake Stage Relative to Trend Line (m)
4
3
2
1
0
-1
-2
-3
-4
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995

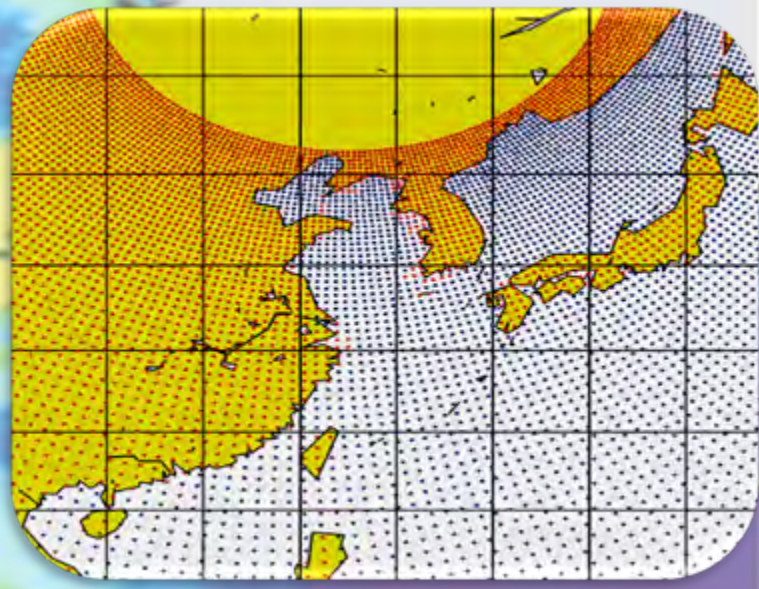
Objective

❖To explore SSS interannual variability in the YECS through the CRD variation in relation to ENSO.

Model Experiment

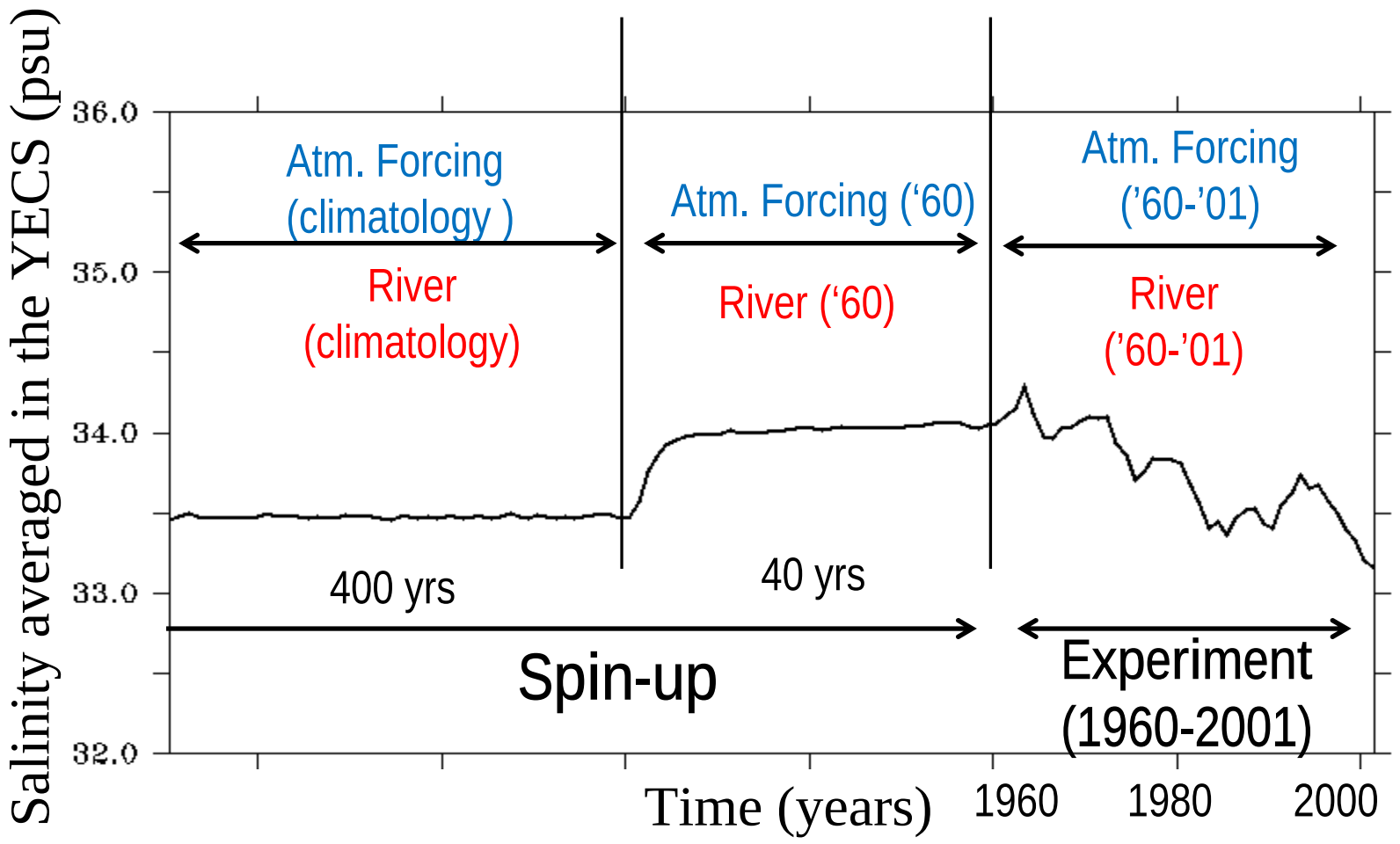
Model domain and grid points





- Model: Max Planck Institute Ocean Model (Marsland et al. 2003)
- Surface forcing:
  - Daily ECMWF Re-analysis data (1.125°)
  - Changjiang river discharge

Model Experiment



Application of Cyclostationary EOF

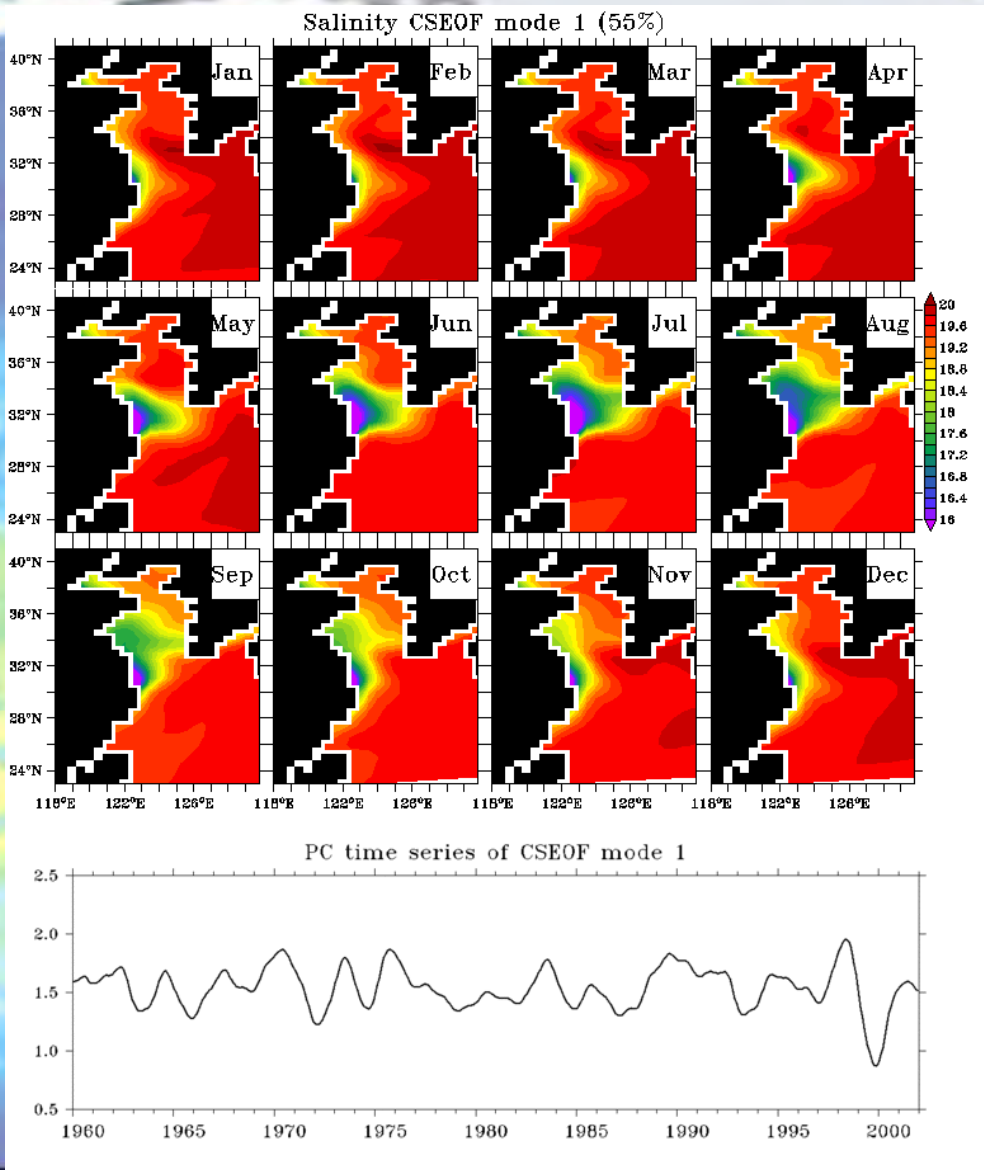
EOF analysis

$$A(r,t)=\Sigma_n LV_n(r)PC_n(t)$$

CSEOF analysis
(Kim and North, 1997)

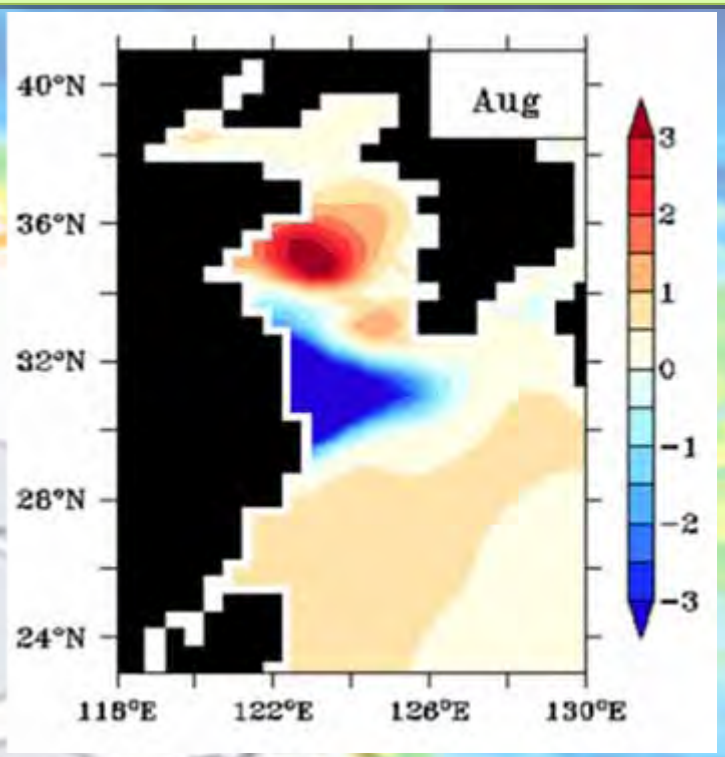
$$A(r,t)=\Sigma_n LV_n(r,t)PC_n(t)$$
$$LV_n(r,t)=LV_n(r,t+d)$$

d=12



SSS interannual variability

SSS CSEOF mode 3 (7.1%)

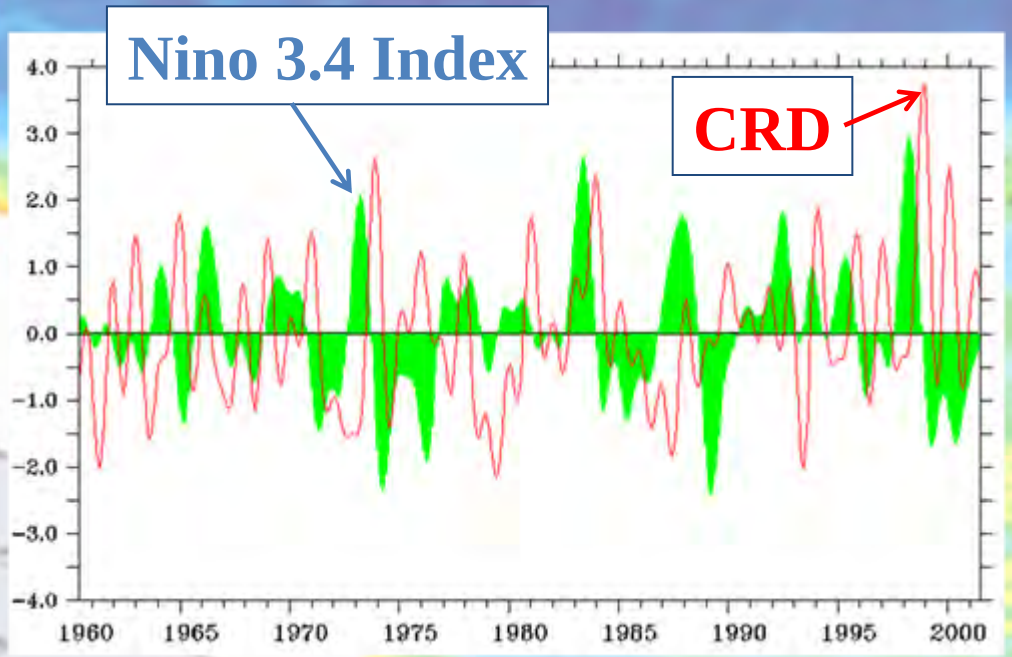


SSS (mode 3)

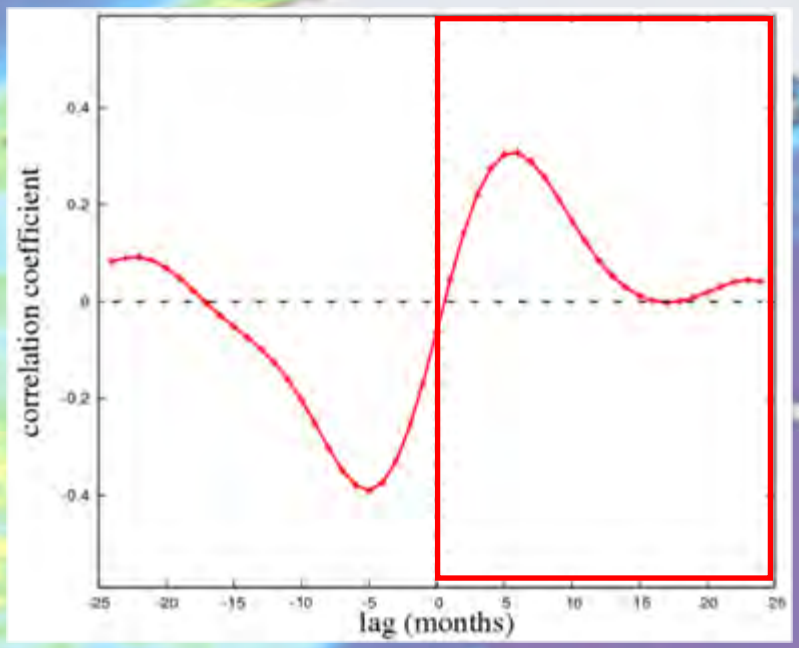
CRD (mode 2)

correlation coeff.: 0.67

Relation of CRD with ENSO



Lag correlation

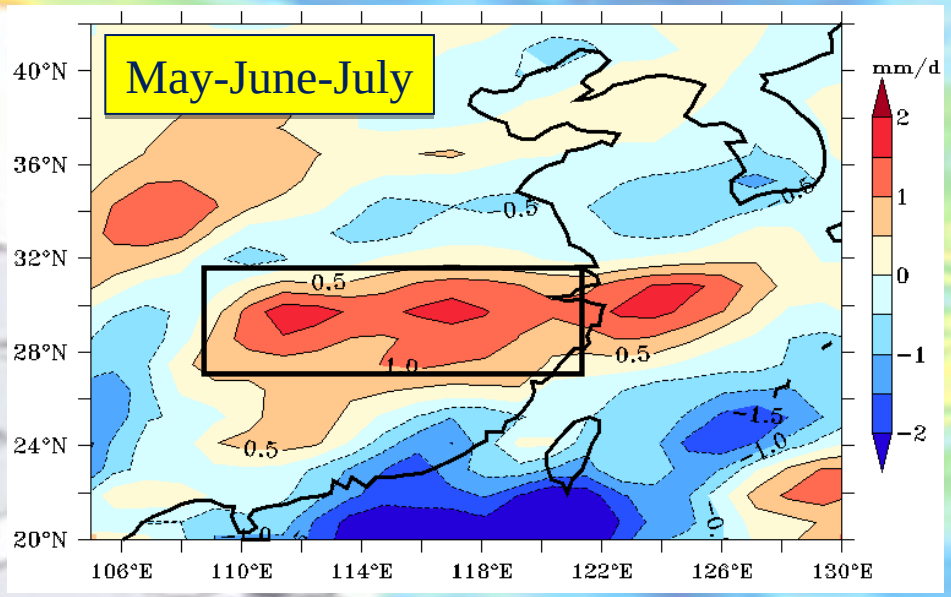


La Niña ← lags CRD

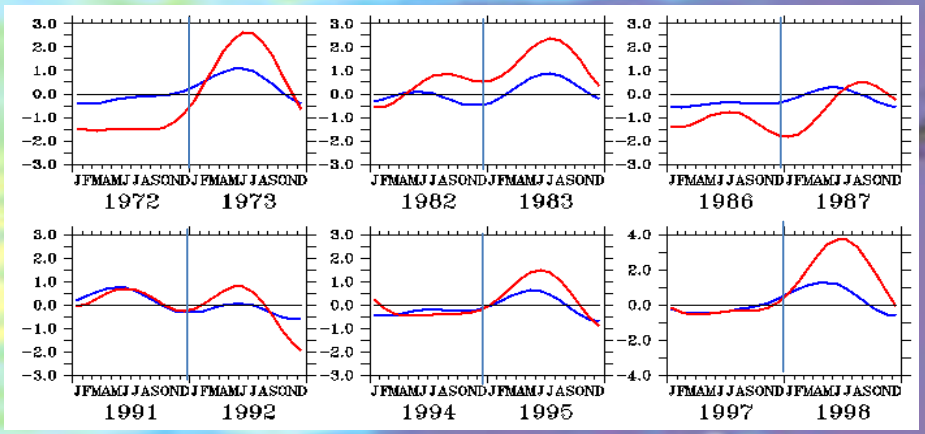
→ El Niño leads CRD

Precipitation increase in East China in El Niño years

Precipitation composite difference (El Niño – La Niña)



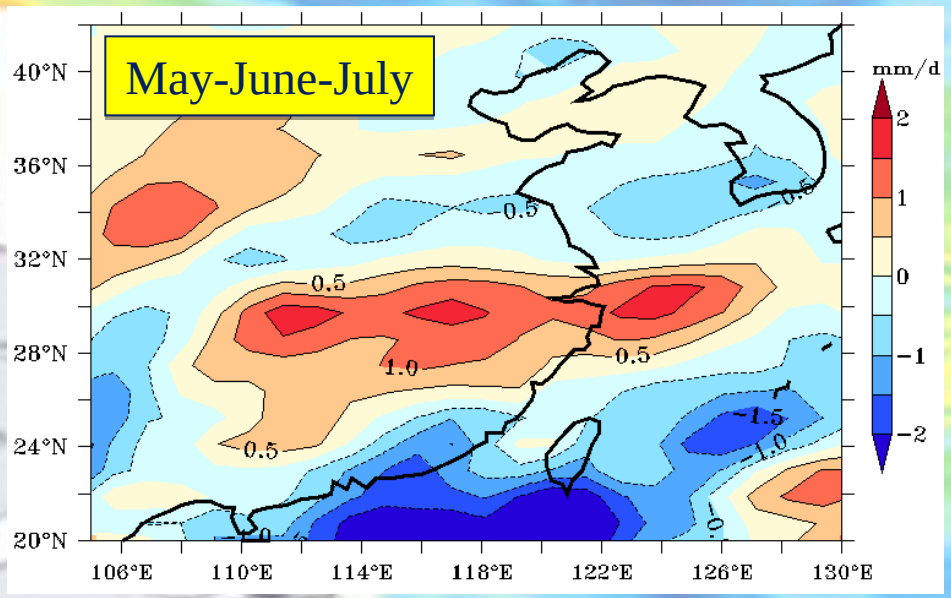
Precipitation over Yangtze valley & CRD

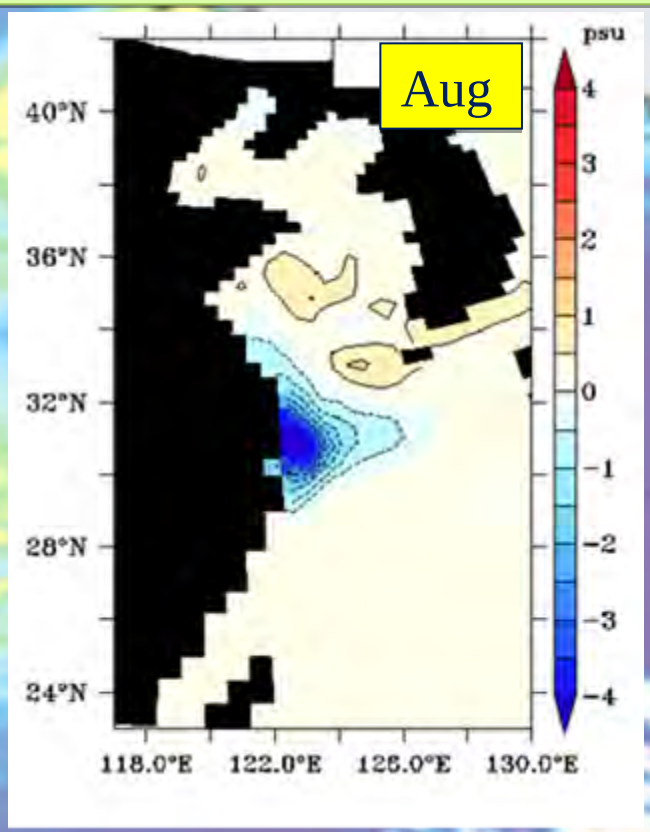


Freshening in the YECS in El Niño years

SSS composite difference (El Niño – La Niña)

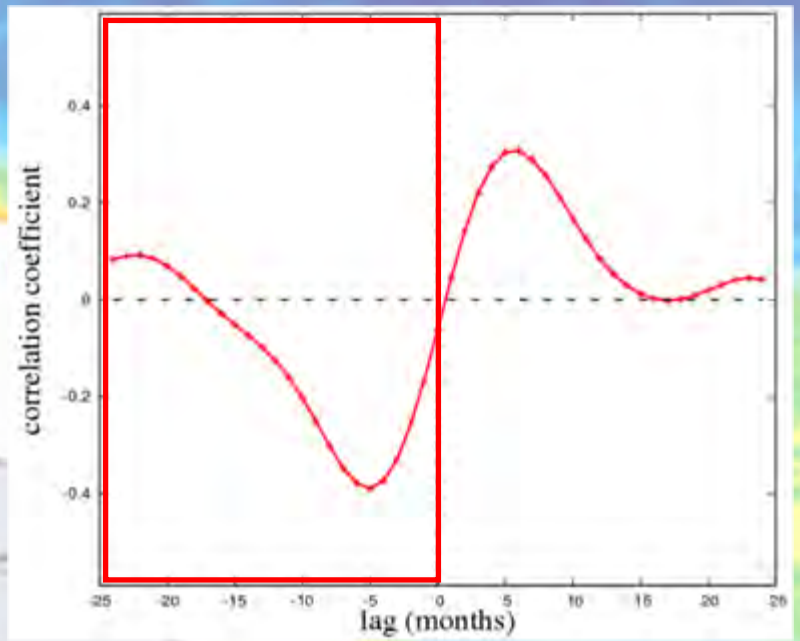
Precipitation composite difference (El Niño – La Niña)



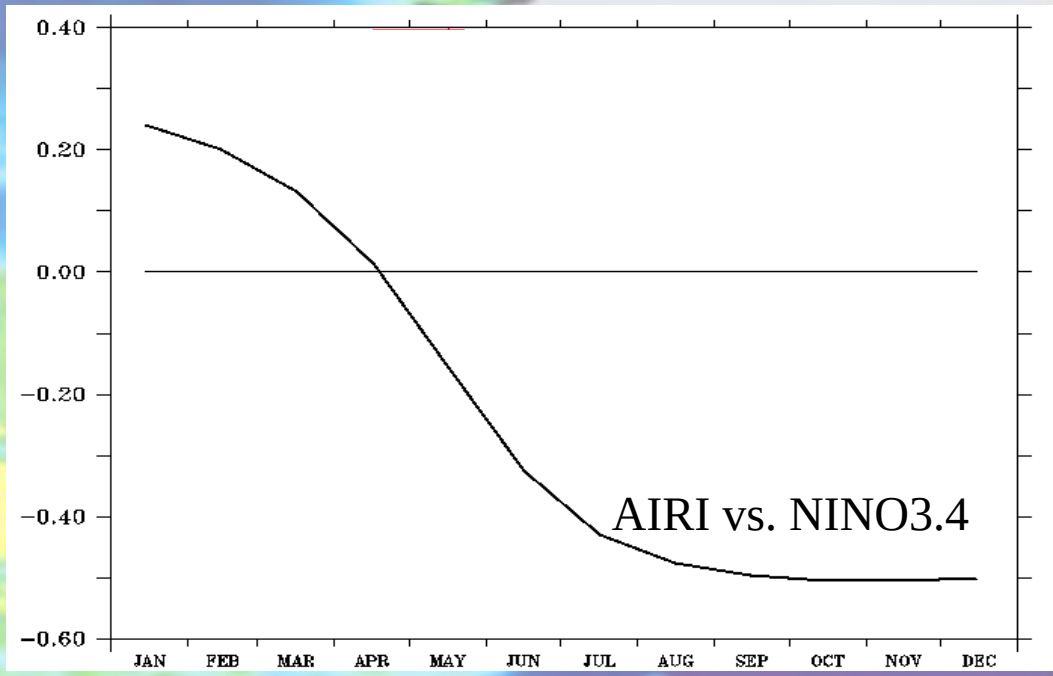


Indian summer monsoon vs. CRD

Lag correlation



Correlation between **AIRI** vs. **Nino3.4** (or **CRD**)



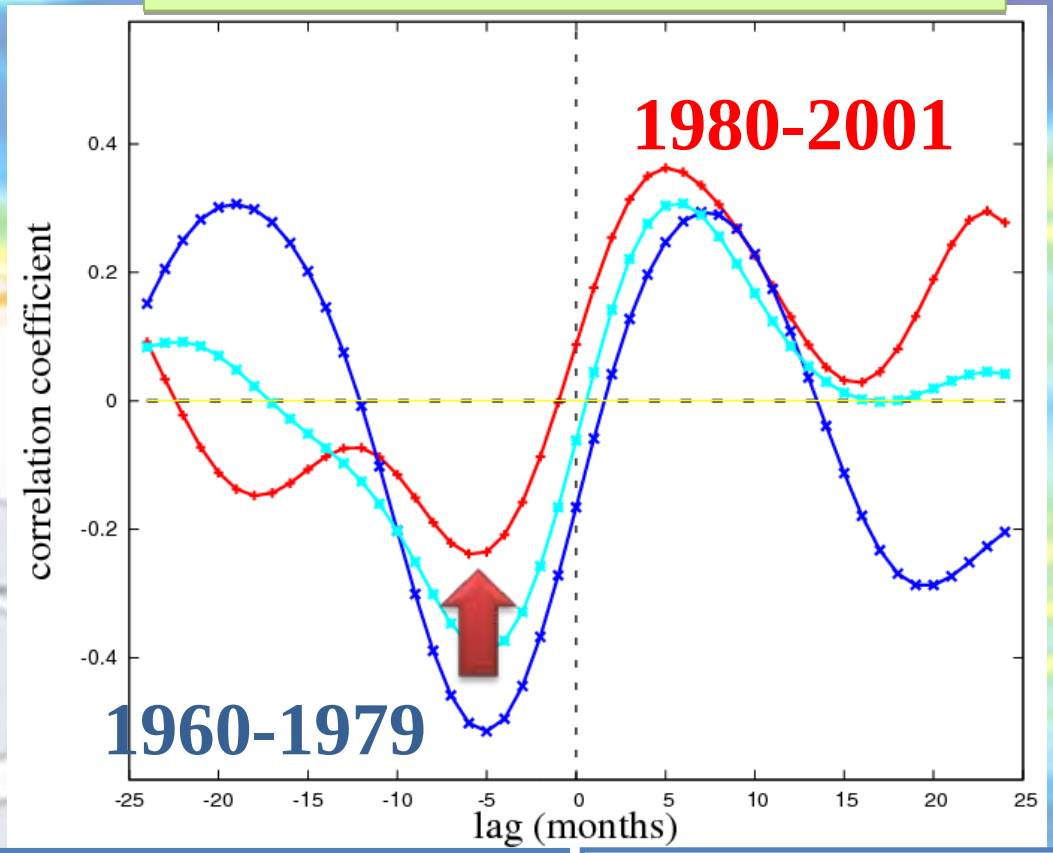
La Niña ← lags CRD

→ El Niño leads CRD

AIRI
(All-India summer rainfall index)

Weakened relation of CRD with Indian monsoon after late 1970s

Lag correlation



Changes in ENSO behavior after late 1970s (increased amplitude and periodicity)

ENSO-ISM relation ↓

ENSO-EASM relation ↑

La Niña lags CRD ←

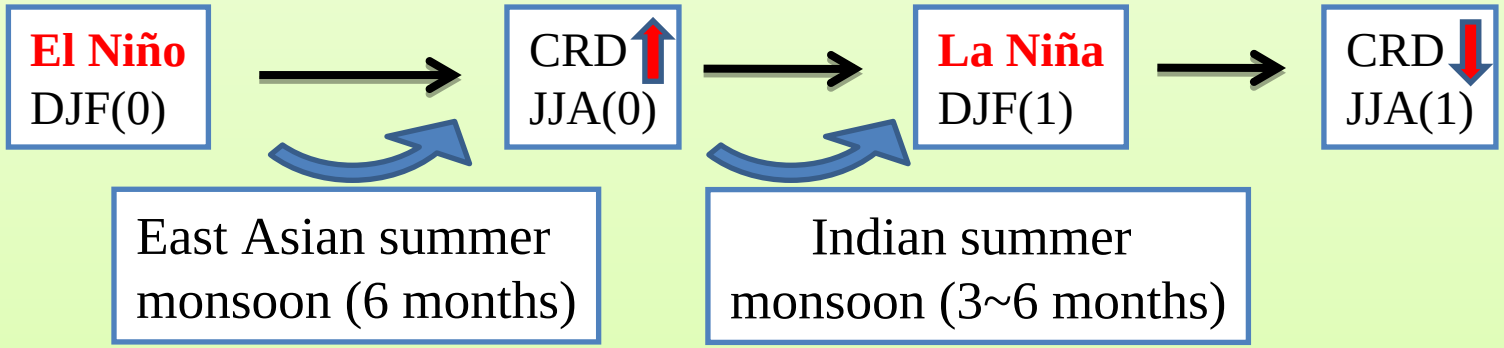
→ El Niño leads CRD

Conclusion

❖ SSS in the YECS is influenced by ENSO through CRD variation.

❖ SSS interannual variation is 25% of the total variance except 1st and 2nd mode in CSEOF.

❖ CRD shows a biennial oscillation in relation with summer monsoons-ENSO interaction.



❖ Weakened relation of CRD with Indian summer monsoon (ISM) after late 1970s due to weakening ISM-ENSO interaction.