

Intraseasonal Predictability of Siberian High and East Asian Winter Monsoon and Its Inter-Decadal Variability

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Prediction of EAWM

- Seasonal predictability
 - Most from ENSO, link to midlatitude EAWM weak (Wang et al. 2009, Kang and Kim 2011)
 - Relationship with AO/NAO mainly inter-decadal, not interannual (Gong et al. 2001, Park et al. 2011)
- Intraseasonal predictability
 - ISO identified in tropics
 - Usefulness to mid & high latitudes unclear

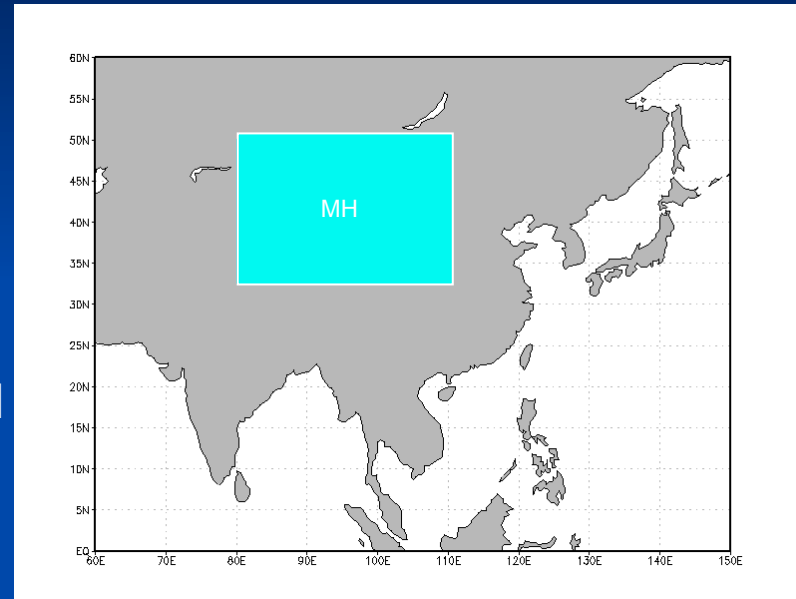
SMH (anomaly)

MH (anomaly) (1979-2008)				
corr.	Oct	Nov	Dec	Jan
OND				
NDJ				

Due to land-sea difference SMH starts to develop in fall before winter season officially sets in (Chang et al. 2004).

During this transition period, how do the rolling 3-month seasonal forecasts perform on individual months?

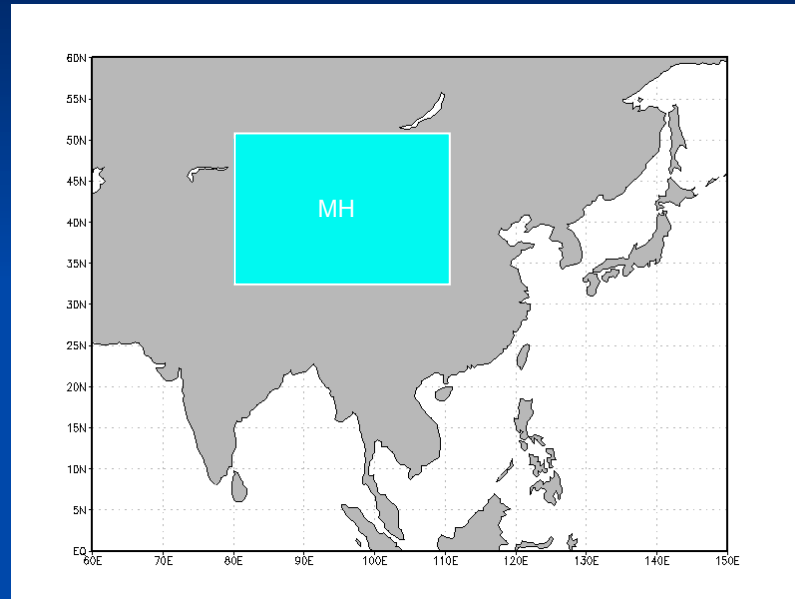
Mongolian High (MH) covering Mongolian and northern China.

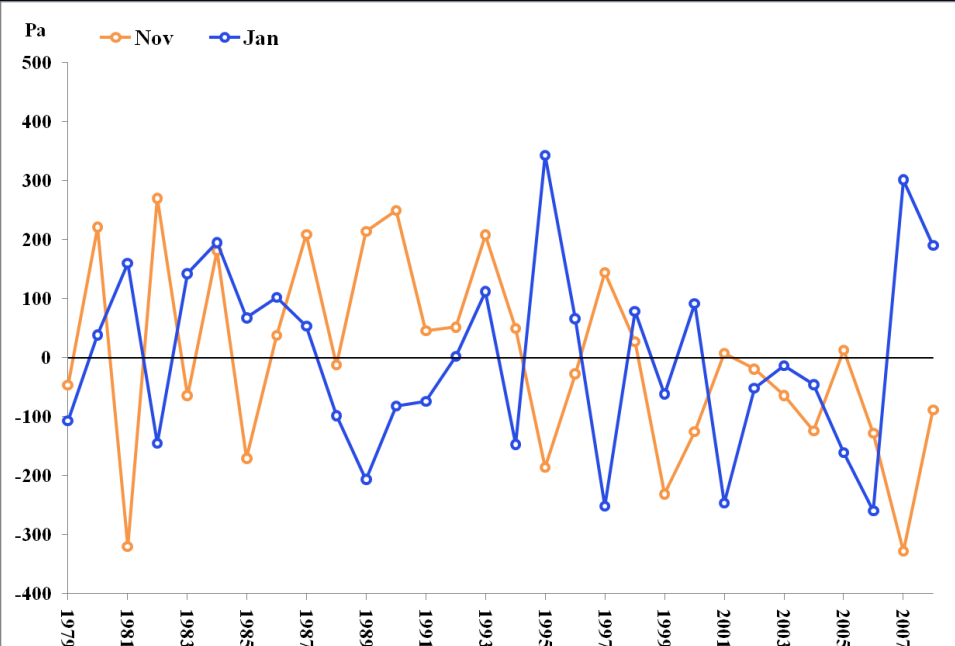
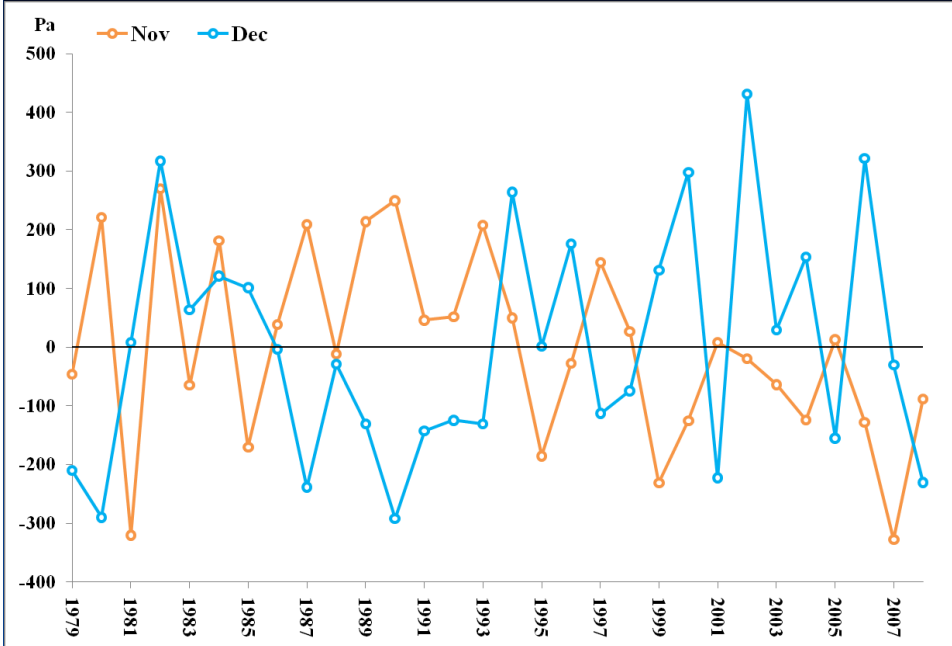


SMH (anomaly)

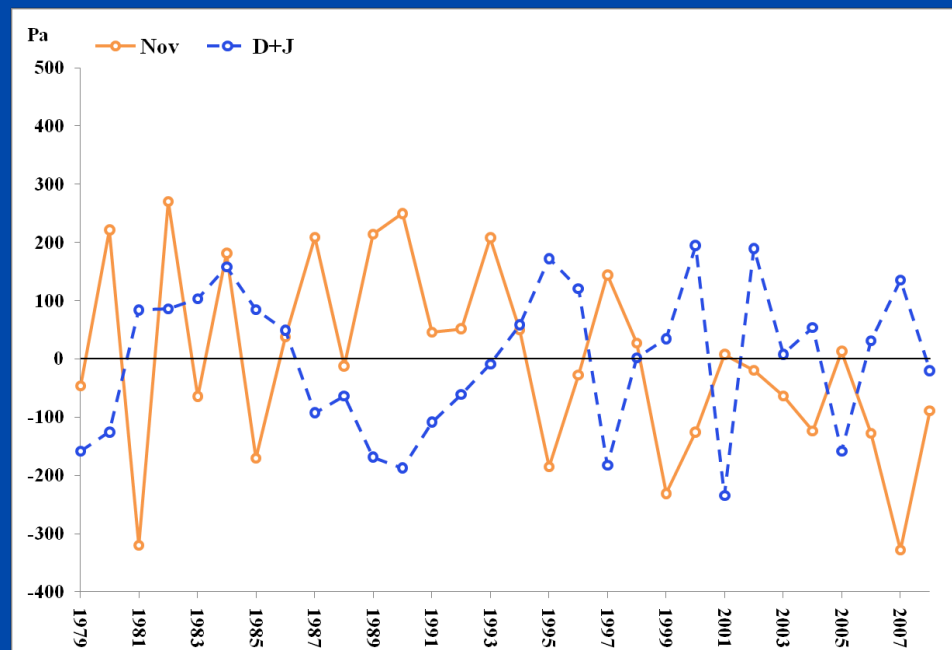
MH (anomaly) (1979-2008)				
corr.	Oct	Nov	Dec	Jan
OND	.56	.44	.56	-.20
NDJ	.11	.18	.65	.42

MH (anomaly) (1979-2008)					
	Oct	Nov	Dec	Jan	D+J
Oct	1				
Nov	.11	1			
Dec	-.05	-.30	1		
Jan	.10	-.37	-.03	1	

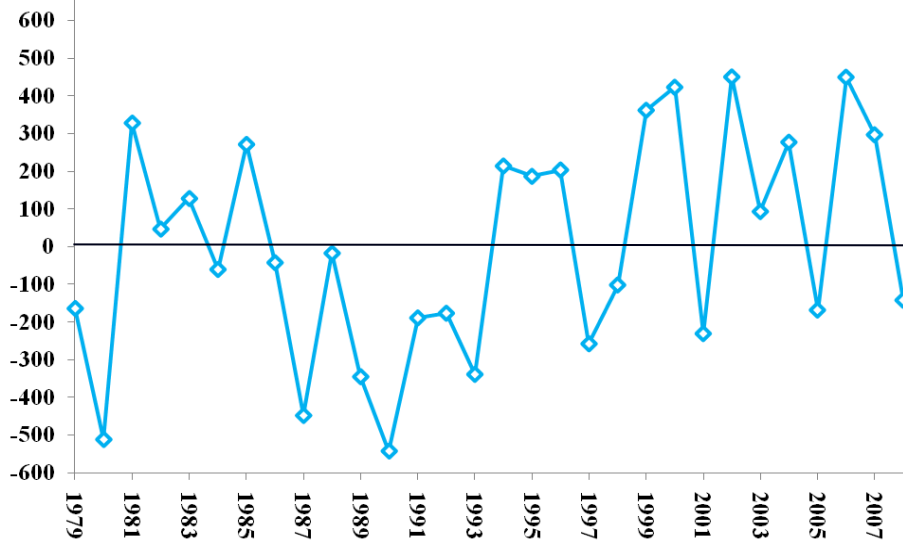




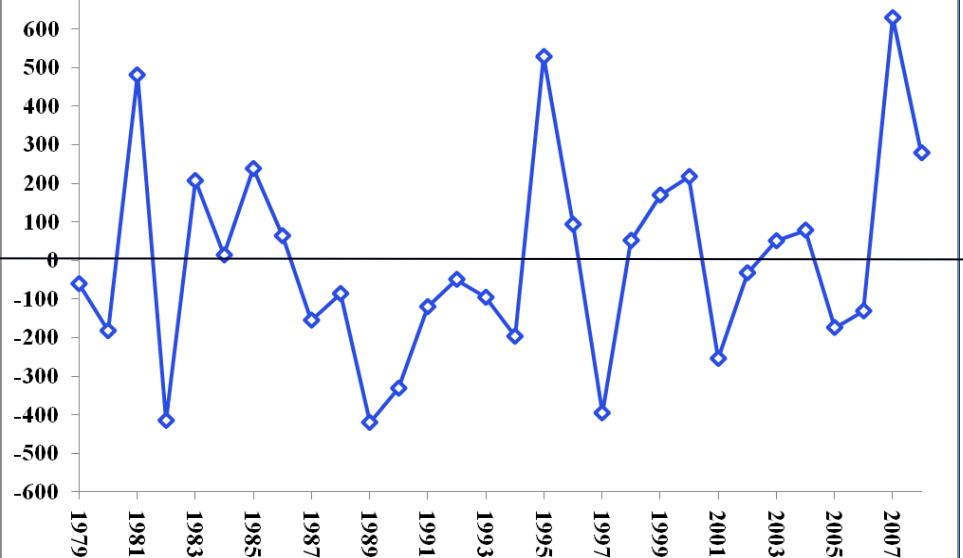
MH SLP
anomaly



Pa $\Delta = \text{DEC-NOV}$

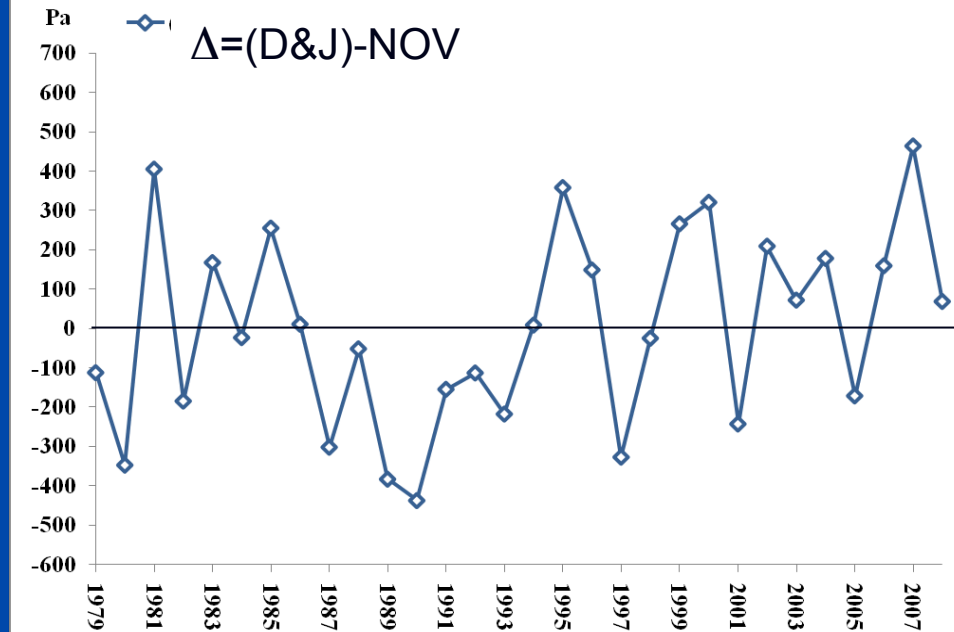


Pa $\Delta = \text{JAN-NOV}$

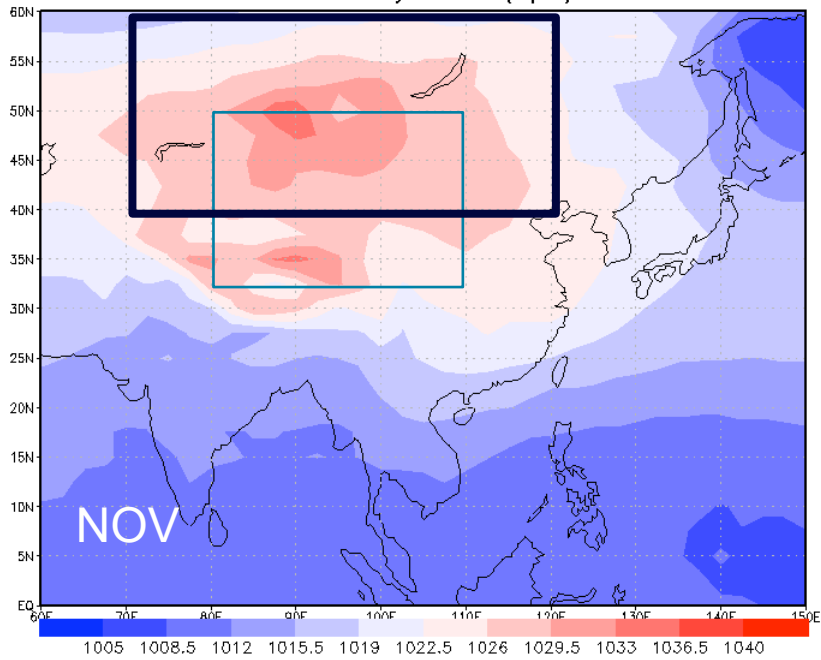


$\Delta = \text{MMM-NOV}$

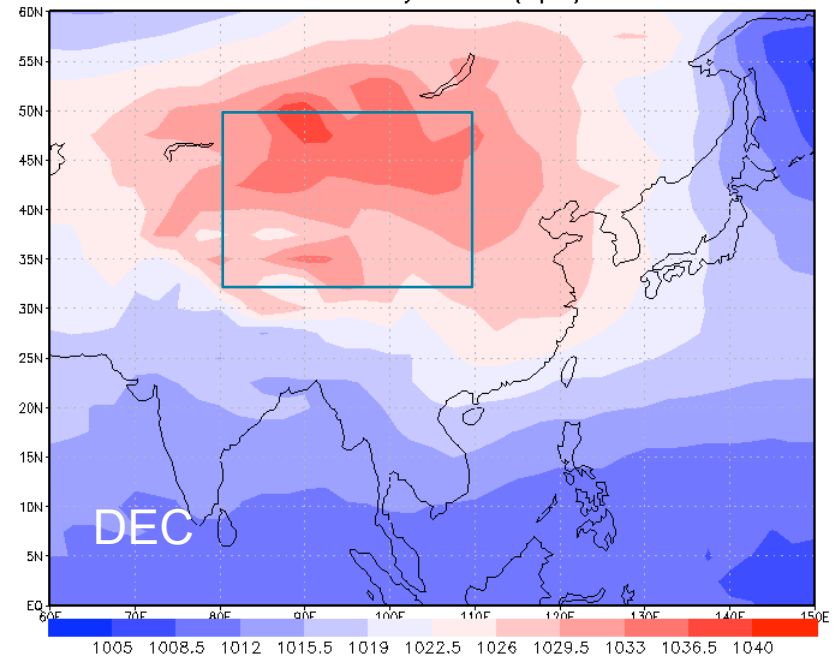
Pa $\Delta = (\text{D\&J})-\text{NOV}$



SMH 30yr Nov (hpa)

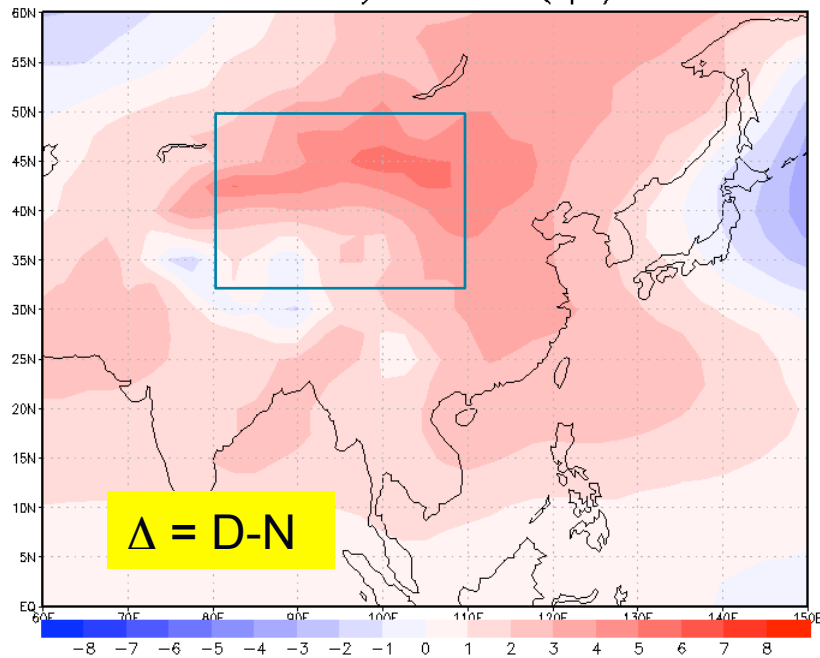


SMH 30yr Dec (hpa)

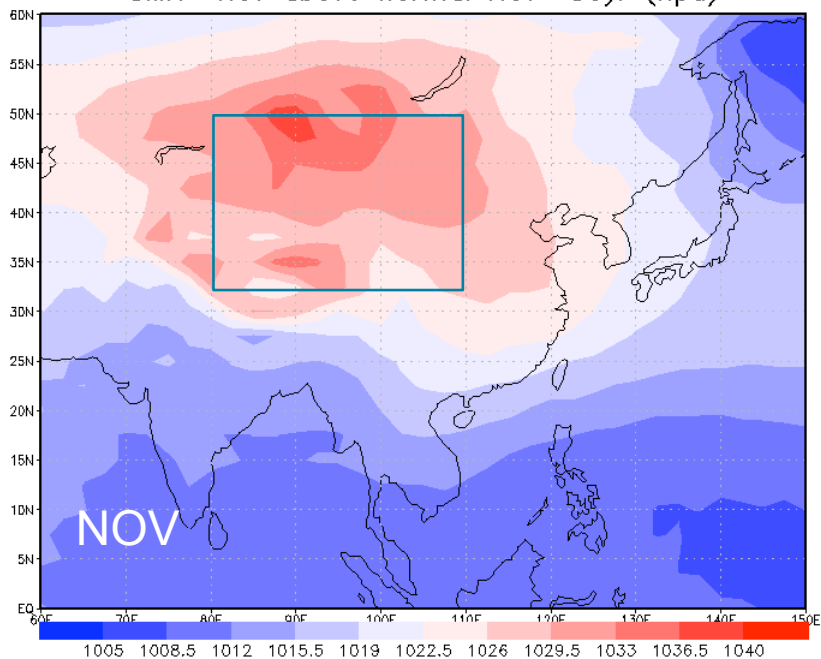


1979-2008
Seasonal-March
Climatology

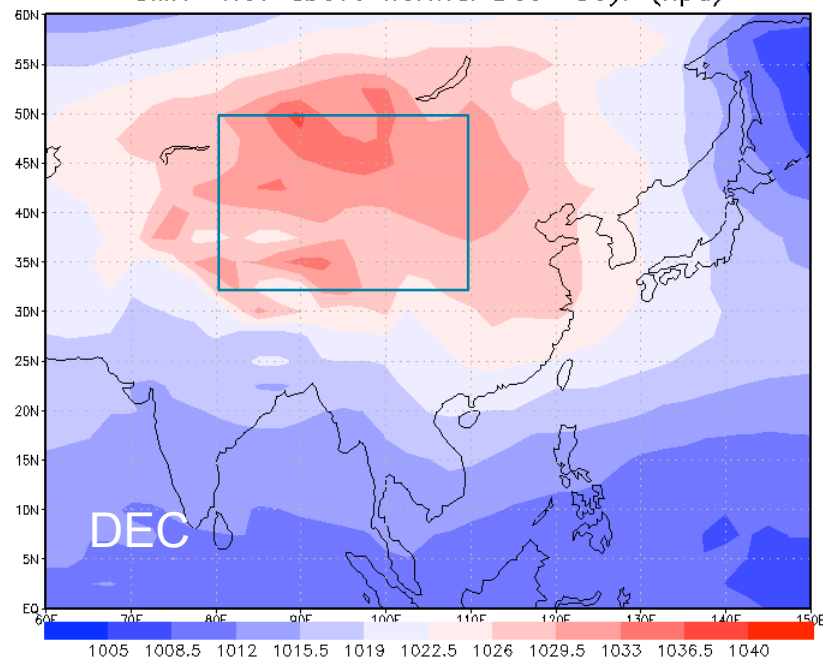
SMH 30yr Dec-Nov (hpa)



SMH Nov above normal Nov 30yr (hpa)

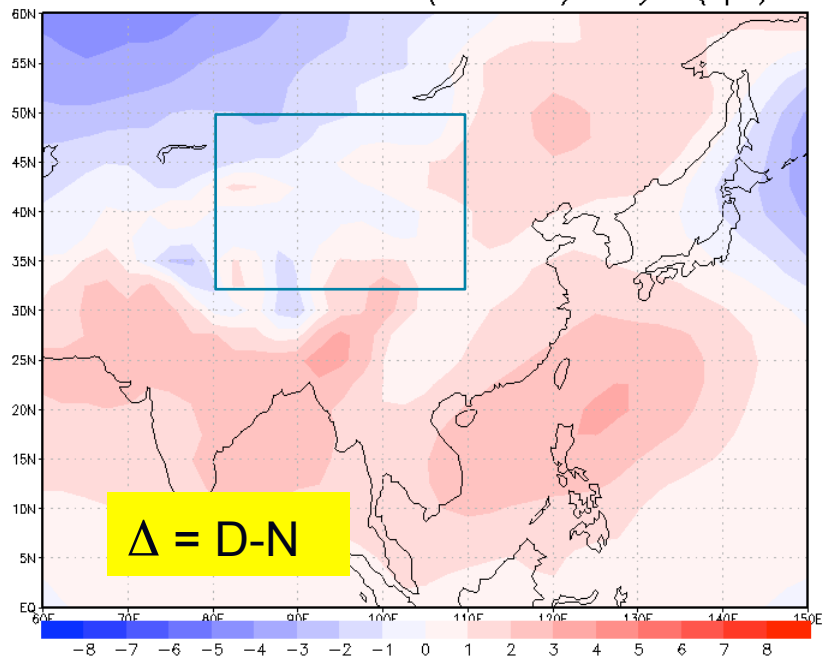


SMH Nov above normal Dec 30yr (hpa)



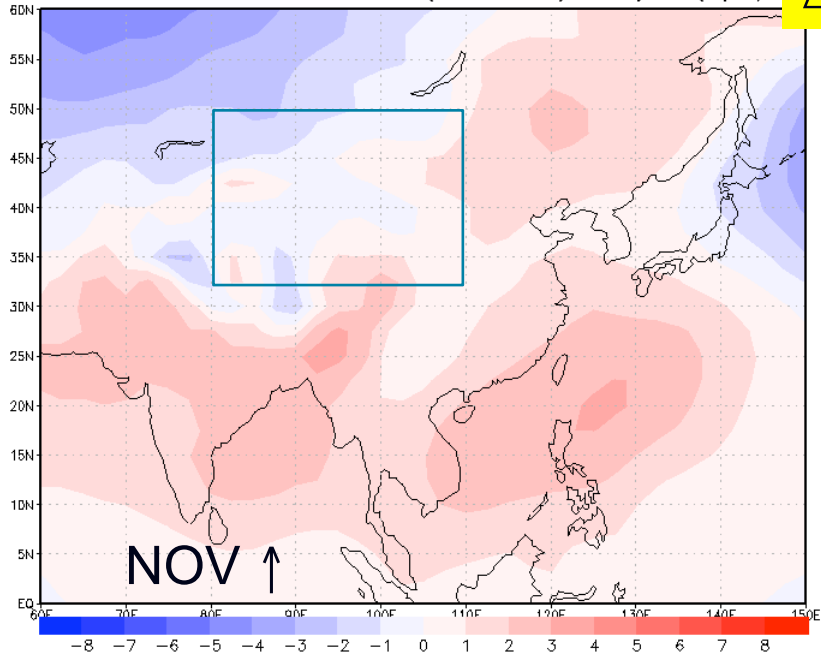
NOV ↑

SMH Nov above normal (Dec–Nov) 30yr (hpa)



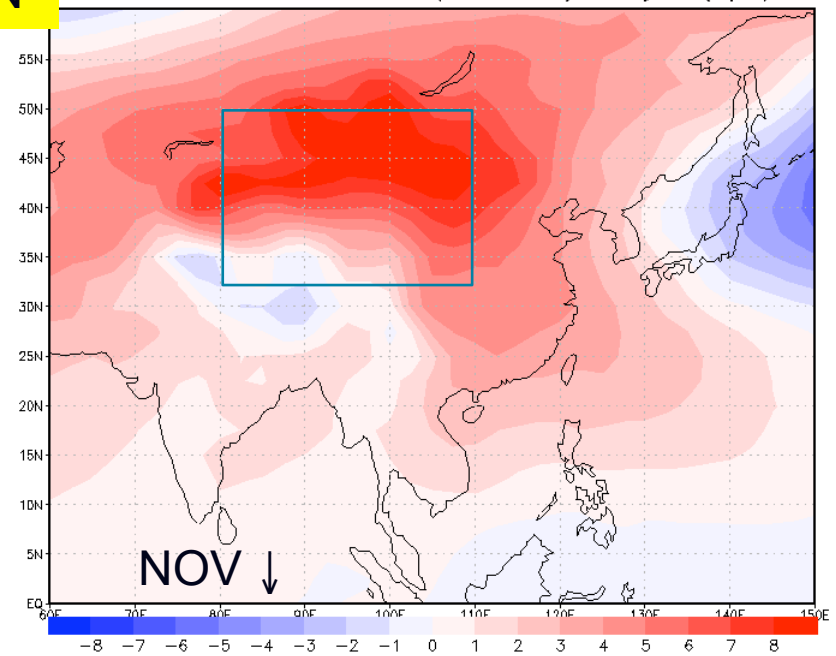
$$\Delta = D - N$$

SMH Nov above normal (Dec–Nov) 30yr (hpa)

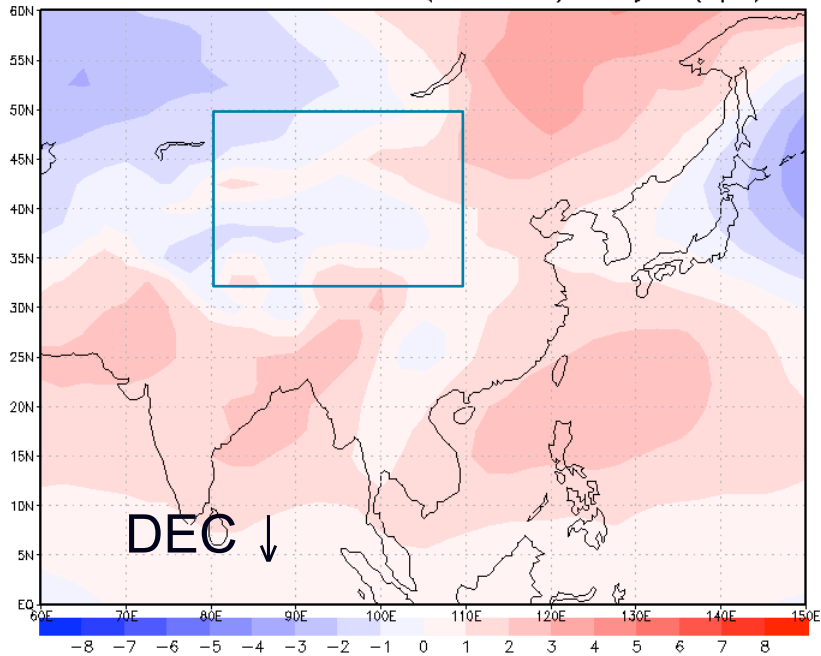


$\Delta = D - N$

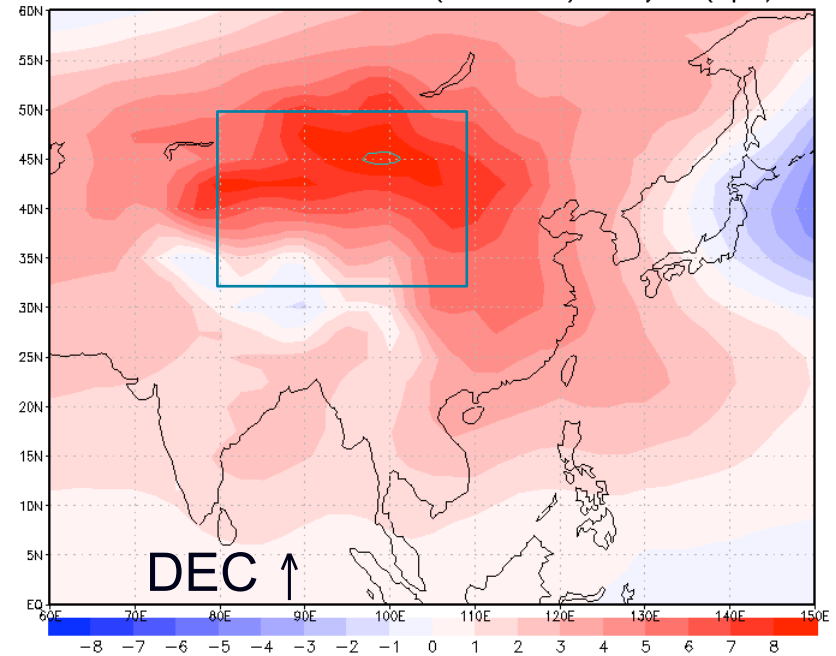
SMH Nov below normal (Dec–Nov) 30yr (hpa)



SMH Dec below normal (Dec–Nov) 30yr (hpa)



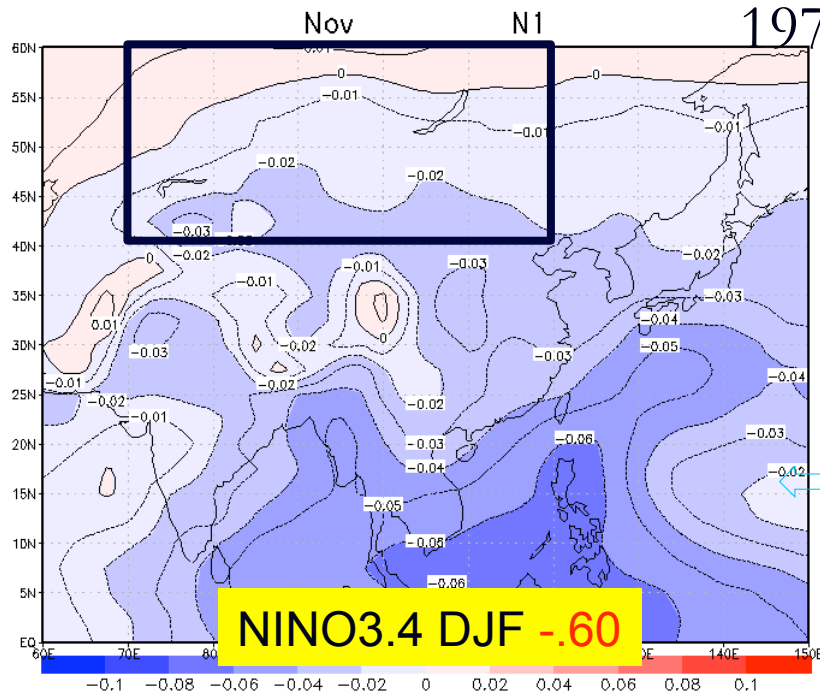
SMH Dec above normal (Dec–Nov) 30yr (hpa)



SVD of SLP

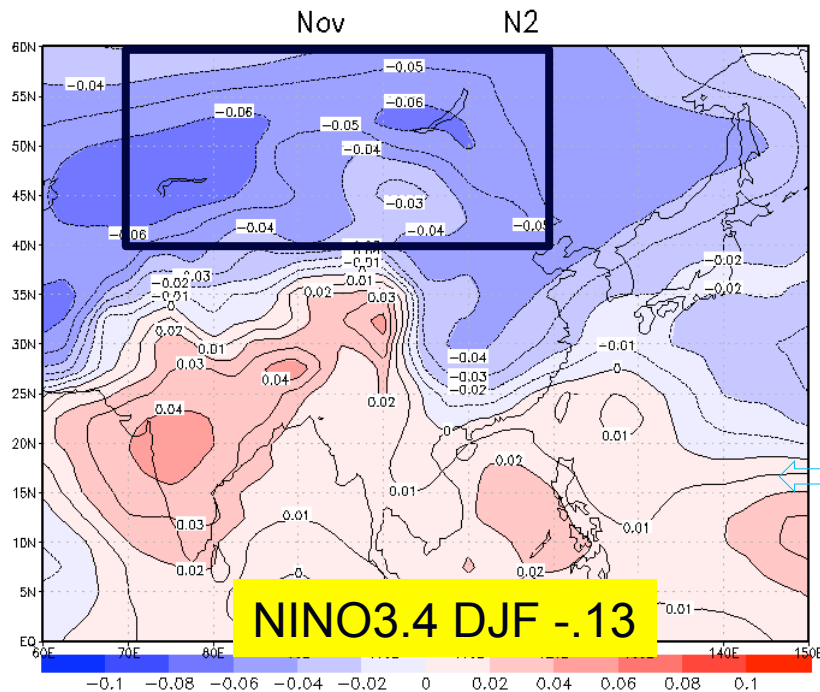
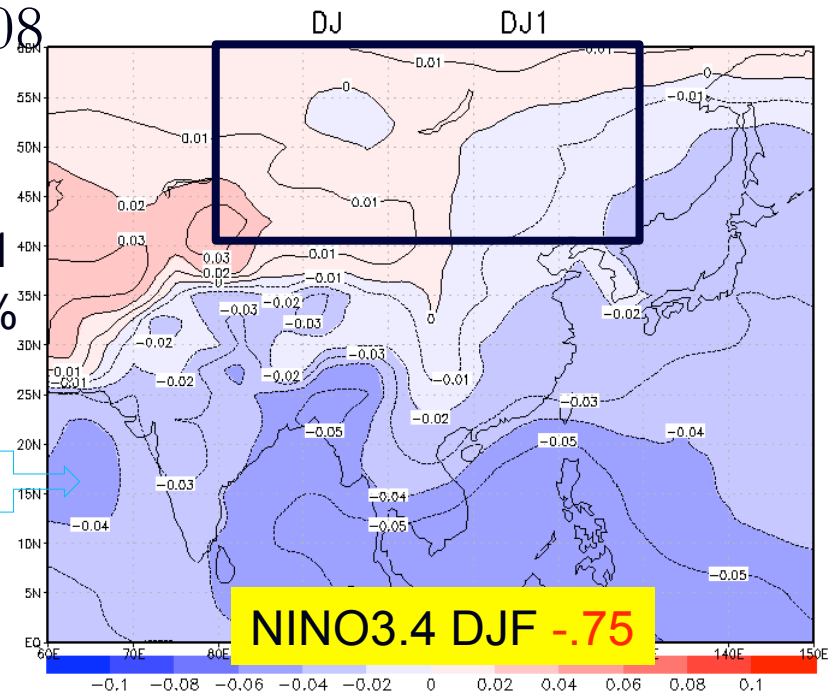
NOV versus $(\text{DEC} + \text{JAN})/2$

1979-2008



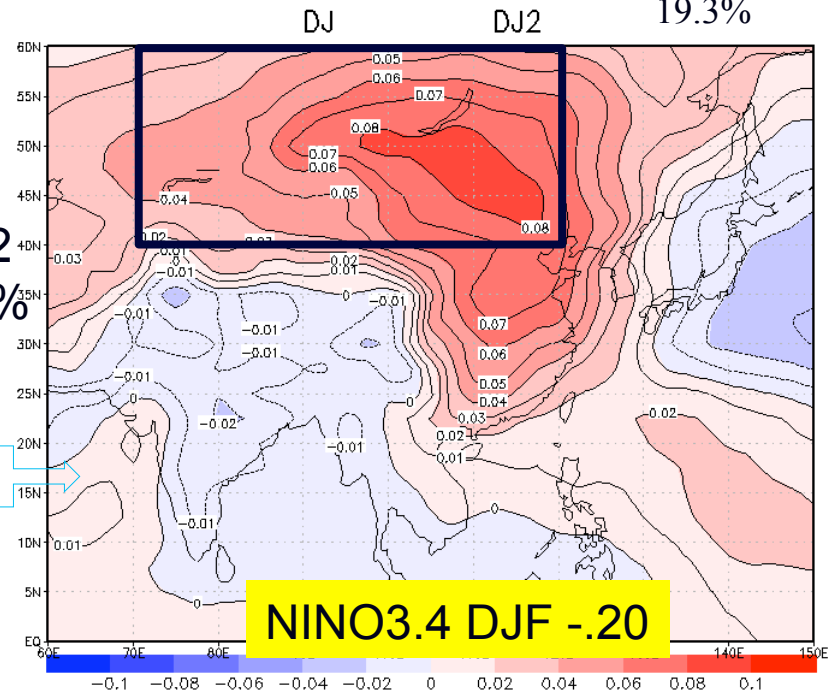
SVD1
67.9%

0.681



SVD2
19.3%

0.594



SH (40N-60N,70E-120E)

1958-2008

58-08	Nov	Dec	Jan	Feb
Nov	1			
Dec	-0.05	1		
Jan	-0.09	0.03	1	
Feb	-0.12	-0.12	0.19	1
DJ	-0.09	0.76	0.67	0.04

1958-1978

58-78	Nov	Dec	Jan	Feb
Nov	1			
Dec	0.21	1		
Jan	0.23	0.06	1	
Feb	-0.10	-0.31	0.07	1
DJ	0.31	0.76	0.70	-0.18

1979-2008

79-08	Nov	Dec	Jan	Feb
Nov	1			
Dec	-0.30	1		
Jan	-0.42	-0.02	1	
Feb	-0.12	0.05	0.31	1
DJ	-0.51	0.75	0.65	0.24

1958-2008

	Nov	Dec	Jan	Feb	Mar
NDJ	0.45	0.65	0.56	-0.03	-0.21
DJF	-0.14	0.50	0.63	0.66	-0.05
JFM	-0.21	-0.11	0.60	0.76	0.46

1958-1978

	Nov	Dec	Jan	Feb	Mar
NDJ	0.68	0.68	0.64	-0.18	-0.26
DJF	0.20	0.45	0.65	0.52	-0.10
JFM	-0.16	-0.19	0.57	0.69	0.41

1979-2008

	Nov	Dec	Jan	Feb	Mar
NDJ	0.12	0.65	0.44	0.20	-0.13
DJF	-0.41	0.53	0.62	0.76	0.05
JFM	-0.26	-0.05	0.64	0.83	0.53

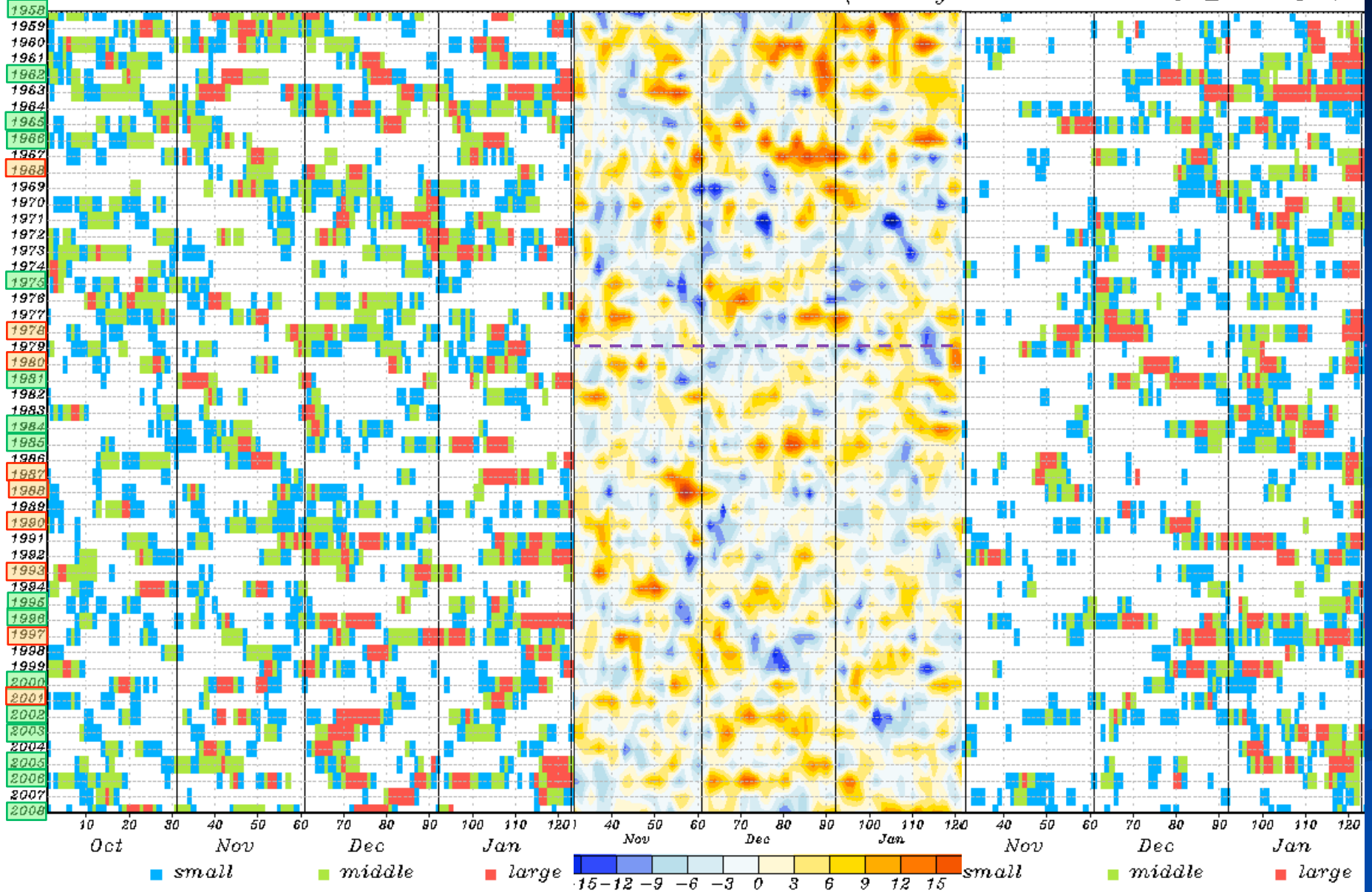
Possible Mechanisms?

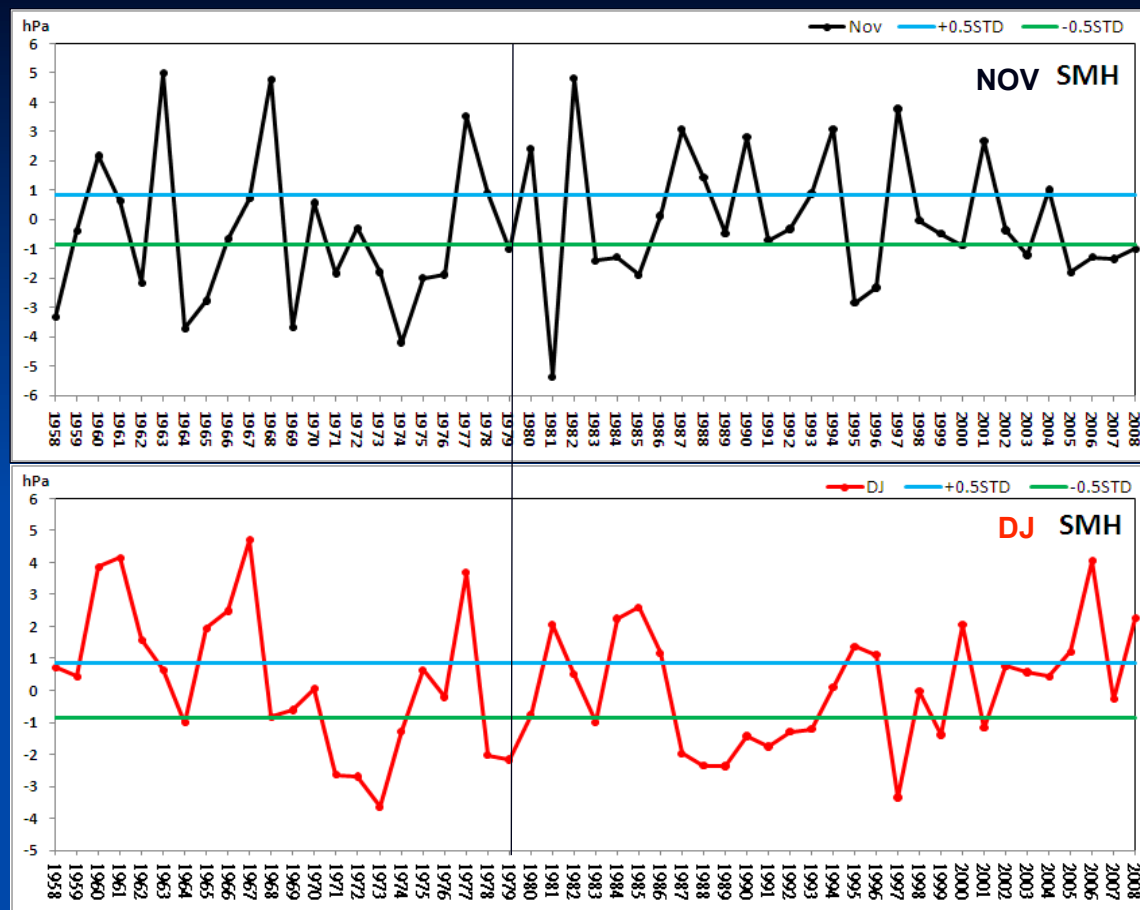
- ENSO - No
- Snow Cover/Depth - No
- NAO/AO - No
- AO phase?
 - Earlier decades (58-08) AO cold phase: more blocking
 - Recent decades (79-08) AO warm phase: less blocking
 - Warm phase also has lower amplitude of intra-seasonal variability (Gong and Ho 2004)
 - If blocking develops early it tends to be less likely to develop later, and vice versa?

Atlantic_blocking (1)

SMH (anomaly)

Pacific_blocking (19





1958-1978 (21y)

1979-2008 (30y)

Nov- /DJ+

1958, 1962, 1965,
1966, 1975

1981, 1984, 1985, 1995, 1996,
2000, 2002, 2003, 2005, 2006,
2008

Nov+ /DJ-

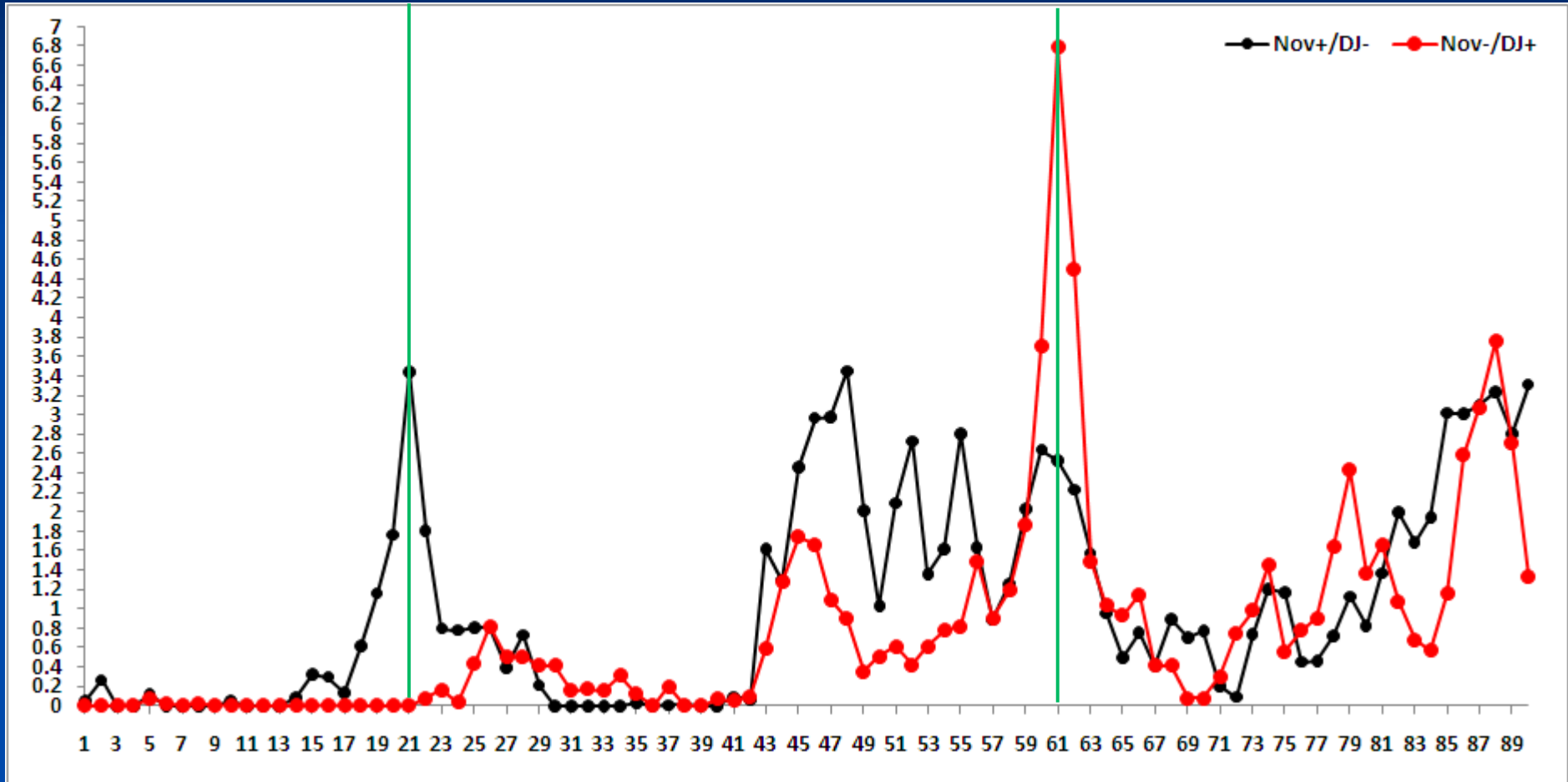
1968, 1978

1980, 1987, 1988, 1990, 1993,
1997, 2001

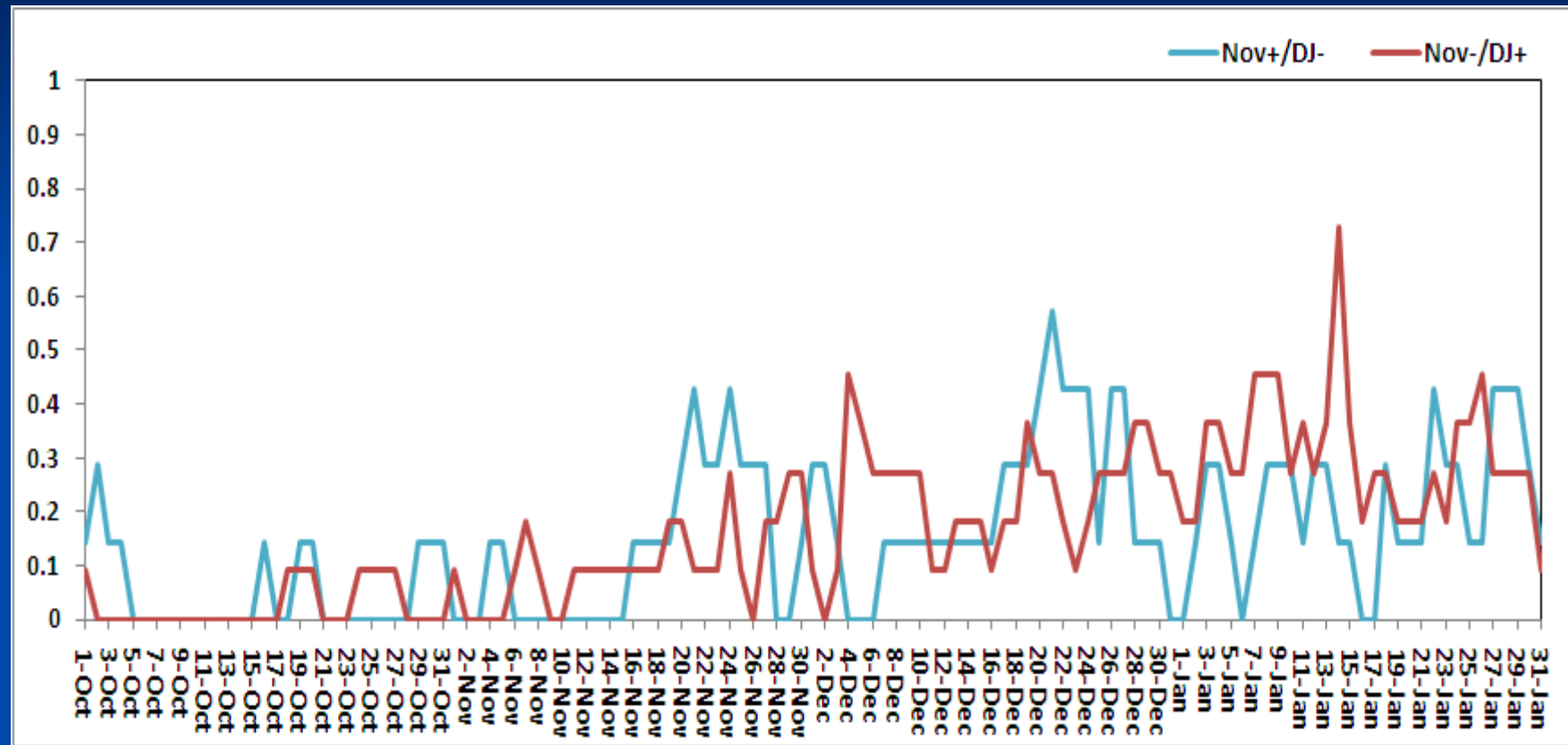
Pacific Blocking index (m/deg latitude)

Nov+ max

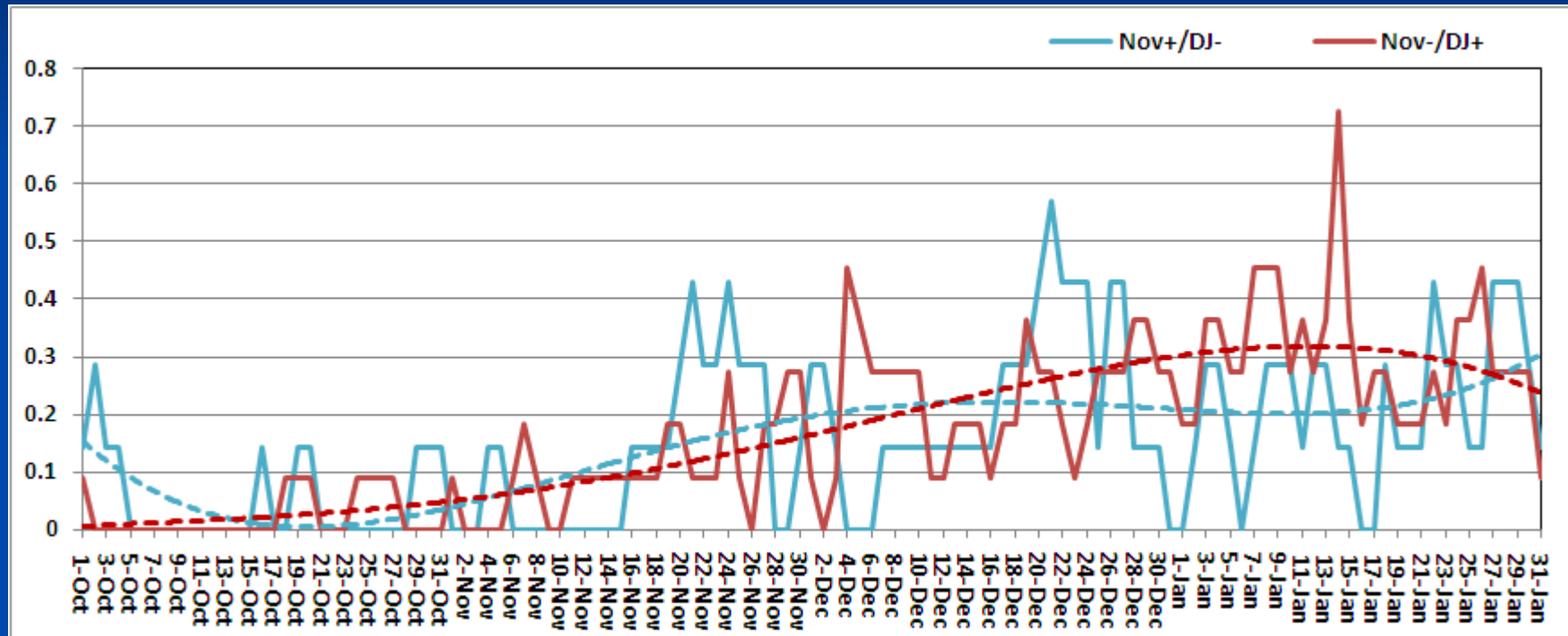
Dec+ max



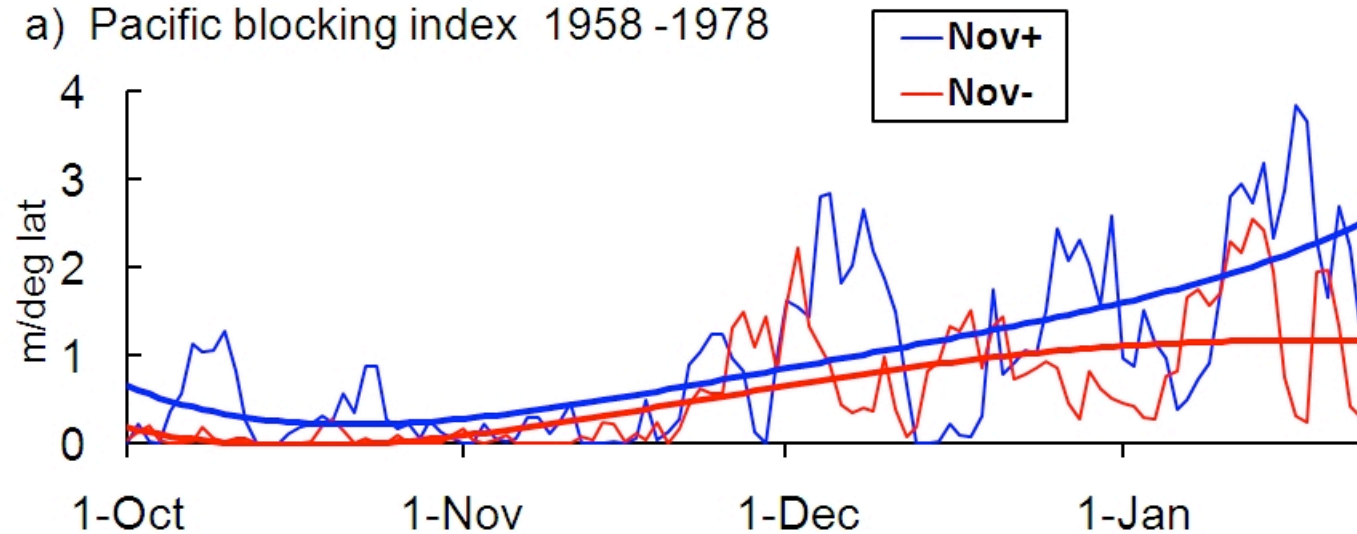
Pacific Blocking (days/year)



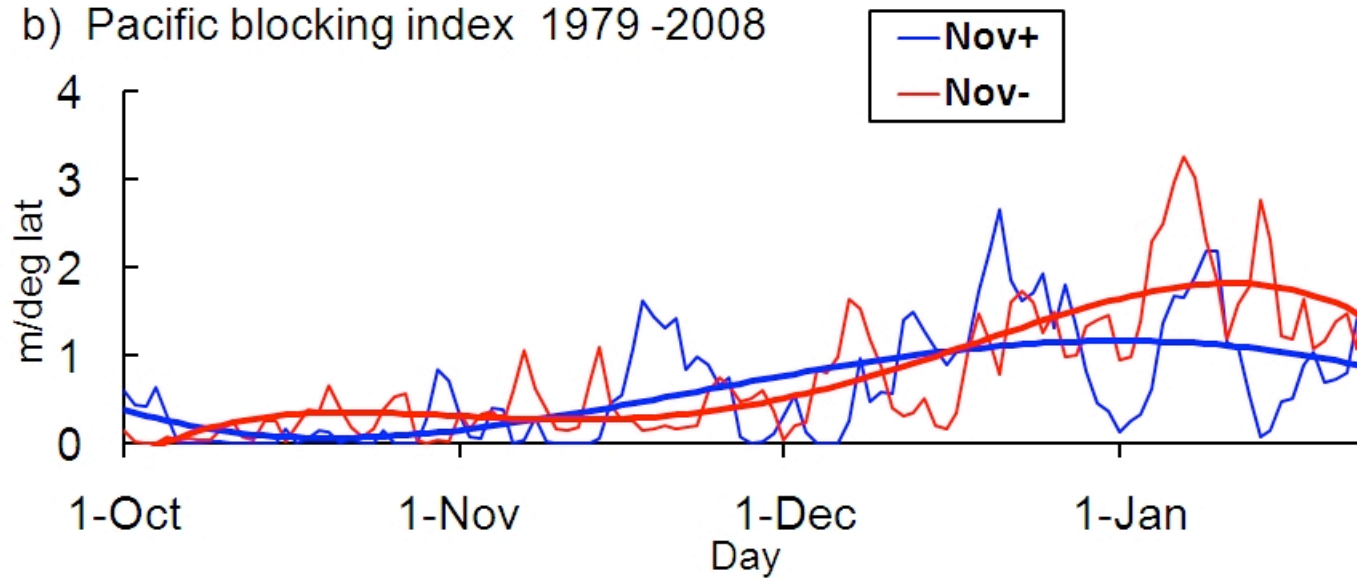
Pacific Blocking (days/year)



a a) Pacific blocking index 1958 -1978



b b) Pacific blocking index 1979 -2008



Summary

- In 1979-2008, SH anomalies tend to change sign as the season transitions from NOV to DEC & JAN.
- Effect shows up on cold surge track from eastern China and Korea southward to southern China coast.
- Shows up as SVD2 in Nov vs Dec & Jan: SVD1 is ENSO mode, SVD2 is not related to ENSO.
- Not seen in 1959-1978 – Related in part to less frequent Pacific blocking events in the more recent decades?
- Appears to be the only major circulation system where a phase reversal can be predicted from the preceding month.
- A perfect NDJ seasonal forecast will have little use for November, and may degrade December and January forecasts.

Thank You!