

Tropical Forcing of North Pacific
Decadal and Interdecadal Variability
Explored Using a GCM Ensemble

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Special thanks to

Michael Alexander

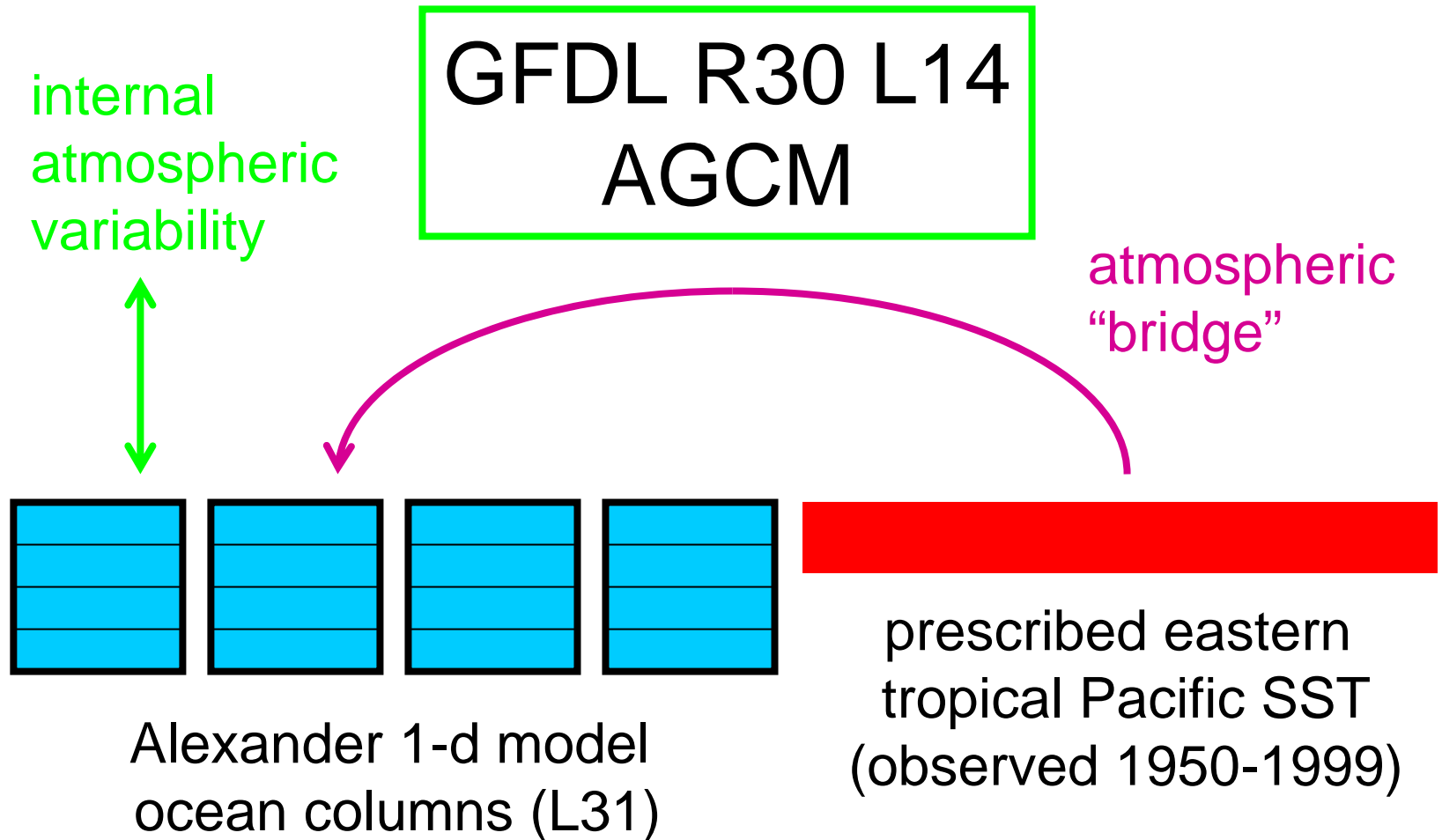
John Lanzante

Ngar-Cheung Lau

Basic Questions

- What role does stochastic atmospheric forcing play in decadal and interdecadal North Pacific variability?
- What role does tropical forcing play in decadal and interdecadal North Pacific variability?
- Are midlatitude ocean dynamics or a midlatitude coupled atmosphere-ocean mode (e.g., Latif and Barnett 1996) required for oscillatory features in North Pacific SST?

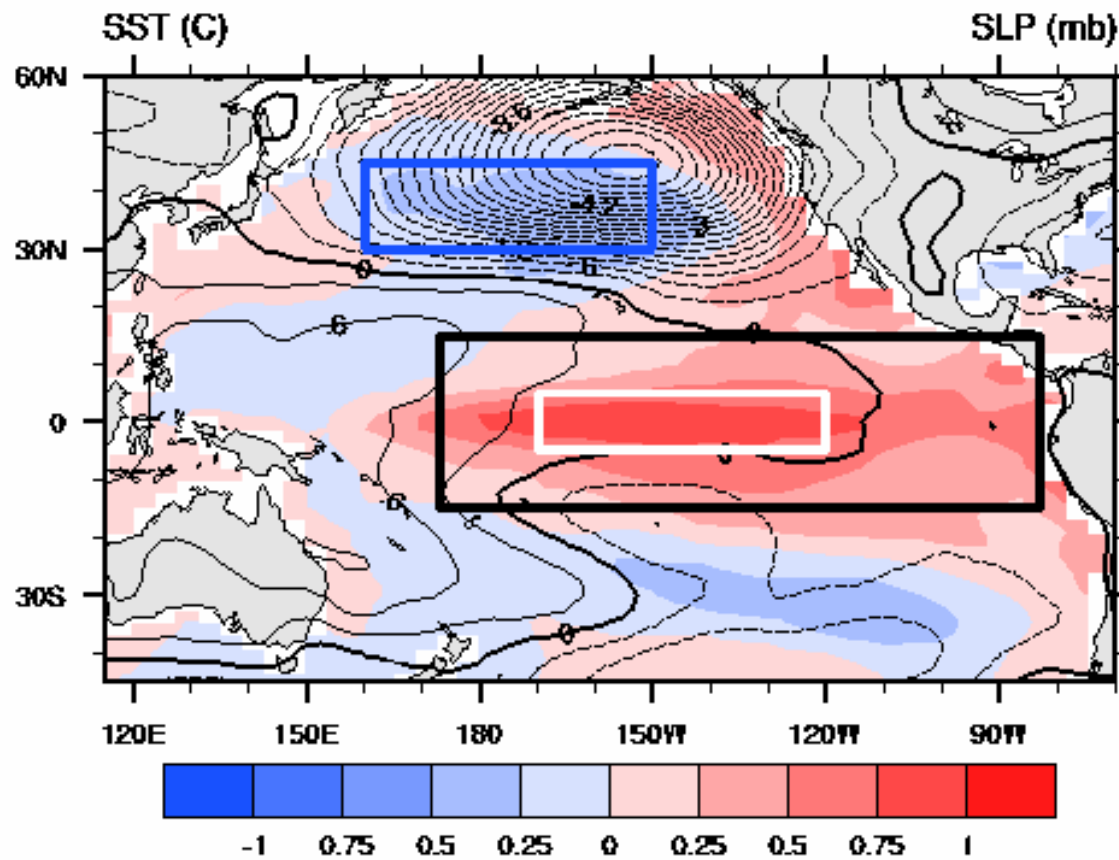
Experimental Setup



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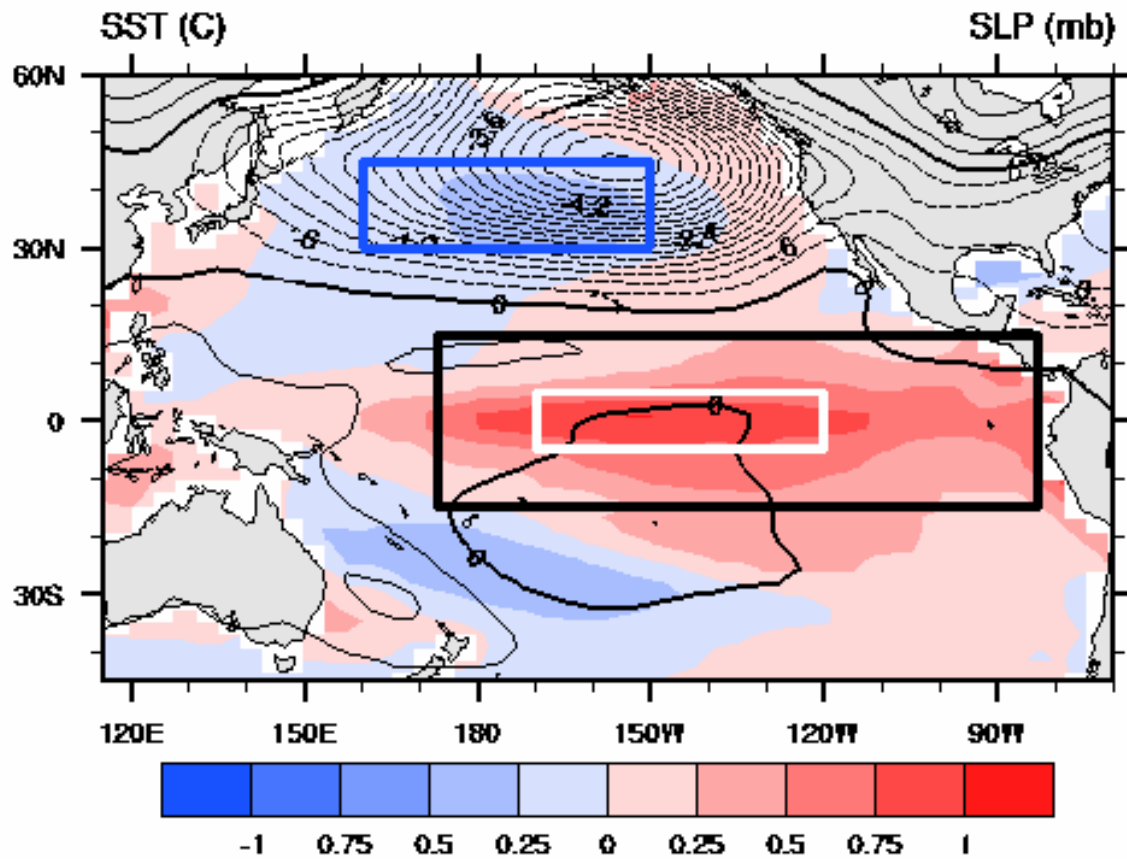
- 16 runs with ocean model globally
- 8 runs with ocean model for only North Pacific (prescribed climatological SST elsewhere)
- all runs have prescribed eastern Tropical Pacific SST (observed 1950-1999)

Observed SST EOF 1 and SLP EOF 1 (JFM 1950-1999)



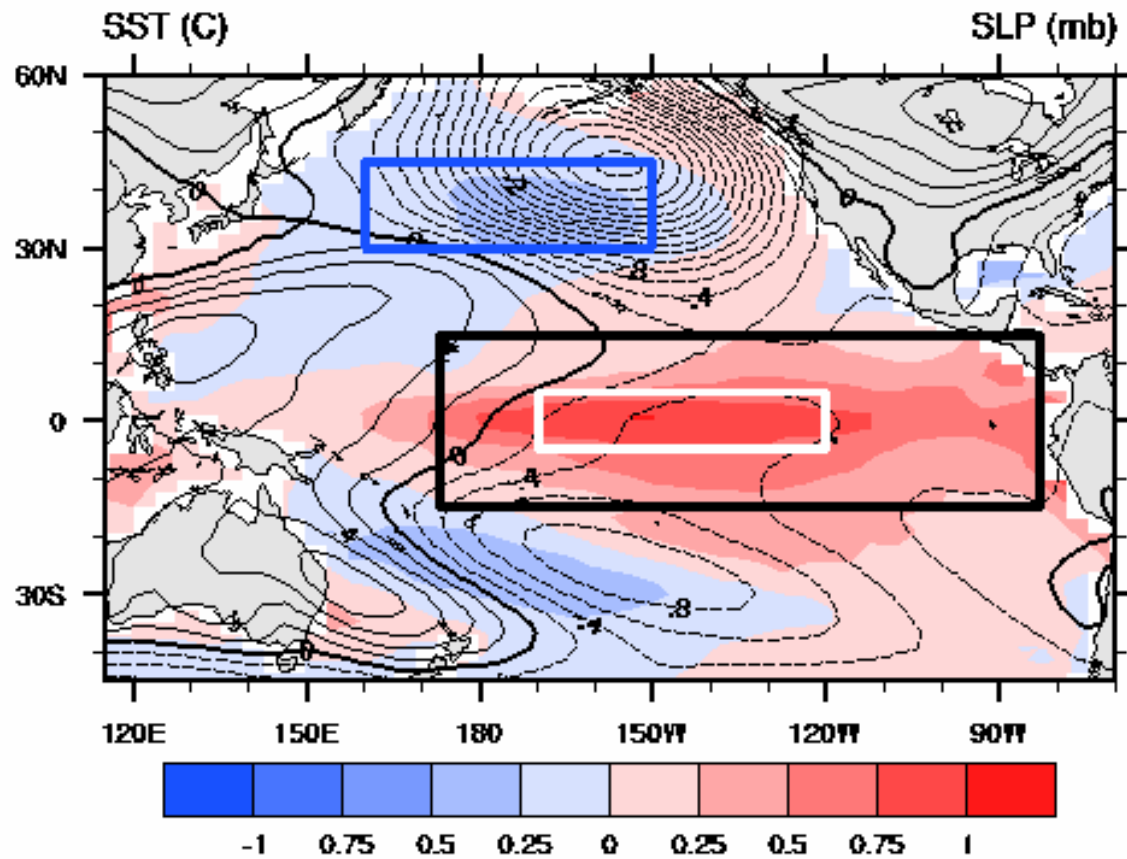
CONTOUR FROM -5.4 TO 1.2 BY .3

Model SST EOF 1 and SLP EOF 1 (JFM 1950-1999)



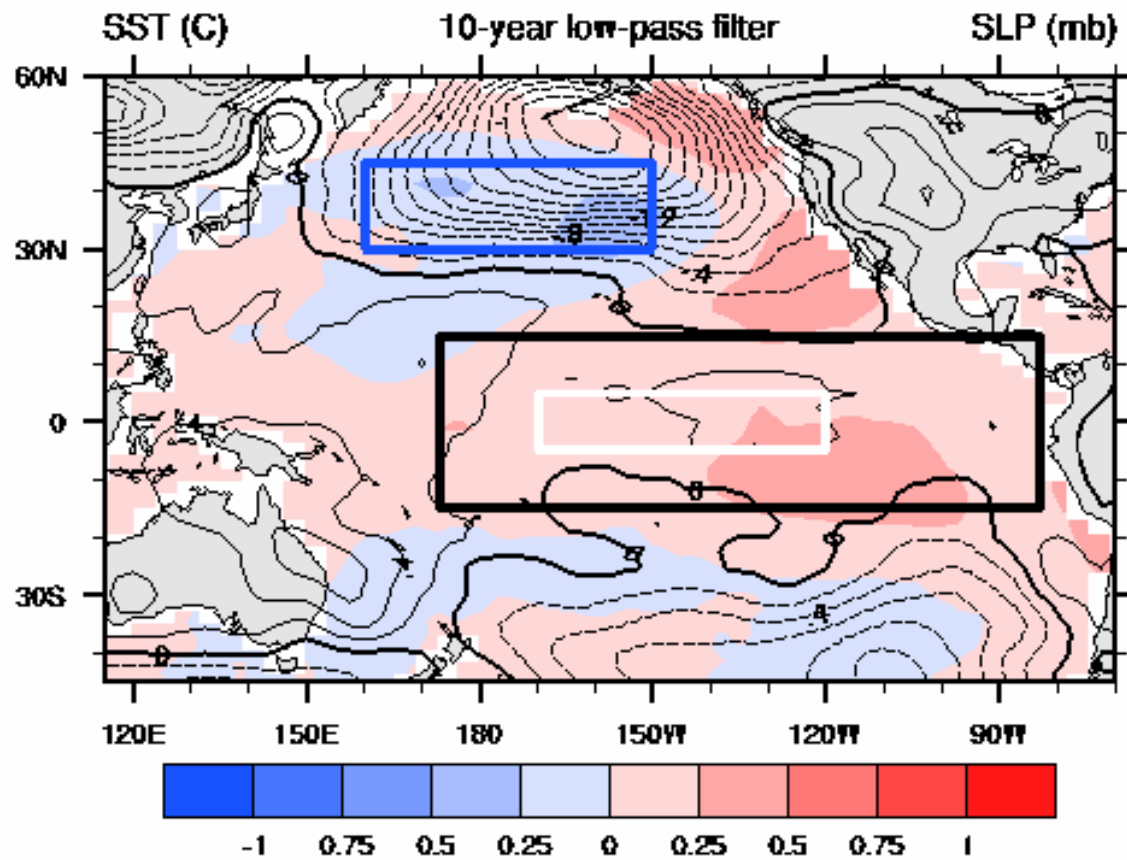
CONTOUR FROM -5.4 TO 2.1 BY .3

Model Ensemble SST EOF 1 and SLP EOF 1 (JFM 1950-1999)



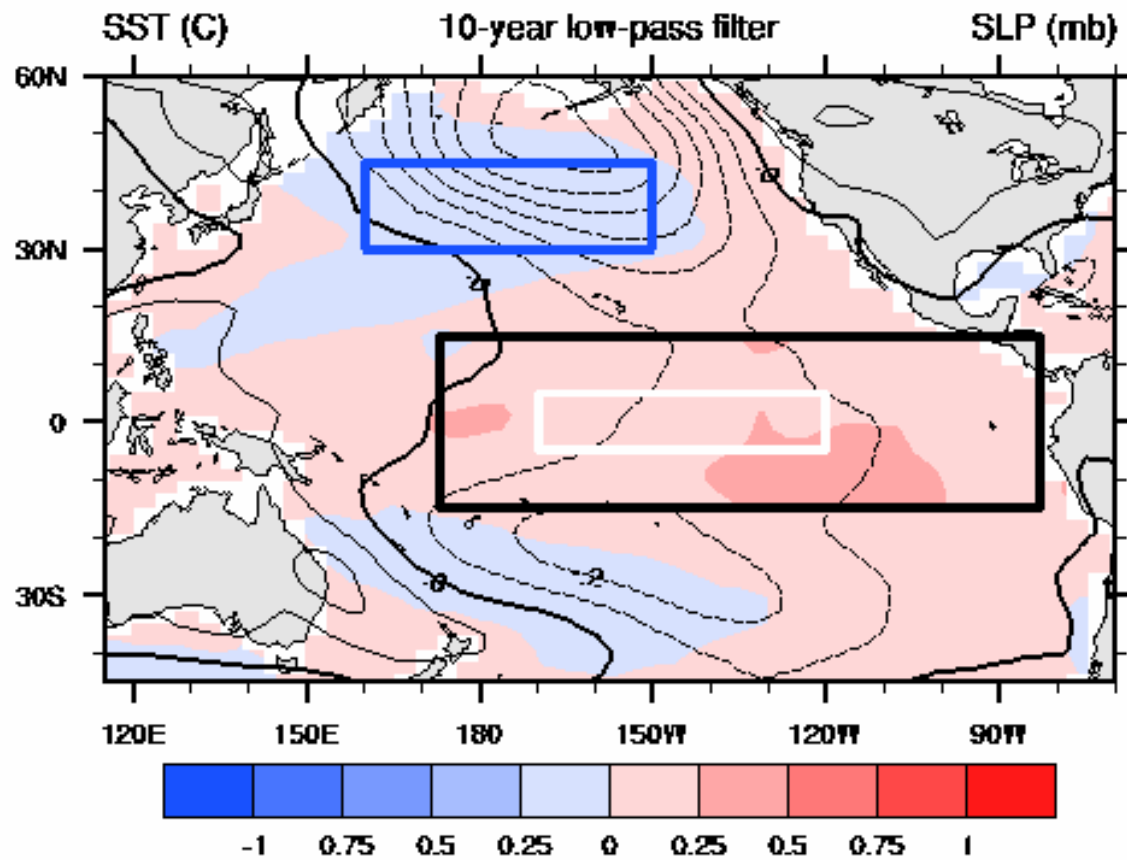
CONTOUR FROM -3 TO 1 BY 2

Observed SST EOF 1 and SLP EOF 1 (JFM 1950-1999)



CONTOUR FROM -2.4 TO 1.6 BY 2

Model Ensemble SST EOF 1 and SLP EOF 1 (JFM 1950-1999)



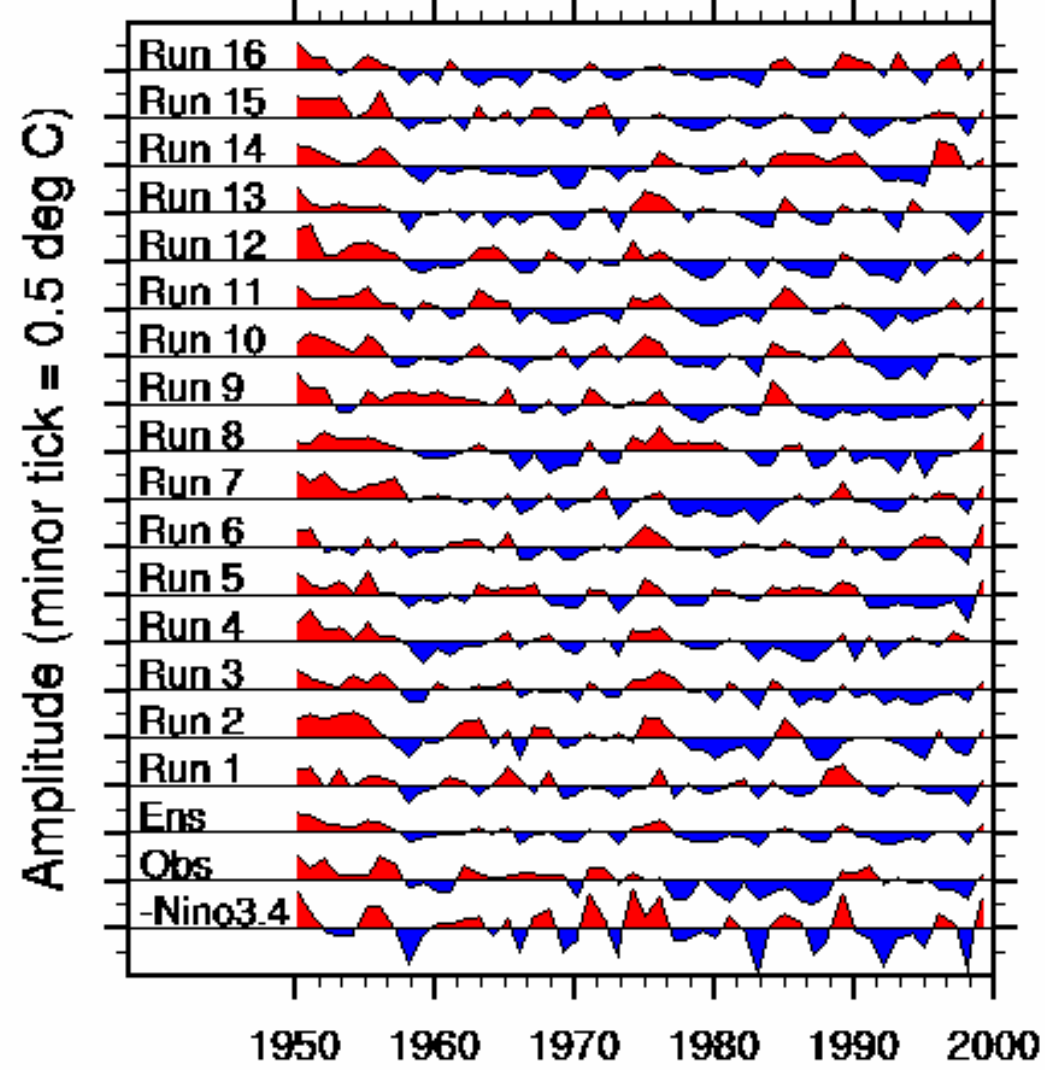
CONTOUR FROM -.6 TO .2 BY .1

Contributions to SST variability

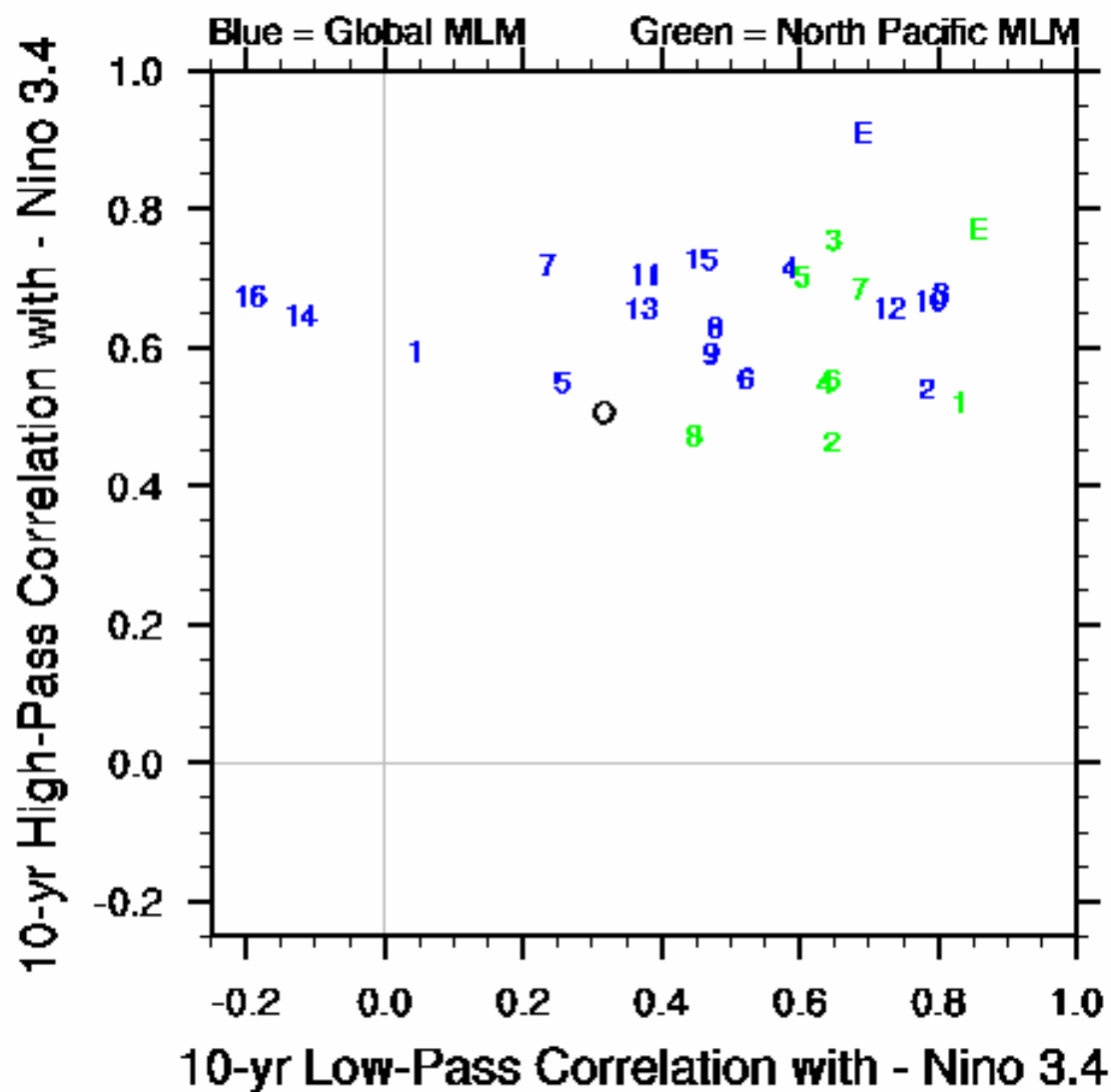
- Alexander ocean model SST due only to surface fluxes and vertical ocean processes
- This study adds estimated Ekman advection SST anomalies diagnosed from zonal wind stress anomalies, the climatological meridional SST gradient, and 3-month damping

North Pacific SST Index Time Series

Sum of SST and Ekman Advection

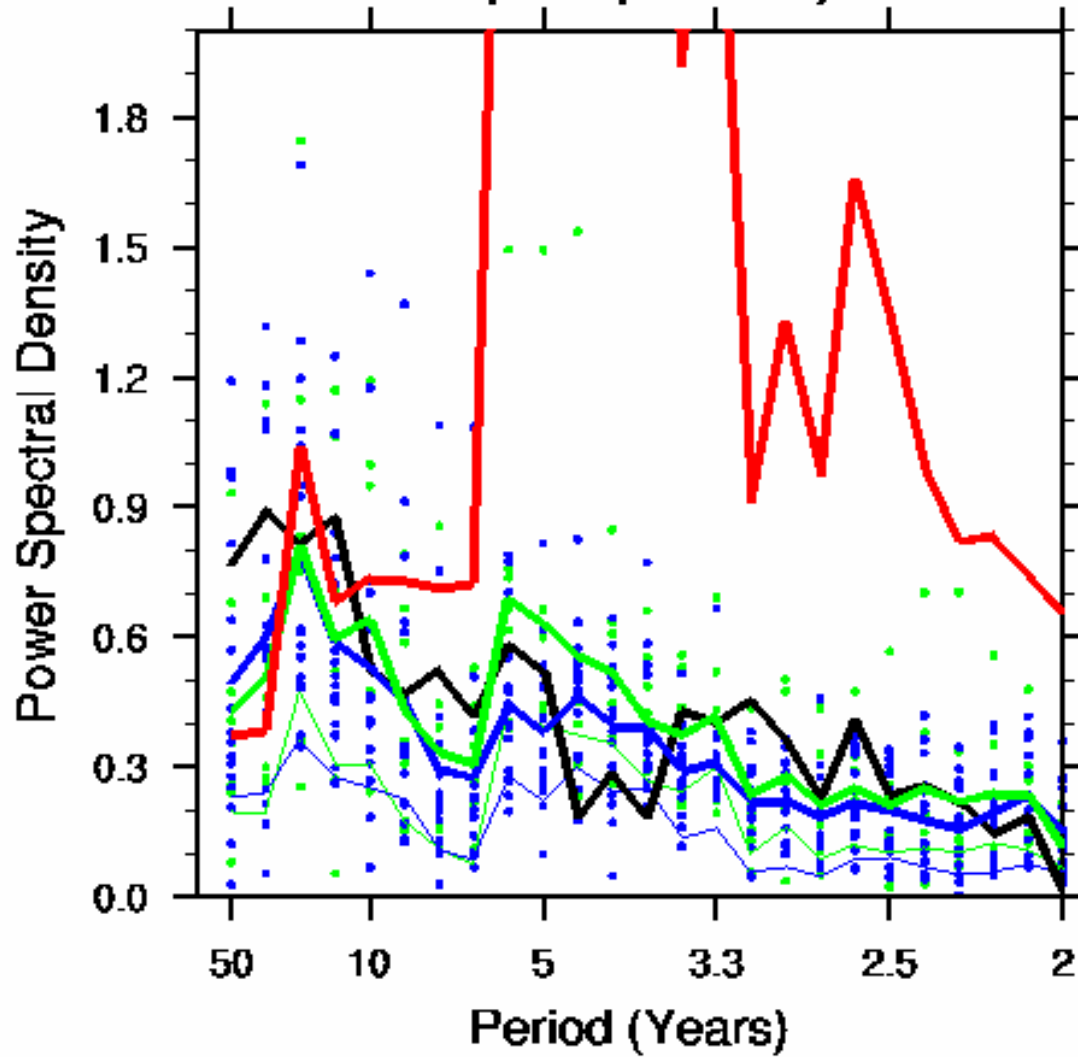


Correlation of North Pacific Index with - Nino 3.4



North Pacific SST Index Spectra

Multitapered Spectral Analysis



Conclusions

- Simulated and observed North Pacific SST variability is correlated with tropical SST on decadal and interdecadal time scales
- Coupling to midlatitude ocean dynamics is not required to produce interdecadal variability and oscillatory features in North Pacific SST
- Differences in interdecadal variability between model runs indicates that stochastic atmospheric forcing may play a substantial role in North Pacific SST evolution