

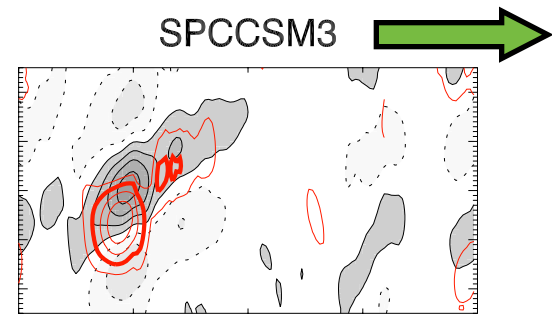
Air-Sea Interaction Diagnostics for the MJO

Charlotte DeMott

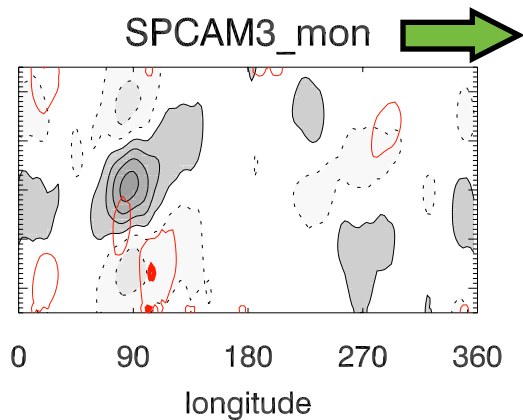
rainfall and SST lag-correlation

(lag vs longitude)

C



5d



mon

“The atmosphere does not see SST; it only senses it through surface fluxes.”--Chidong Zhang (2005)

Two Questions:

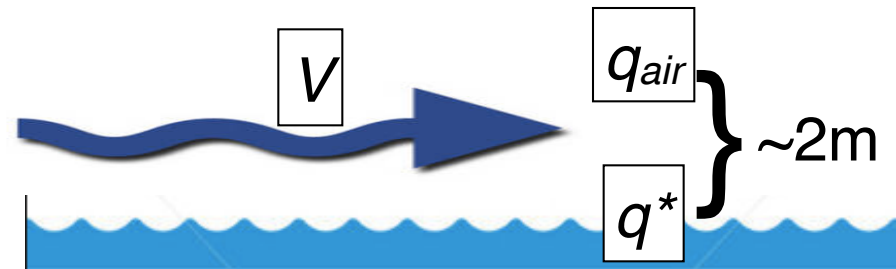
How do SSTs in the coupled system impact surface fluxes?

How does the MJO respond to the surface flux changes?

Latent Heat Flux

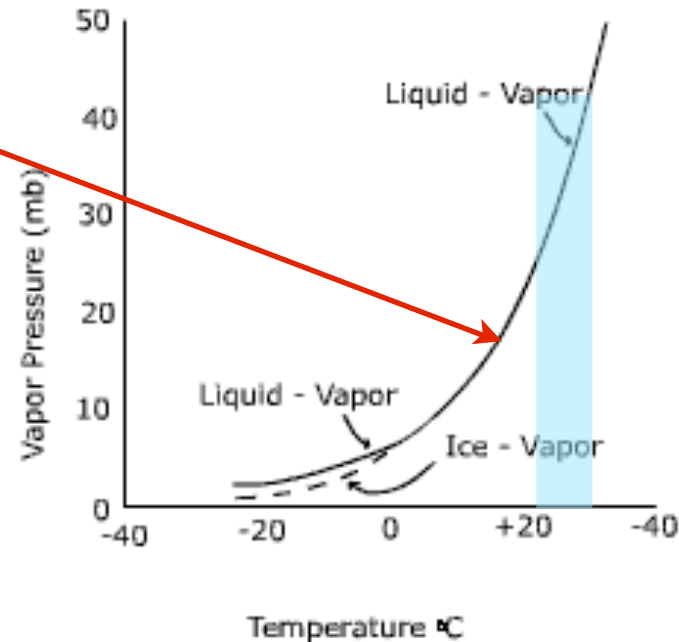
$$LH = \rho L C_H |V| (q_{SST}^* - q_{air})$$

$$\Delta q = (q_{SST}^* - q_{air})$$



$$w_s \cong 0.622 \frac{e_s}{p}$$

$$q^* = \frac{w_s}{w_s + 1} \approx w_s$$



LH should vary nearly linearly with wind speed and SST*

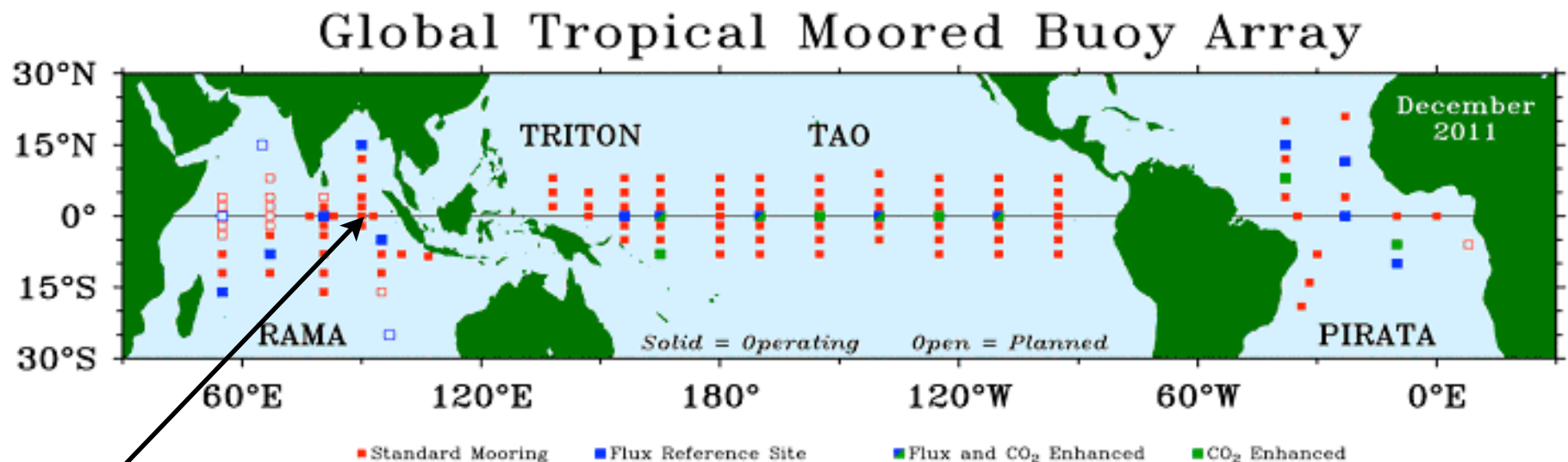
*all other things being equal...

Sensible Heat Flux

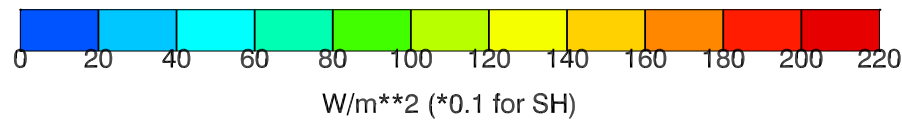
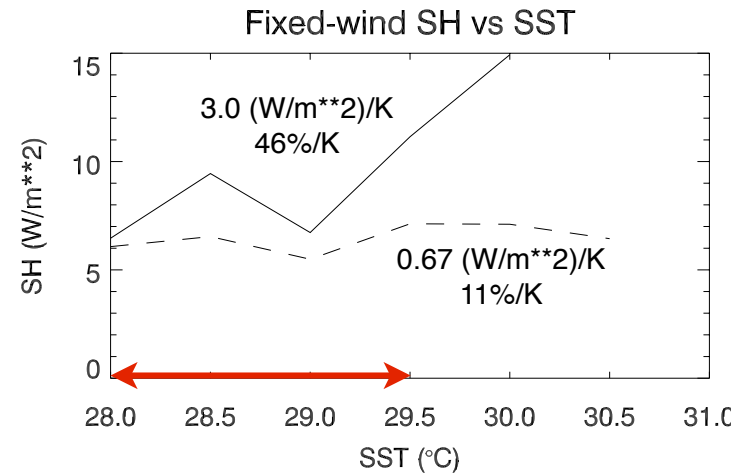
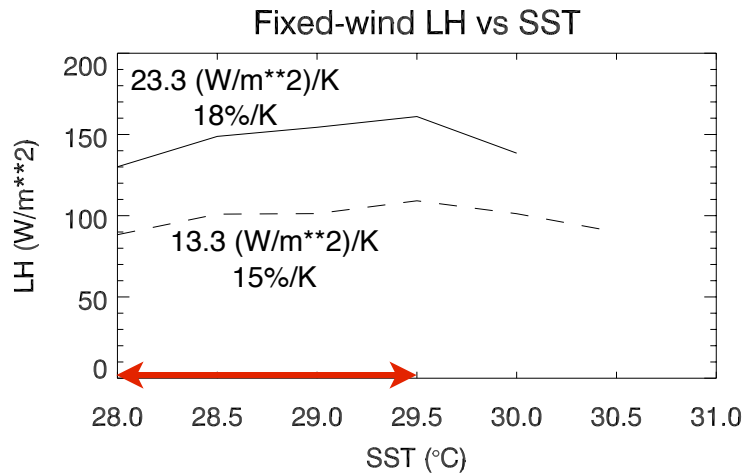
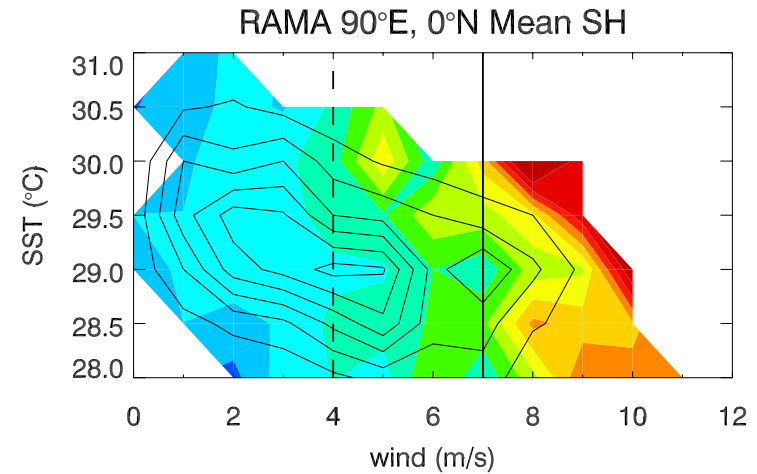
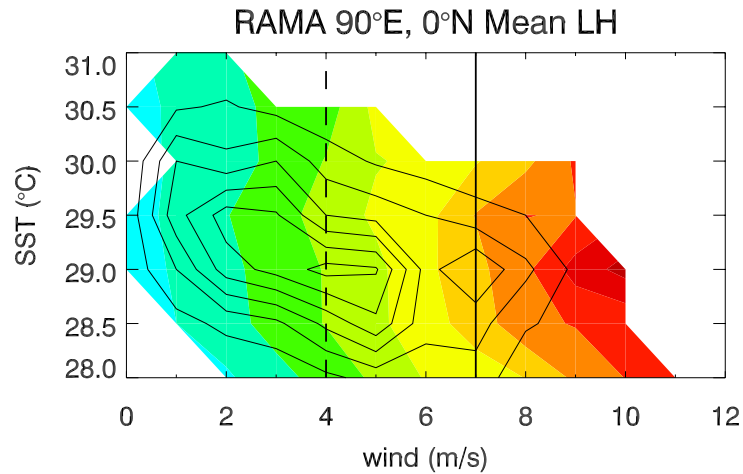
$$SH = \rho L C_H |V| (SST - T_{air})$$

$$\Delta T = (SST - T_{air})$$

SH should vary nearly linearly with wind speed and SST



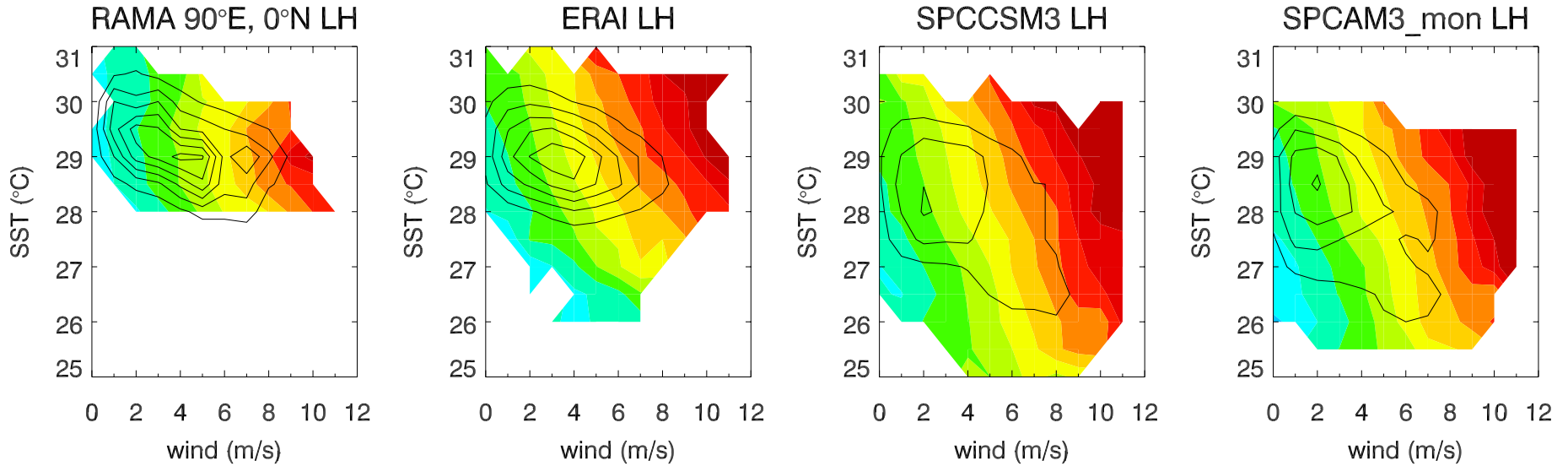
Heat Fluxes vs Wind Speed and SST



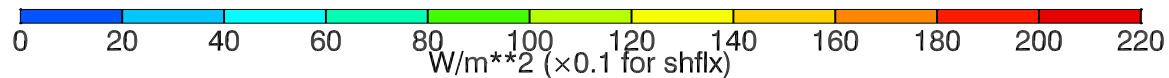
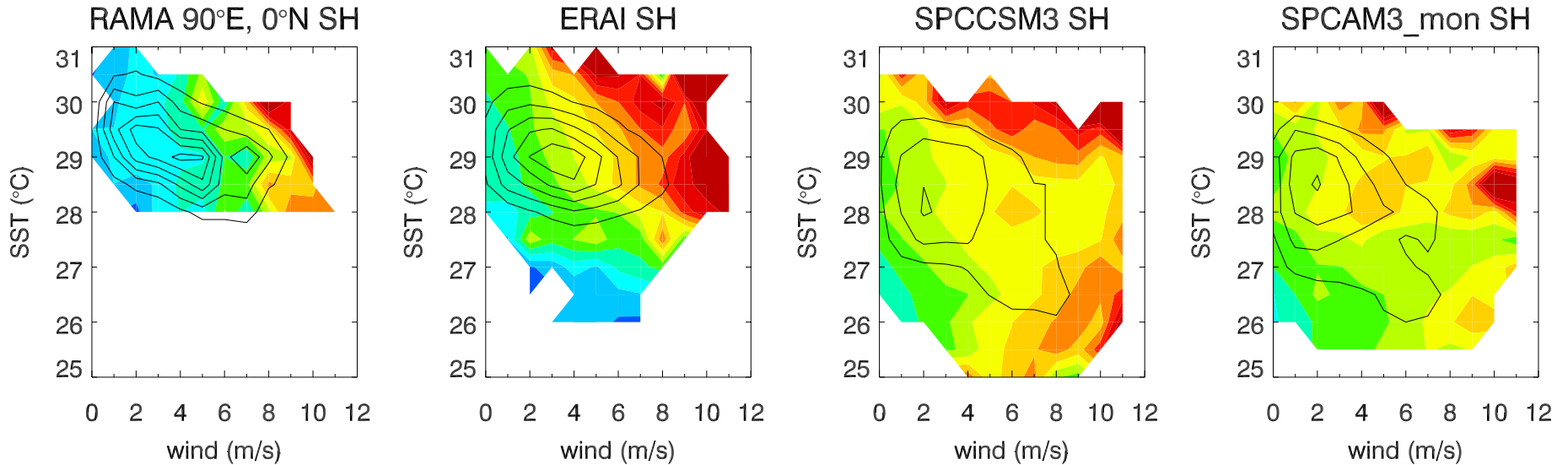
“all other things” usually aren’t equal..

Surface Fluxes vs Wind Speed and SST

LH

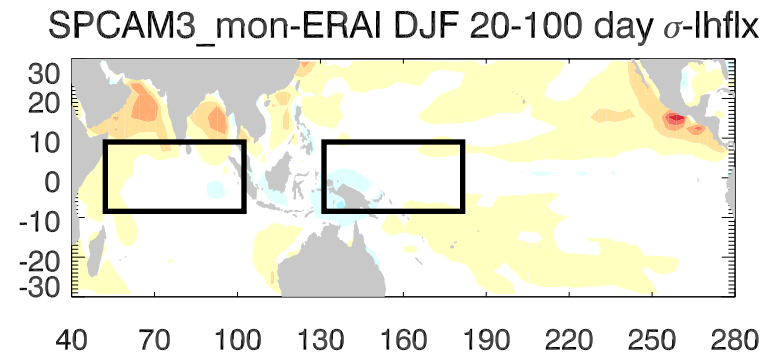
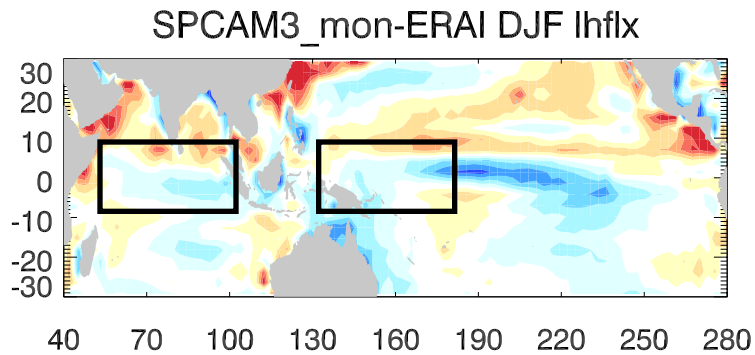
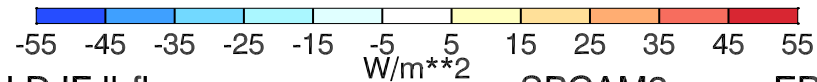
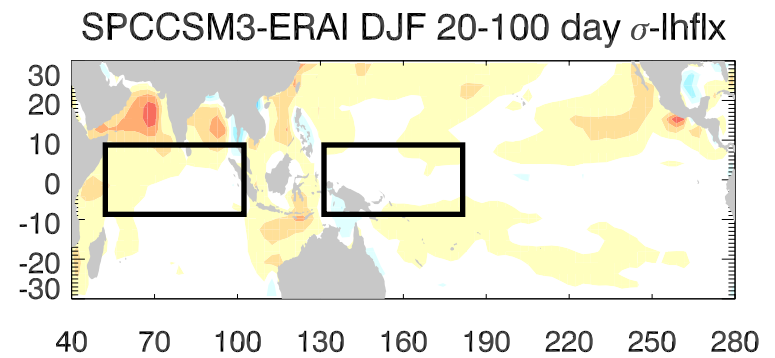
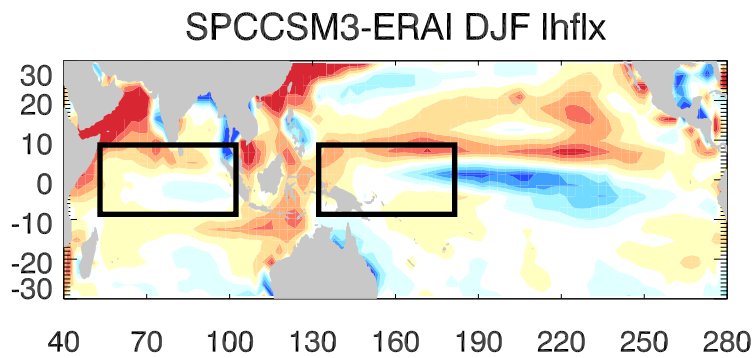
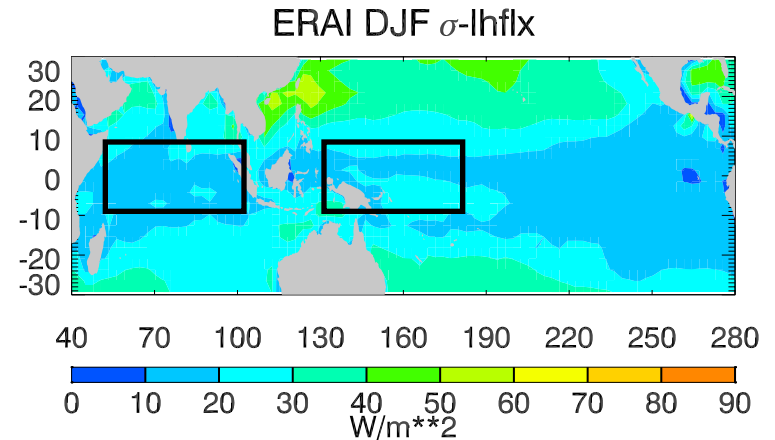
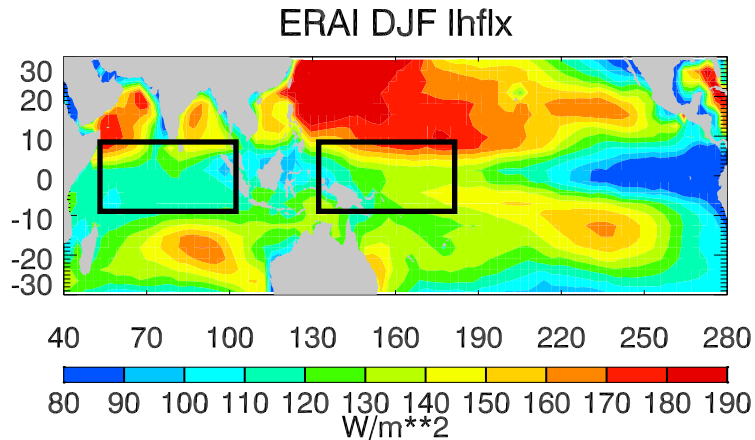


SH



“all other things” impact SH more than LH

Seasonal means and variability

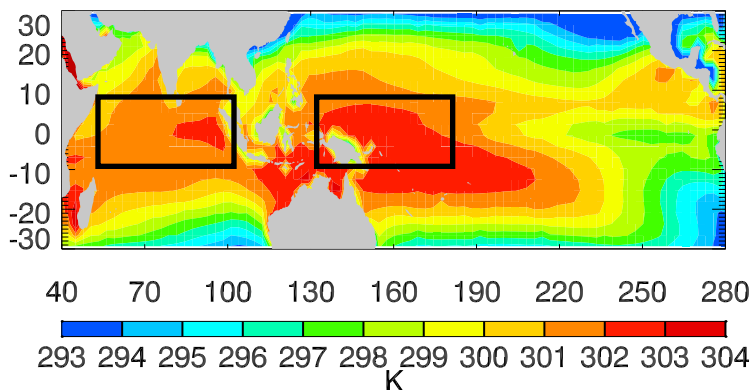


mean

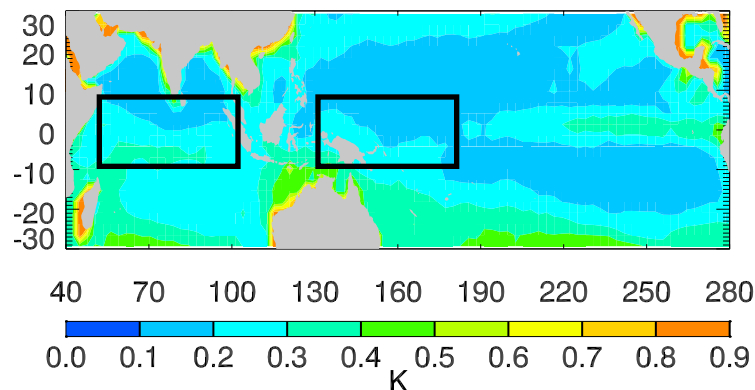
stdev

Seasonal means and variability

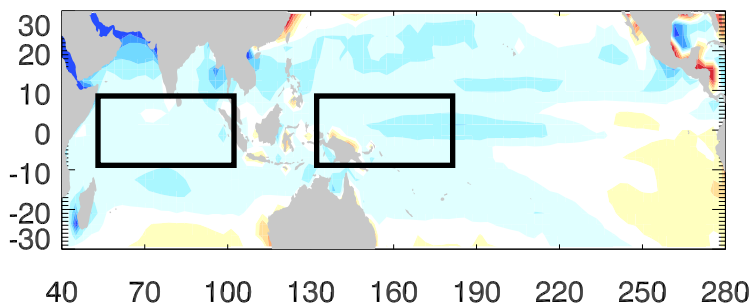
ERA-Interim (ERA-I) DJF SST



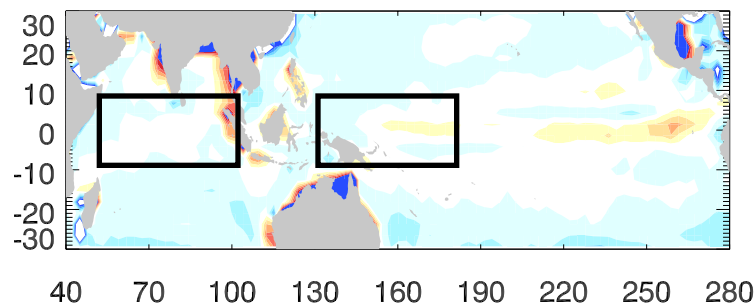
ERA-Interim (ERA-I) DJF σ -SST



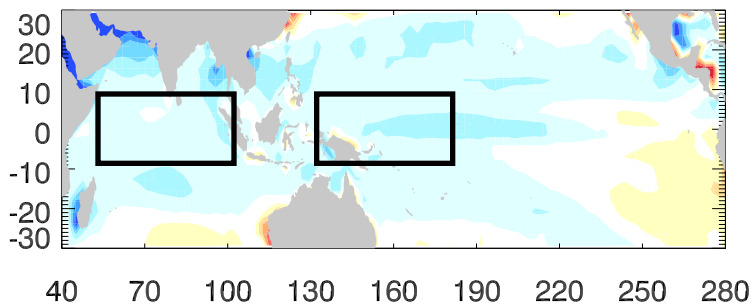
SPCCSM3-ERA-I DJF SST



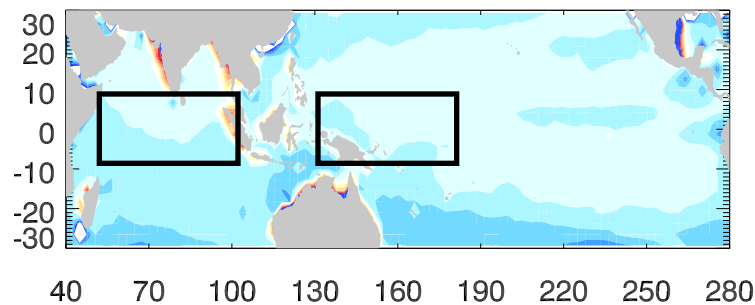
SPCCSM3-ERA-I DJF 20-100 day σ -SST



SPCAM3_mon-ERA-I DJF SST



SPCAM3_mon-ERA-I DJF 20-100 day σ -SST

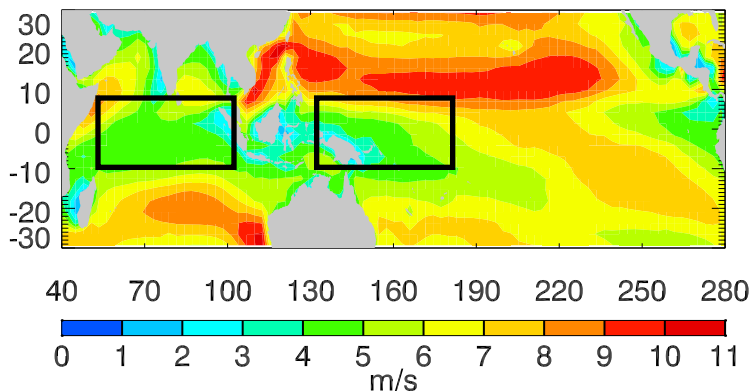


mean

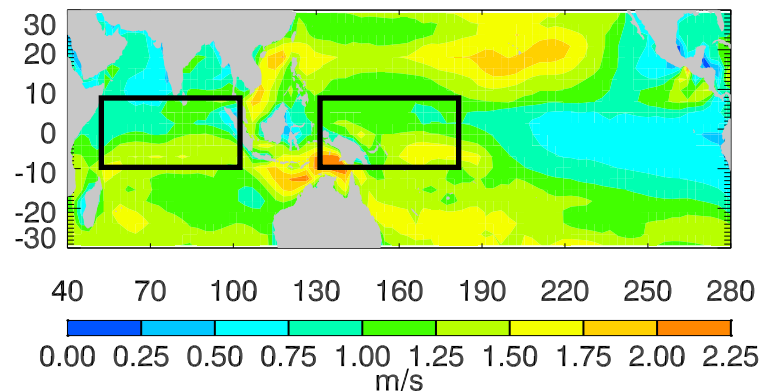
stdev

Seasonal means and variability

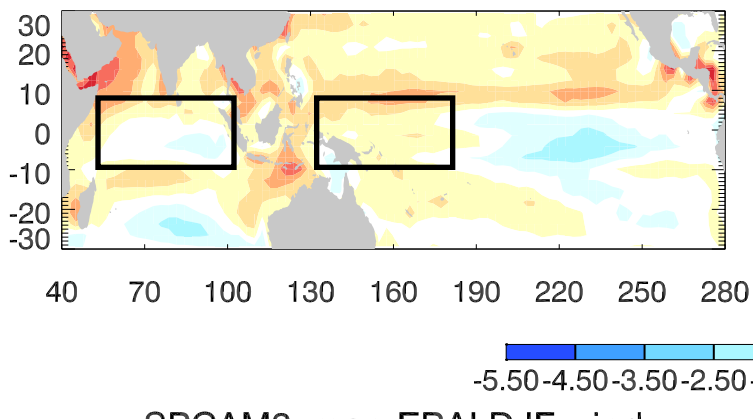
ERA-I DJF wind



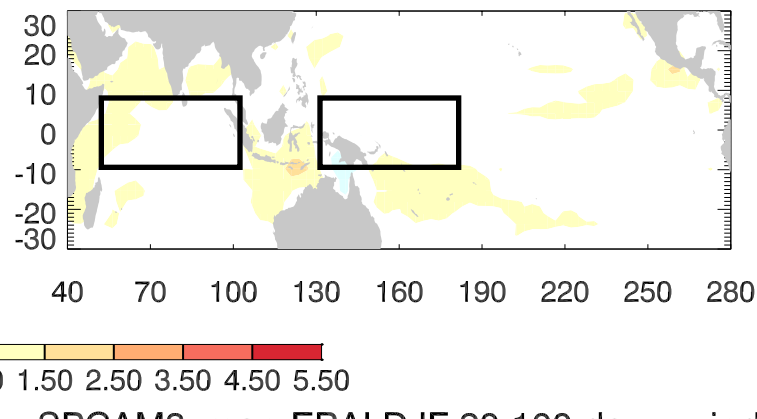
ERA-I DJF σ -wind



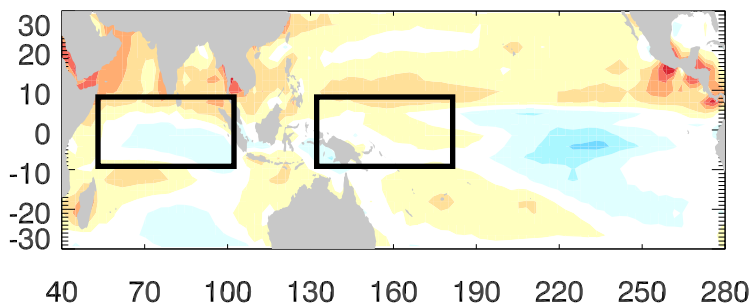
SPCCSM3-ERA-I DJF wind



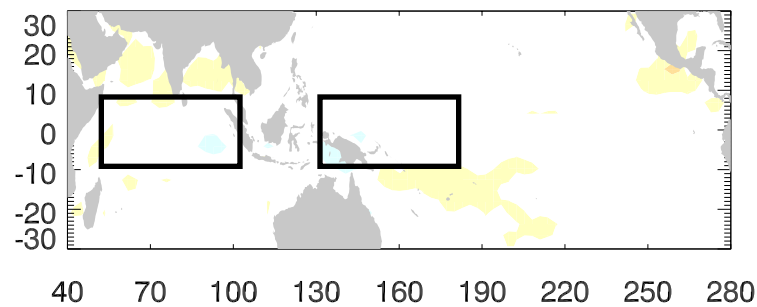
SPCCSM3-ERA-I DJF 20-100 day σ -wind



SPCAM3_mon-ERA-I DJF wind



SPCAM3_mon-ERA-I DJF 20-100 day σ -wind

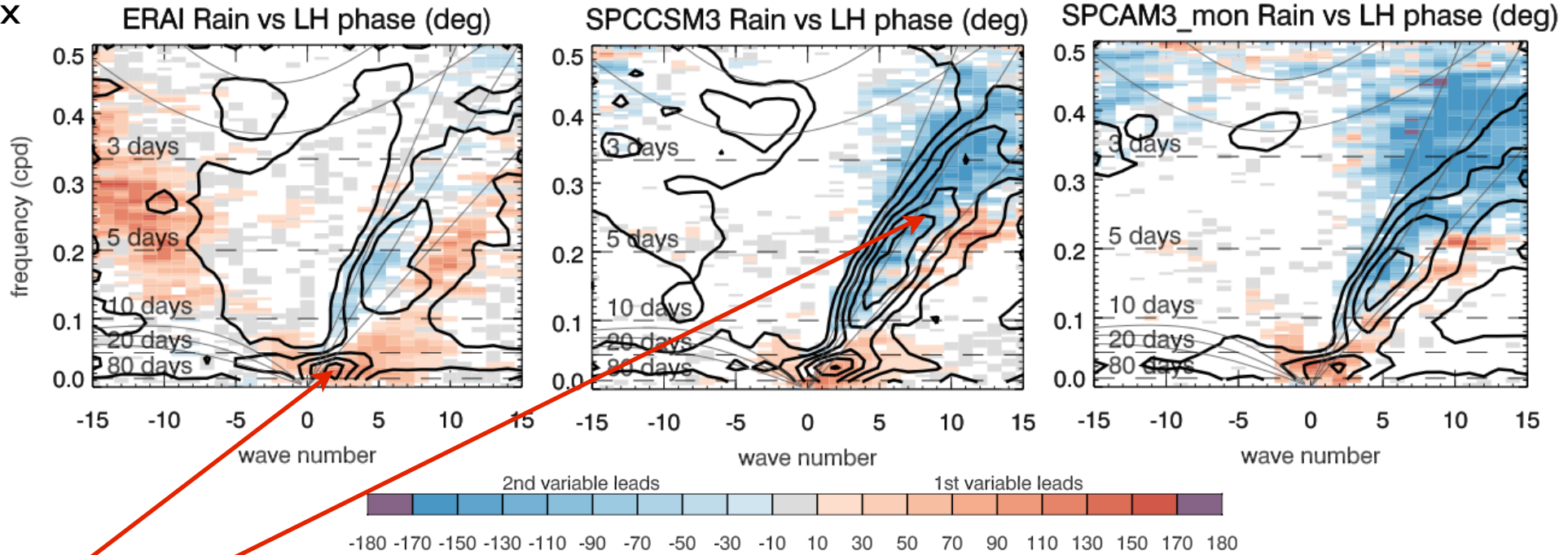


mean

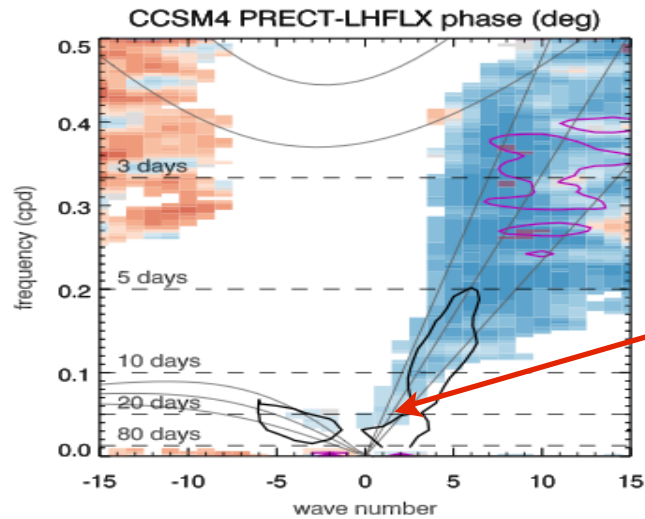
stdev

W-K phase relationships (all seasons)

P, lhflx



MJO, Kelvin waves
have opposite
rainfall-LH phase
relationship



CCSM4
intraseasonal
variance is more
Kelvin wave-like

extra slides

surface flux sensitivities

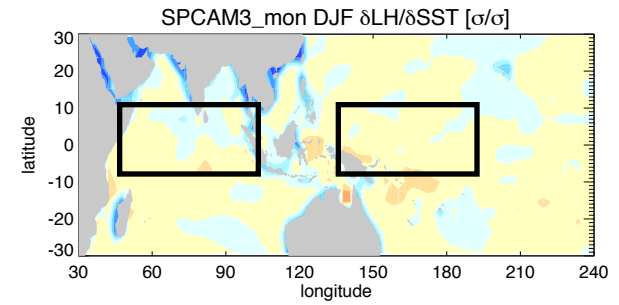
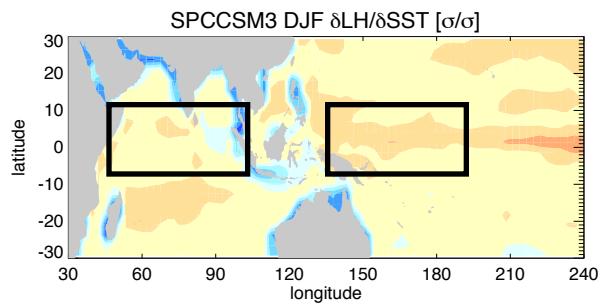
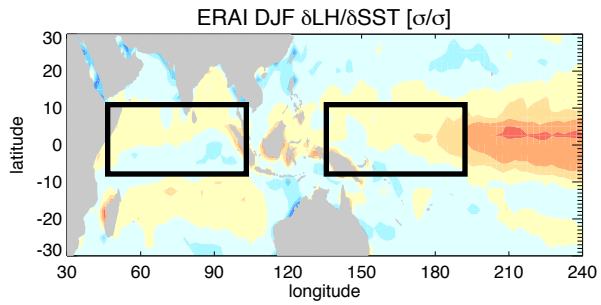
$$\text{LH}' \cong \rho L C_H (\overline{\Delta q} |V|' + \Delta q' |\overline{V}|)$$

what is the SST dependence?

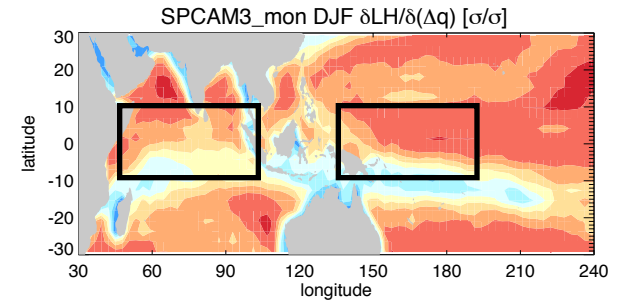
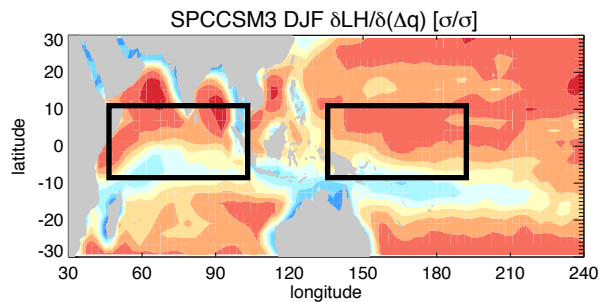
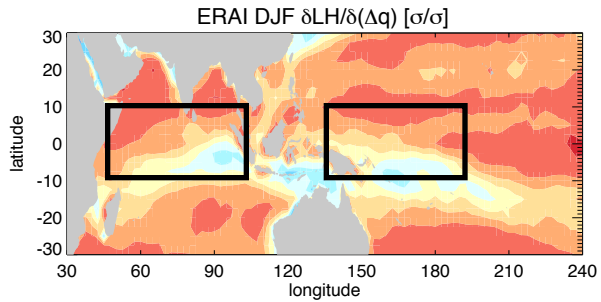
$$\frac{\partial \text{LH}}{\partial \text{SST}} \sim \frac{\partial \text{LH}}{\partial \Delta q} \frac{\partial \Delta q}{\partial \text{SST}} + \frac{\partial \text{LH}}{\partial |V|} \frac{\partial |V|}{\partial \text{SST}}$$

latent heat flux sensitivities

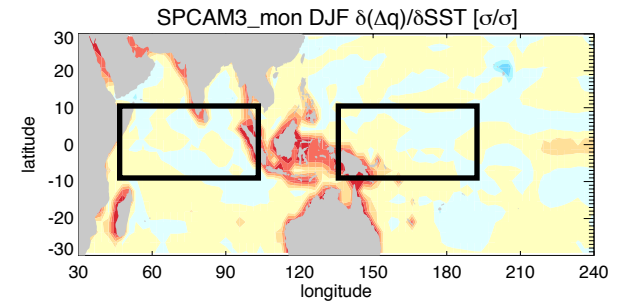
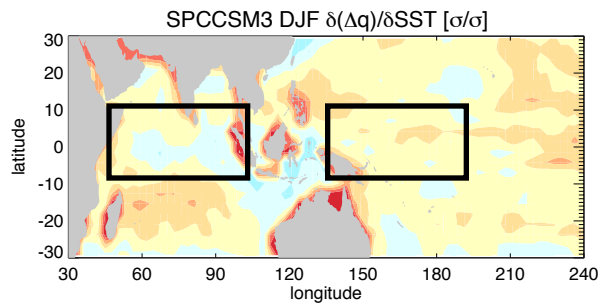
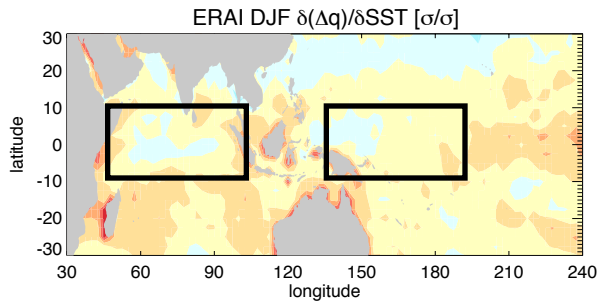
$$\frac{\partial LH}{\partial SST}$$



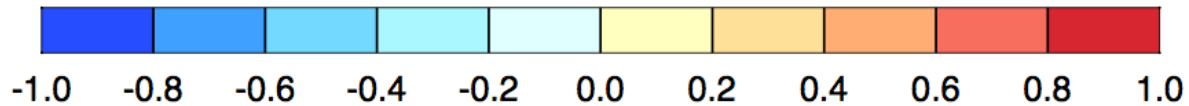
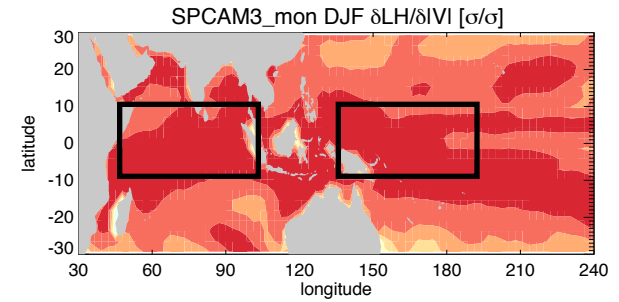
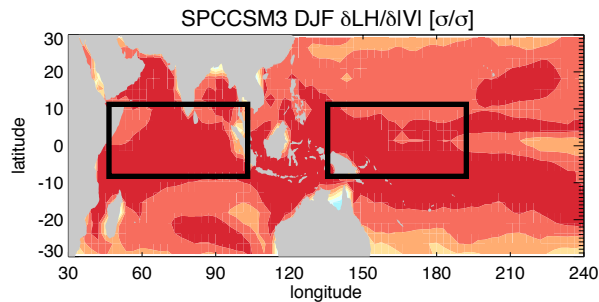
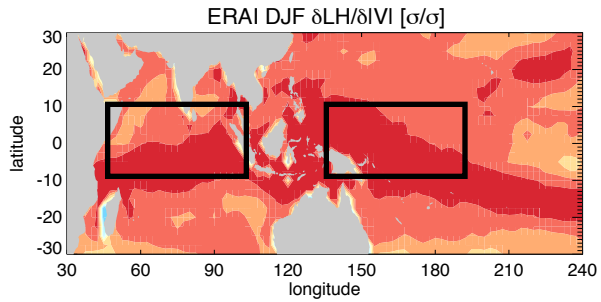
$$\frac{\partial LH}{\partial \Delta q}$$



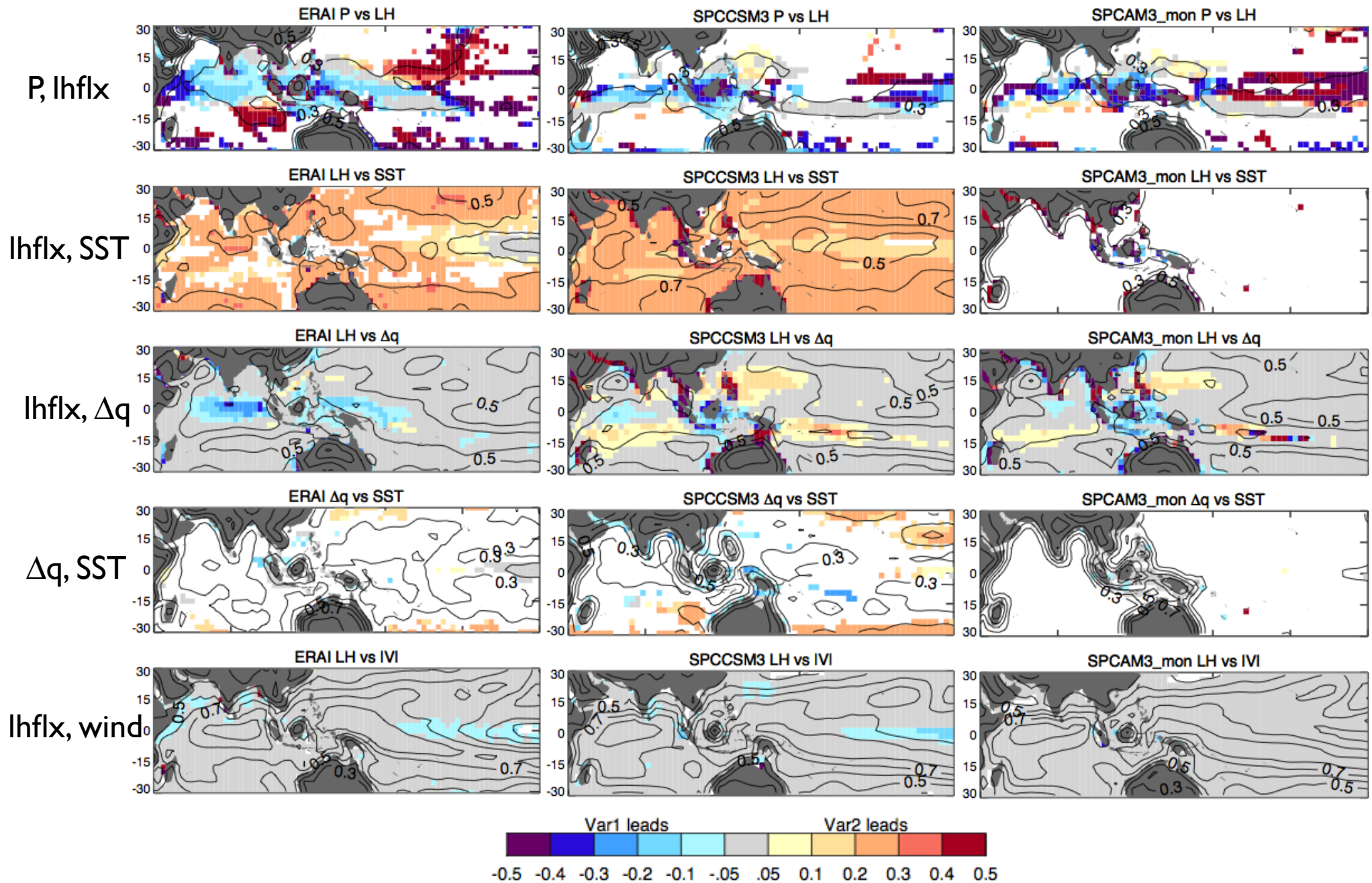
$$\frac{\partial \Delta q}{\partial SST}$$



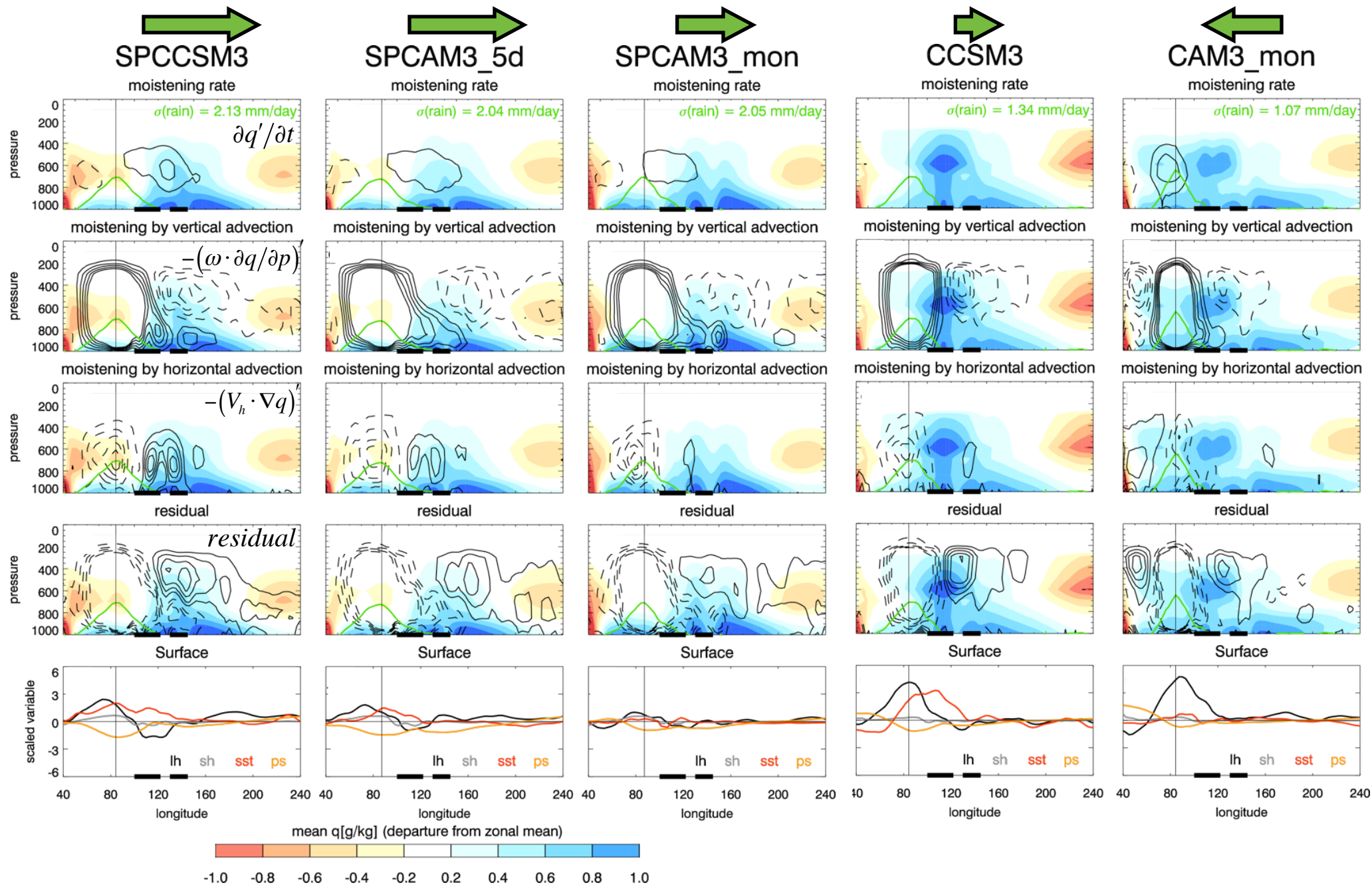
$$\frac{\partial LH}{\partial |V|}$$



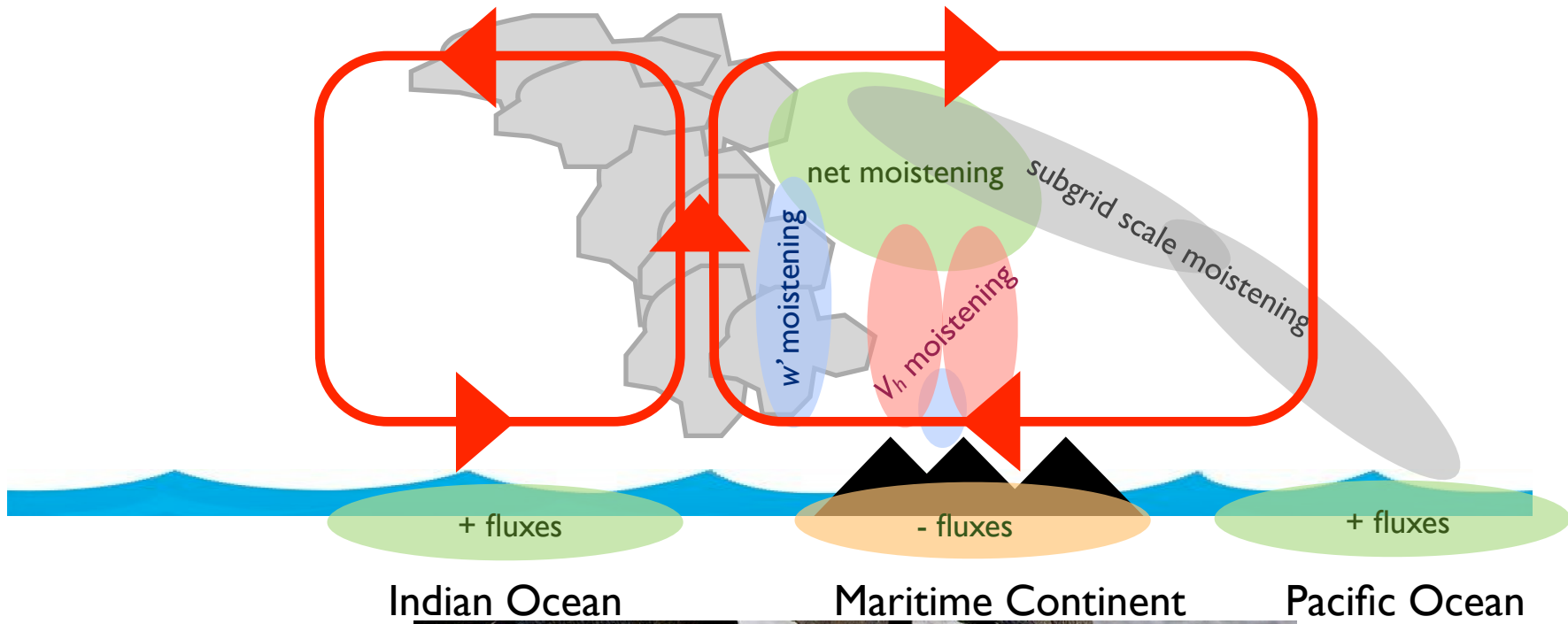
intraseasonal phase relationships (all seasons)



moisture budget cross section composites
all contours [1×10^6 g/kg/s] / [mm/day]



synopsis



Indian Ocean

Maritime Continent

Pacific Ocean



Introduction

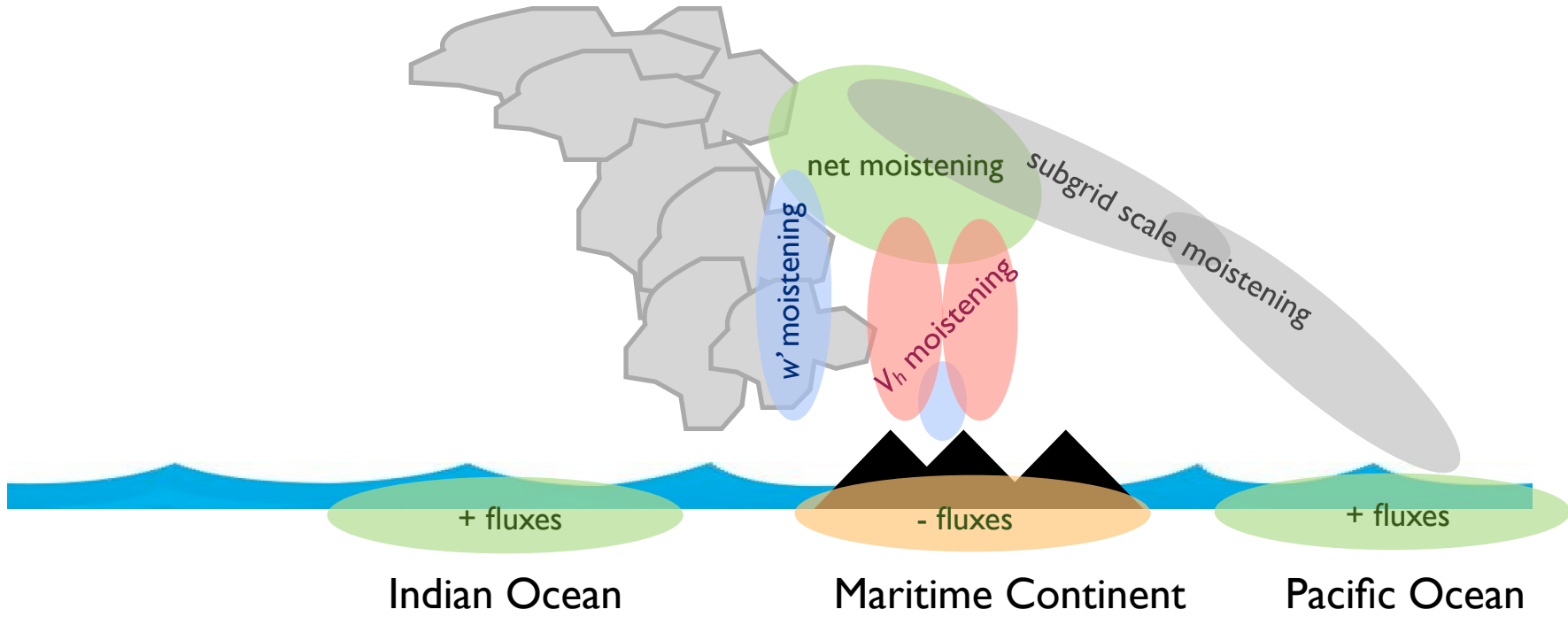
Experiments

Flux sensitivity

Moisture budget

Interpretation

synopsis



synopsis

