



河海大学  
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# Contribution of the Winter Salinity Barrier Layer to Summer Ocean-Atmosphere Variability in the Bay of Bengal

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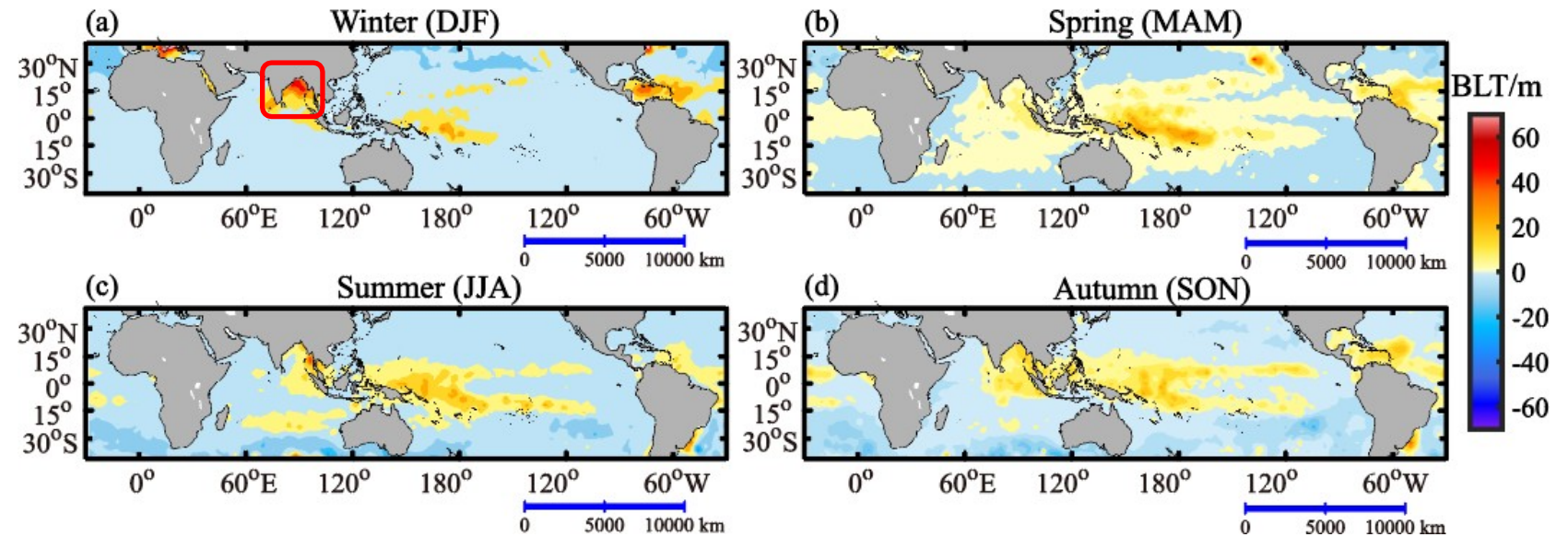


# Bay of Bengal



Considerable freshwater flux  
(local precipitation + river discharge)

(de Boyer Montégut et al., 2007; Rao & Sivakumar, 2003)



## Bay of Bengal

- BL appears in summer, peaks in February, and declines before the arrival of summer monsoon

# Barrier Layer & Indian Summer Monsoon

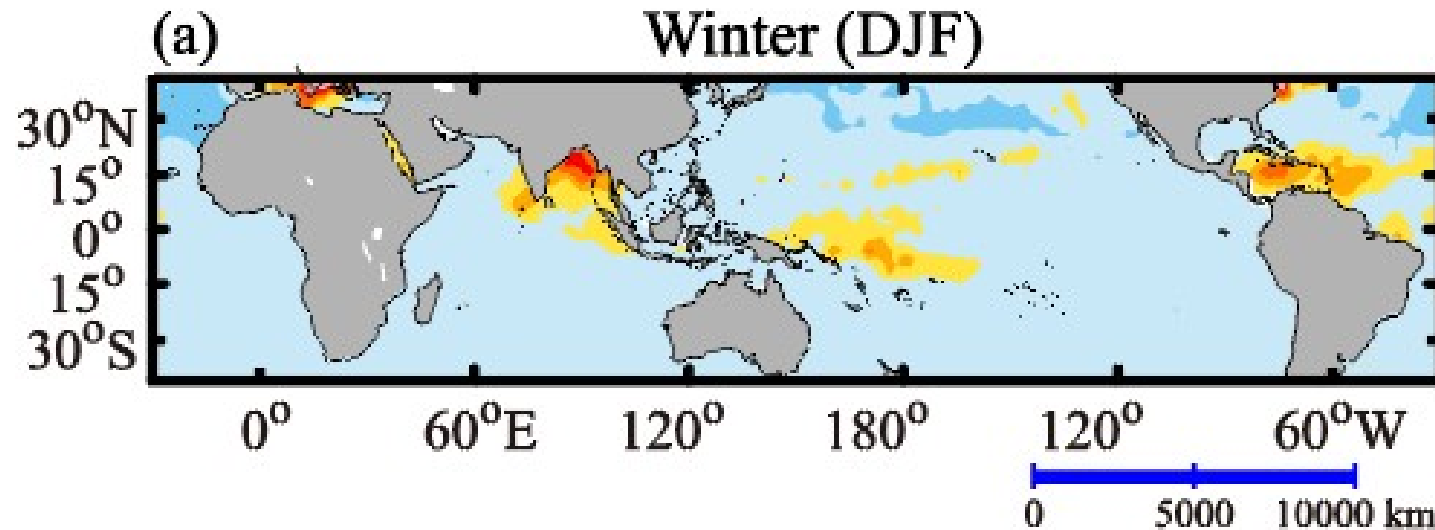
Simultaneous



Persistent



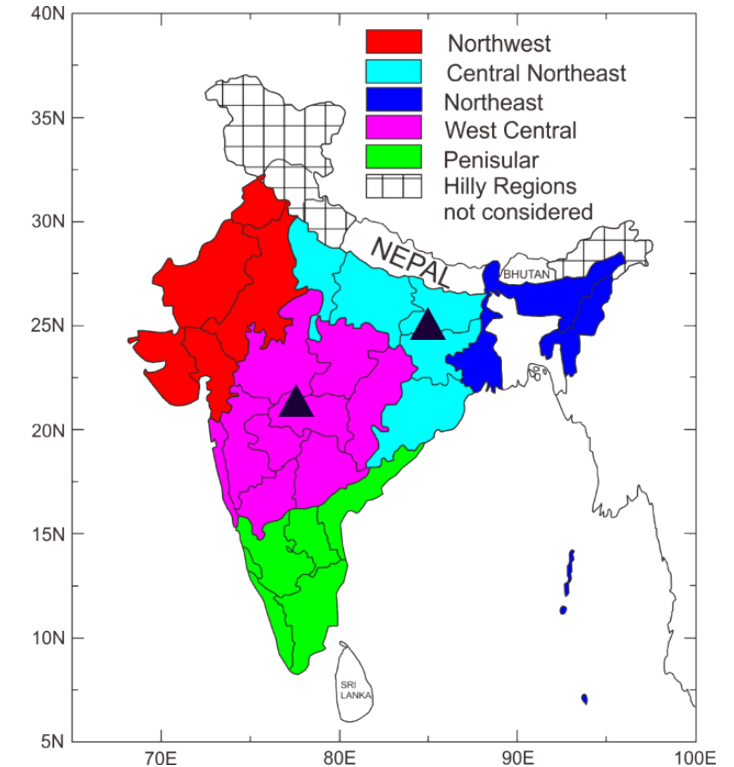
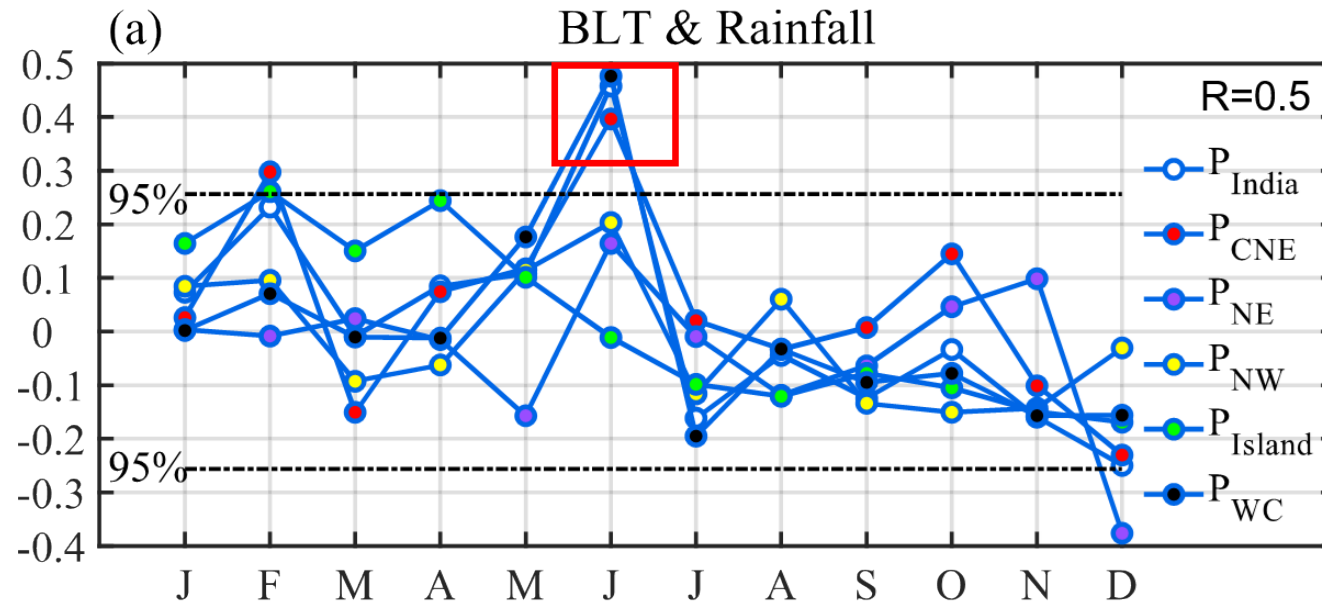
The **persistent effect** of the prior **winter thick BL** on the air–sea interaction in the following seasons and its mechanisms



# Relationships of the prior winter barrier layer with ISM activity

SODA V2.2.4 dataset:  
temperature & salinity

Winter: Dec-Feb

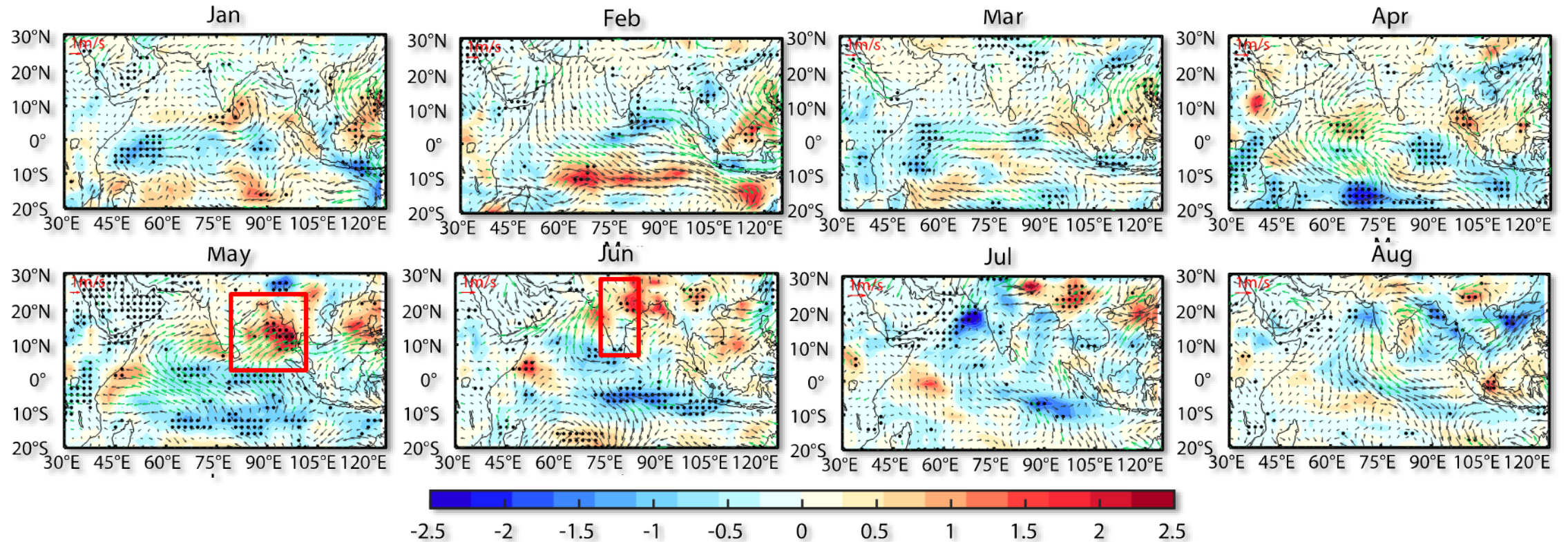


- There exists a significant link between prior winter BLT and precipitation, especially for **total India**, **central northeast India** and **west-central India**.



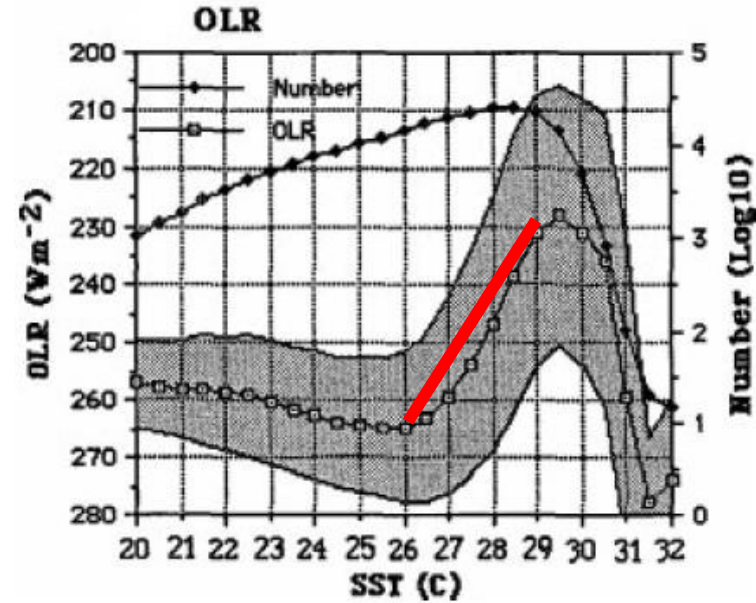
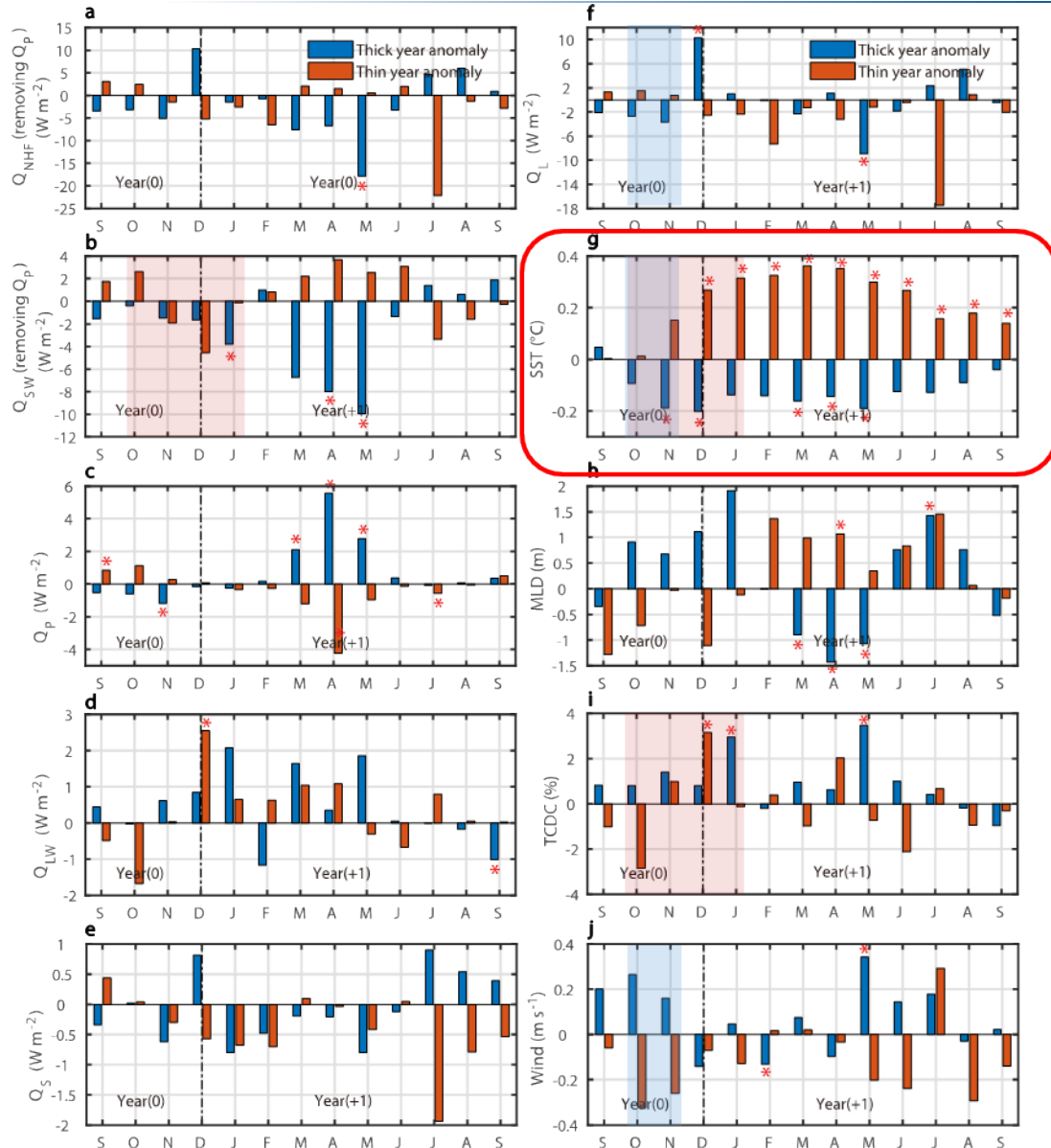
# Southwest winds and precipitation anomalies

## Thick BL years



- Southwest winds and precipitation significantly strengthen over the BoB in **May(+1)**
- The enhanced precipitation over South Asian subcontinent peaks in **June(+1)**

# Persistent SST cooling



(Waliser et al. 1993)

26.5  $^{\circ}C$ -29  $^{\circ}C$

Excessively cold

Deep convection

Oct(0)-Nov(0): Wind–evaporation feedback

- Net heat flux is persistently decreasing (strengthened wind)

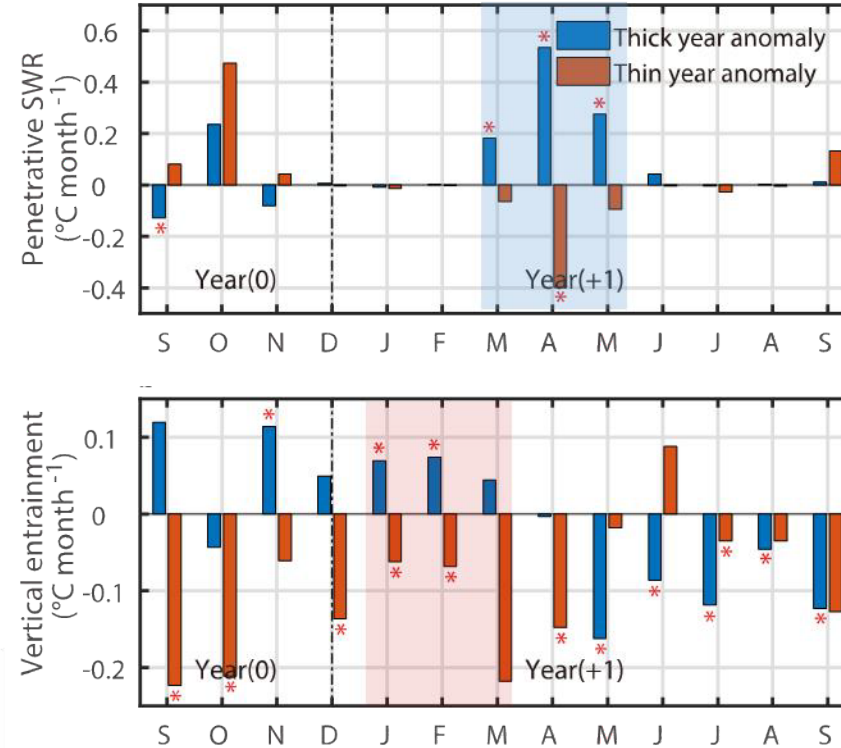
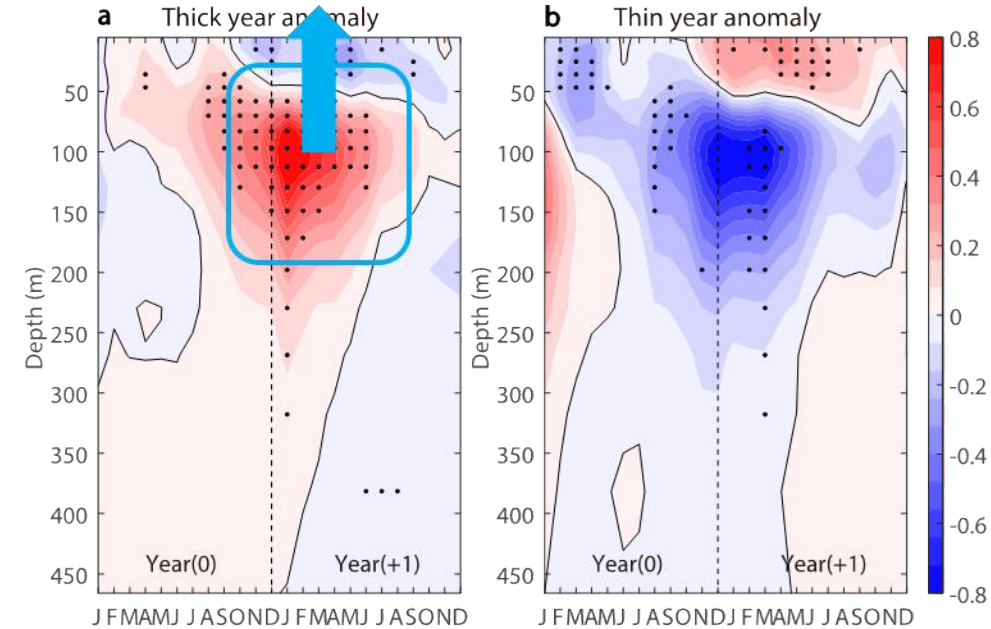
Oct(0)-Jan(+1): Positive Cloud–SST feedback

- Decreased shortwave radiation flux (increased cloudiness)

Atmospheric forcing  
(wind–induced latent heat loss and solar radiation reduction)



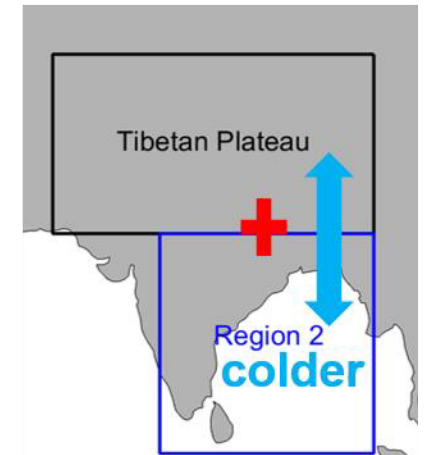
# Role of wintertime salinity barrier layer



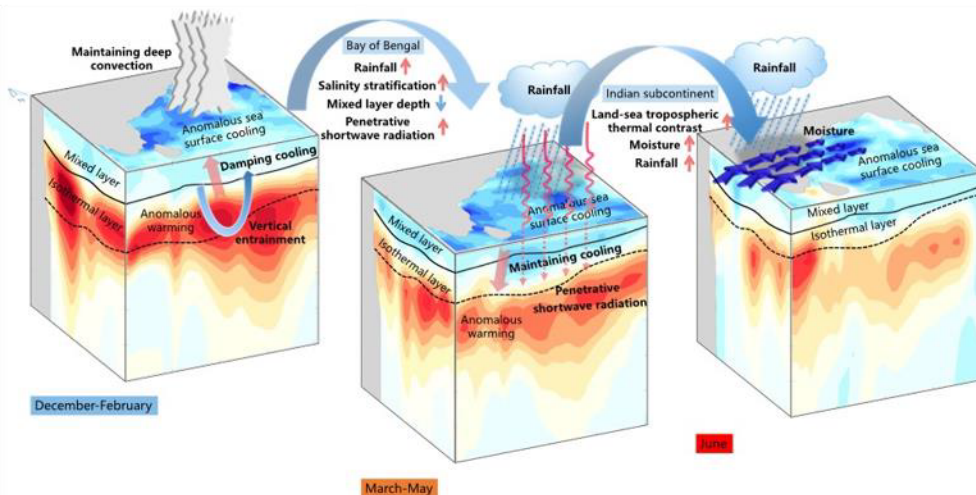
Mar(+1)-May(+1):

Penetrative solar radiation

More penetrative solar heat flux (decreased MLD)



Large thermal contrast



**Pang, S., Wang, X., Foltz, G. R., & Fan, K.** Contribution of the winter salinity barrier layer to summer ocean-atmosphere variability in the Bay of Bengal, **Journal of Geophysical Research: Oceans.** (In Revision)

# Summary & Next work

## Summary

- Prior winter barrier layer (BL) anomalies in the Bay of Bengal (BoB) can modulate SST and potentially Indian summer monsoon activity
- Prior winter thick BL plays a dynamical thermostat role by restraining cold thermocline water entrainment into the ML, favoring the development of deep convection over the BoB
- More penetrative shortwave radiation is absorbed by the BL in March–May for thick BL years, further maintaining the existing SST cooling.

## Next work

- How much influence of winter salinity barrier layer in the Bay of Bengal on the Indian summer monsoon rainfall? (using a climate model to verify the result in this work)





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THANKS