

# IMPACTS OF VERTICAL STRUCTURE OF CONVECTION ON TROPICAL CLIMATE

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Postdoctoral researcher

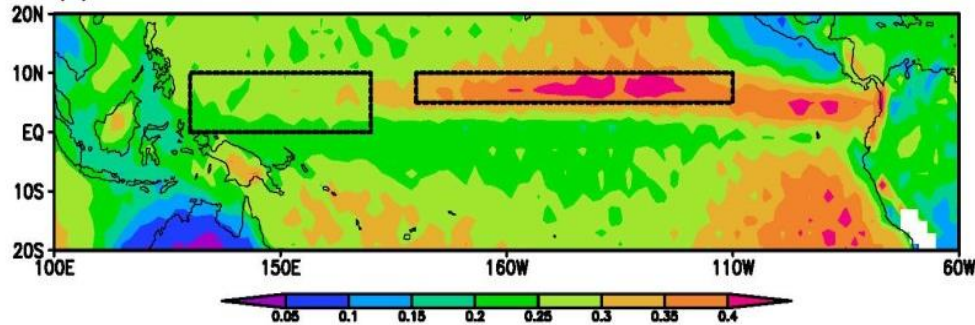
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# Introduction

- ❖ Research interests: understand the impacts of vertical structure of convection on tropical climate
- ❖ Method: analyzing the moist static energy and moisture budgets
- ❖ General approaches:
  - Data analysis
  - Model simulations (CESM)

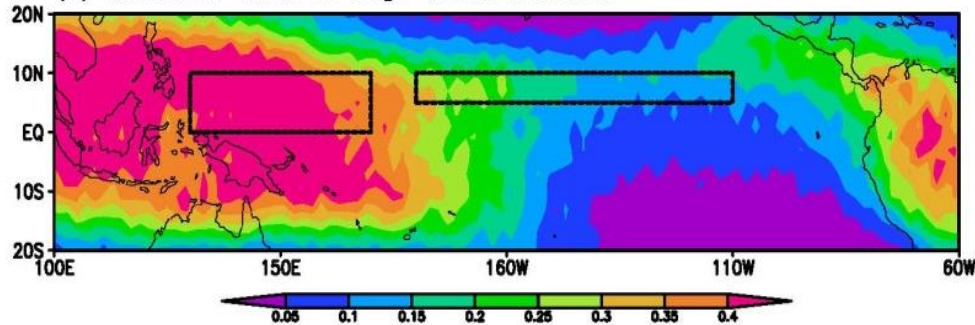
# Contrasting the western and eastern Pacific

(a) CloudSat-CALIPSO Low Cloud Fraction



cloud-top < 5 km

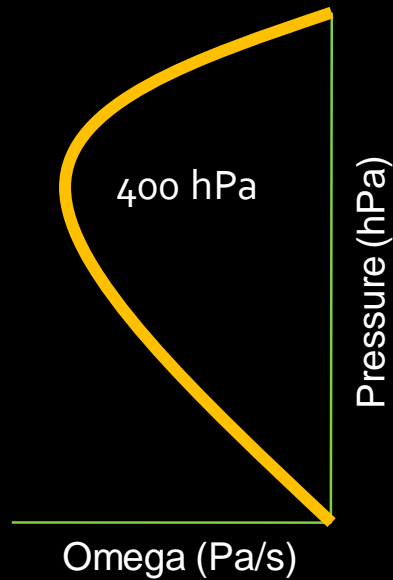
(b) CloudSat-CALIPSO High Cloud Fraction



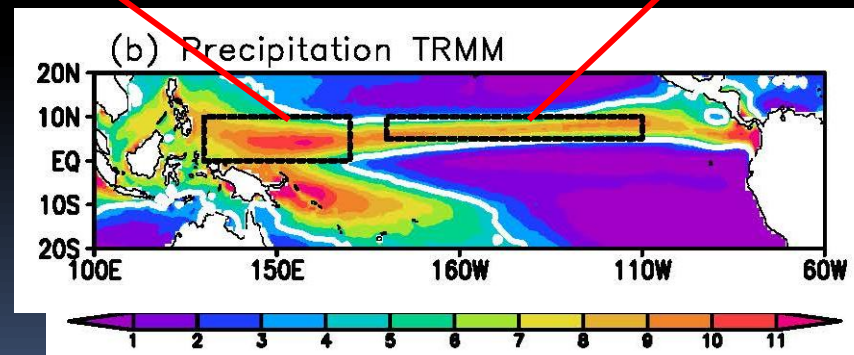
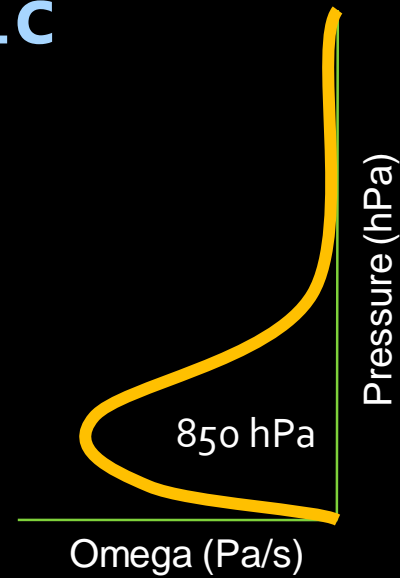
cloud-top: 13-17 km

# Contrasting the western and eastern Pacific

top-heavy  
(deep)



bottom-heavy  
(shallow)



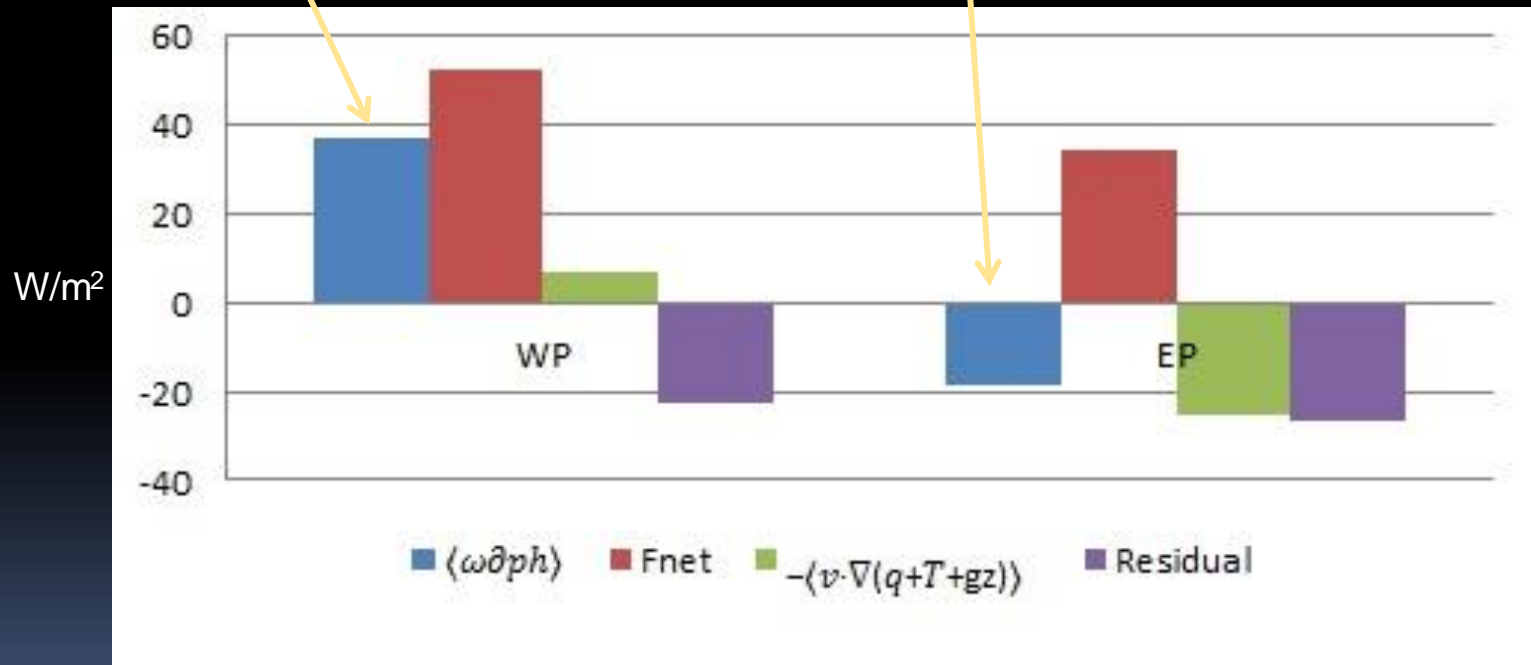
- How deep and shallow convection affect the tropical climate?

# Contrasting the western and eastern Pacific

$$\langle \omega \partial_p h \rangle = -\langle v \cdot \nabla h \rangle + F^{net} + Residual$$

Stabilize

De-stabilize



The sign of column-integrated vertical MSE advection is sensitive to the structure of vertical motion

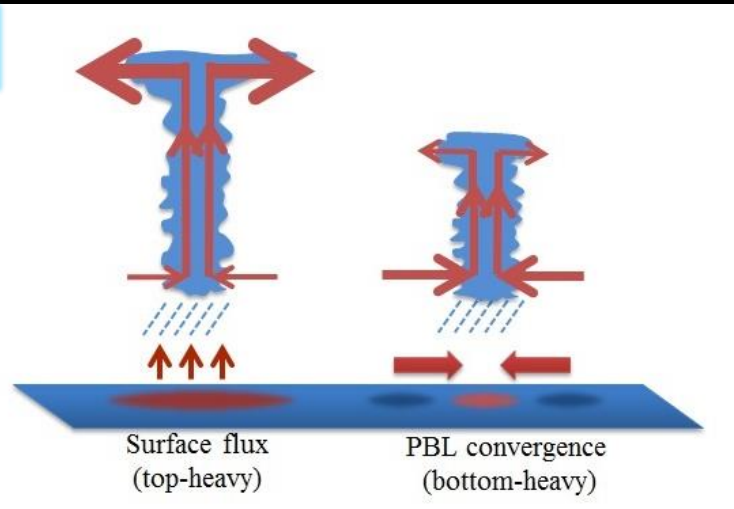
### Top-heavy Convection

$$\langle \omega \partial_p h \rangle > 0$$

Export MSE

Redistribute energy

Stabilize atmosphere




### Bottom-heavy Convection

$$\langle \omega \partial_p h \rangle < 0$$

Import MSE

Destabilize atmosphere

(Bui et al., 2016, J. Atmospheric Sciences)

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- Impacts of model spatial resolution on the vertical structure of convection (using the CESM) (Bui et al., 2017, submitted)
  - Impacts of deep and shallow convection on the gross moist stability (in preparation)
  - Applying the MSE framework to other climate variability: MJO, ENSO, monsoon ...
  - Examining the influence of cloud radiative forcing on the MSE budget