

Weak temperature gradient simulations; sensitivity to the thermodynamic environment

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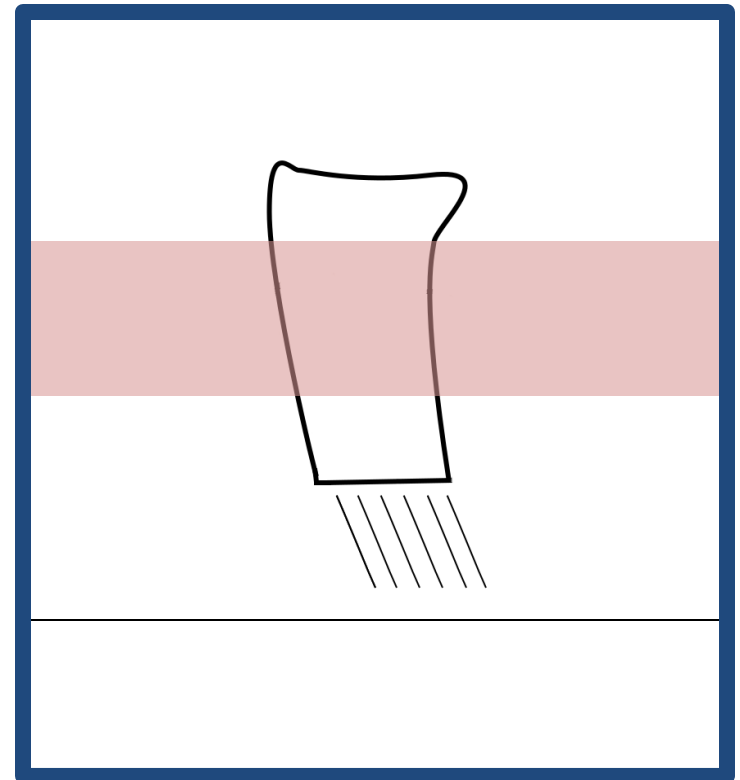
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Weak Temperature Gradient Approximation

Tropics



Model



Weak Temperature Gradient Approximation - model

- WTG – relaxation time scale t_θ
- WTG vertical velocity:

$$w_{WTG} = \frac{\bar{\theta} - \theta_{ref}(z)}{t_\theta \frac{\partial \bar{\theta}}{\partial z}}$$

- Lateral entrainment of moisture

Main Objective

Compare observed and modeled diagnostics

Influence of choice of reference profiles (TOGA-COARE)

Diagnostics used

- Rain rate
- Saturation fraction

$$\frac{\textit{precipitable water}}{\textit{saturated precipitable water}}$$

- Instability Index

$$S_{1-3 \text{ km}}^* - S_{5-7 \text{ km}}^*$$

WTG reference profiles

- Raymond and Zeng (2005)
- 2D RCE: $SST = 302.5$ K, $U = 2$ m/s
- Profiles (TOGA-COARE):

$$\theta_{ref} = \theta_{RCE} + \theta'_{obs}$$

$$r_{t,ref} = r_{t,RCE} + r'_{t,obs}$$

$$SST = SST_{RCE} + SST'_{obs}$$

$$U = U_{RCE} + U'_{obs}$$

WTG reference profiles

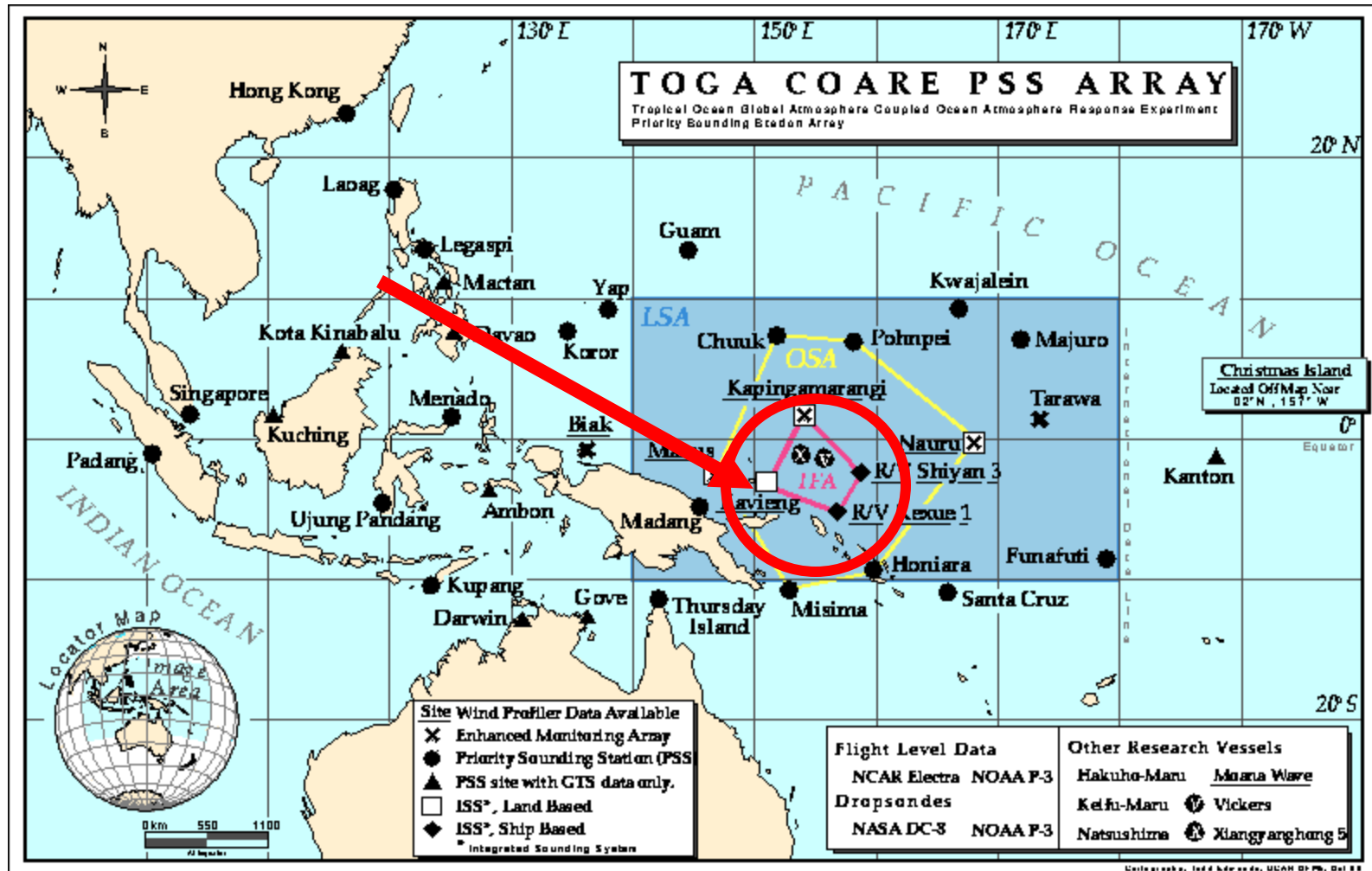
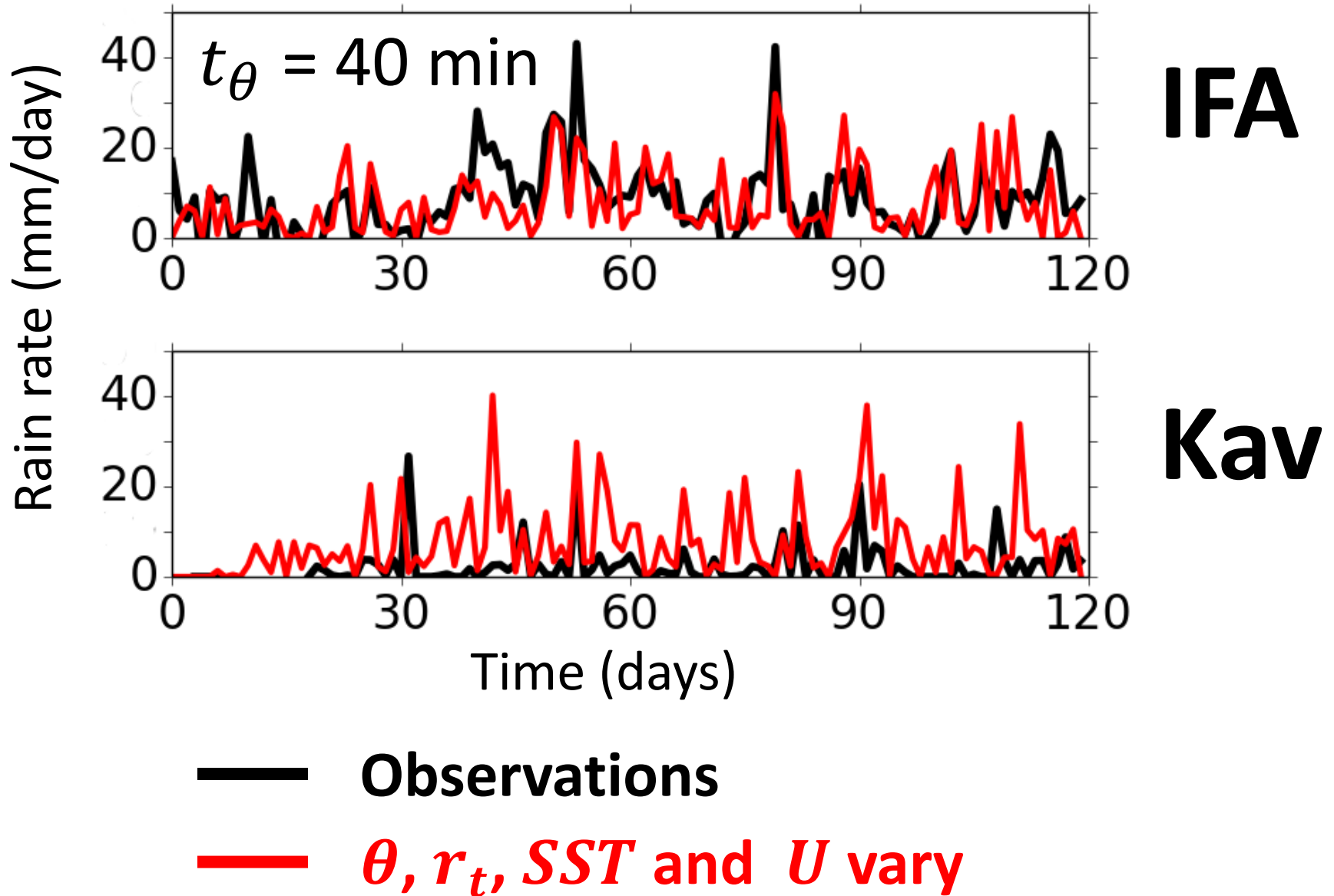


Image courtesy of <http://tornado.atmos.colostate.edu/>

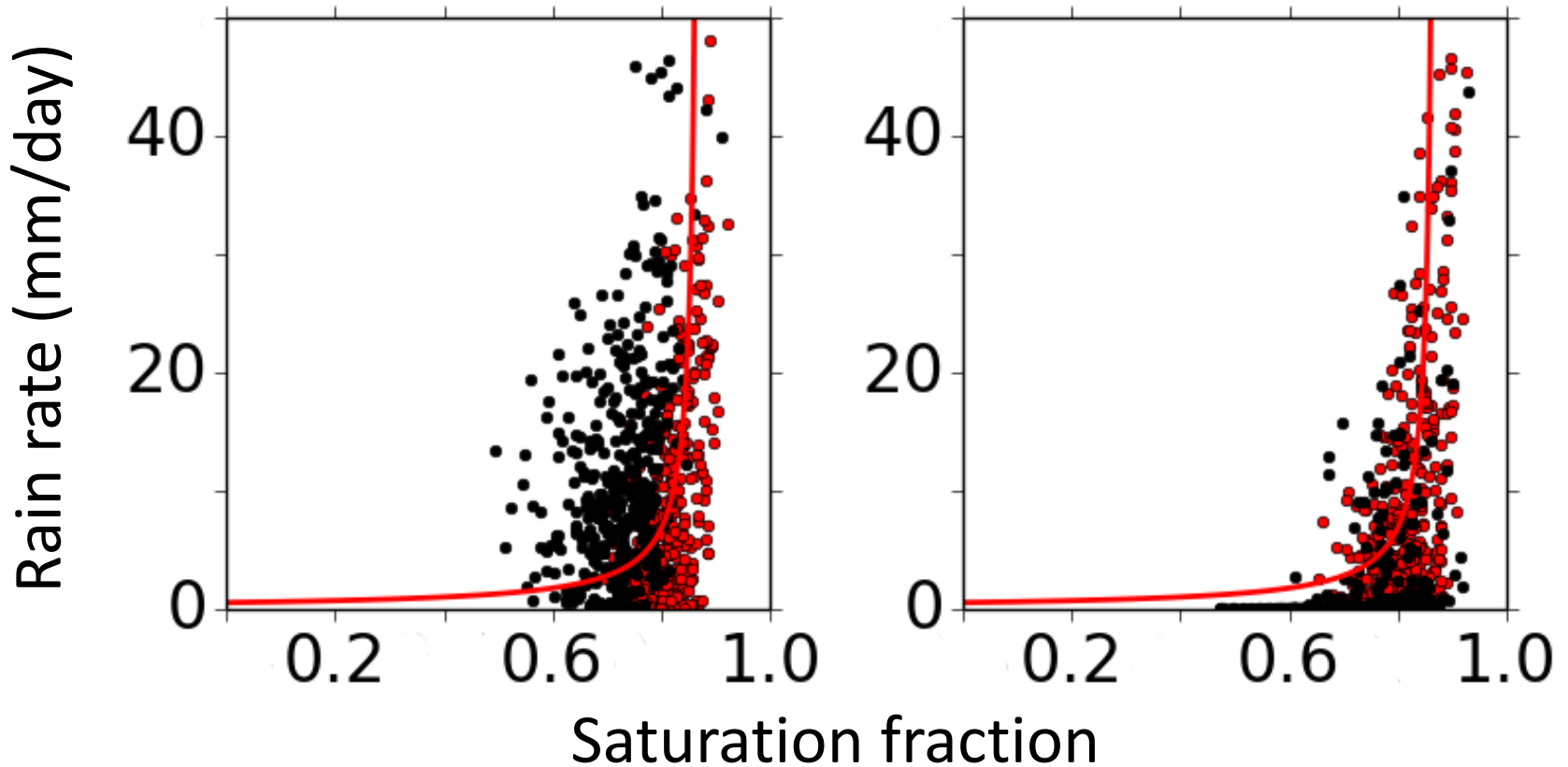
Daily rain rate



Rain rate VS saturation fraction

IFA

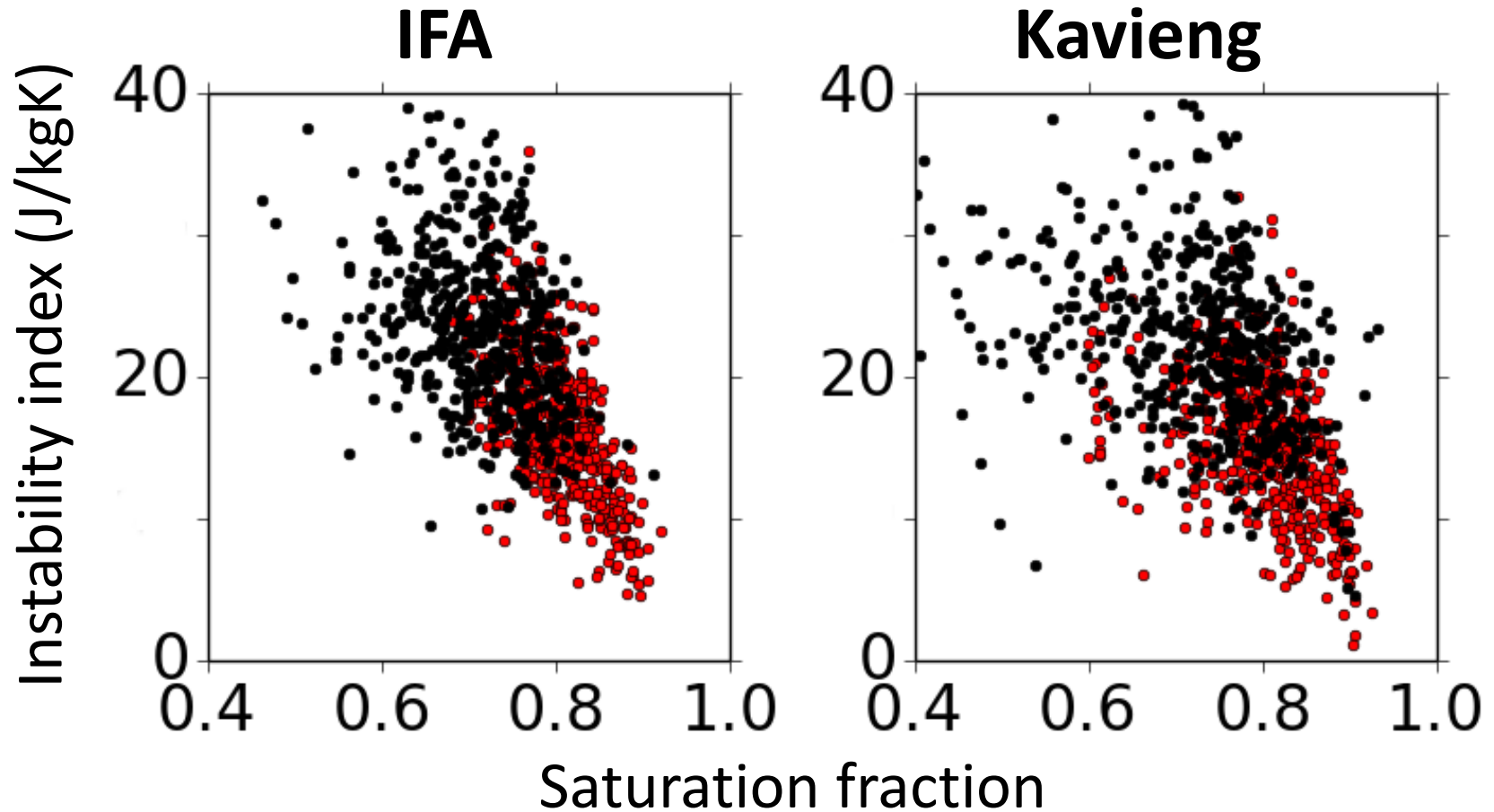
Kavieng



Observations

WTG

Instability index VS saturation fraction



Observations

WTG

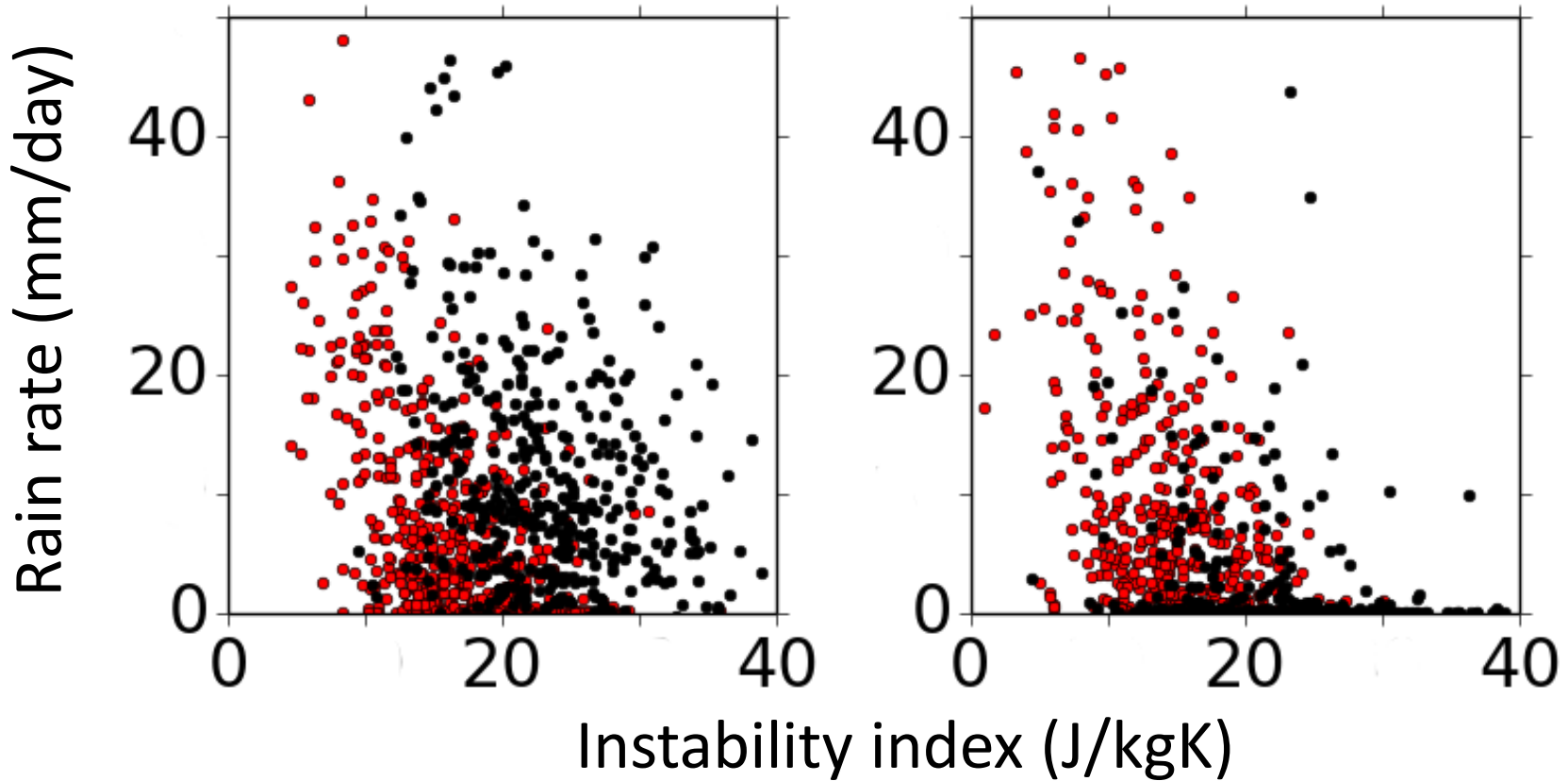
Conclusions and future work

- WTG reproduces observed rain rate for averaged profiles (IFA)
- Diagnostic relationship between instability index and saturation fraction, and rain rate and saturation fraction

Rain rate VS instability index

IFA

Kavieng



Observations

WTG