

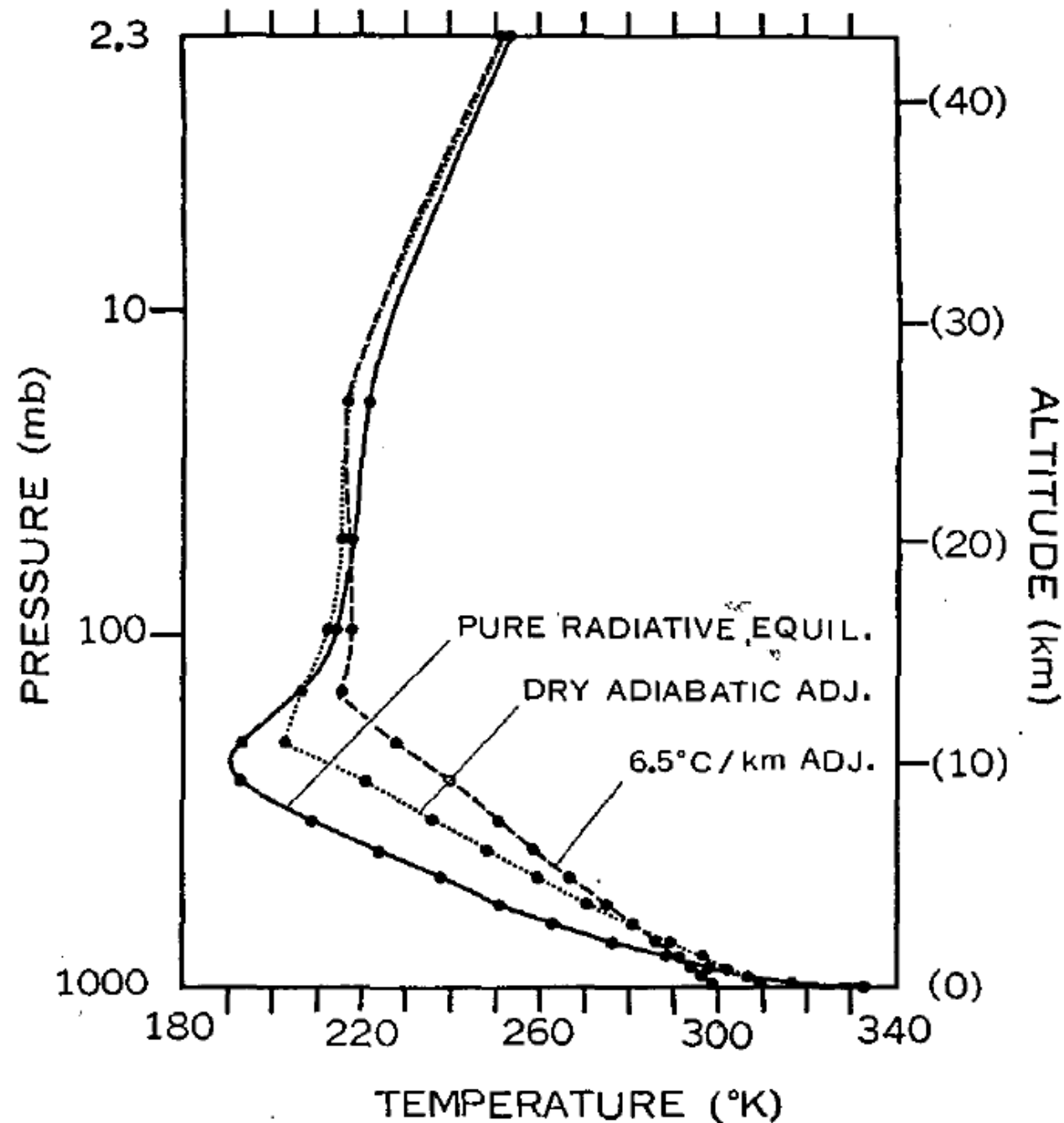
# Radiative-Convective Anti-Equilibrium - The Truth about the relationship of rainfall and radiation

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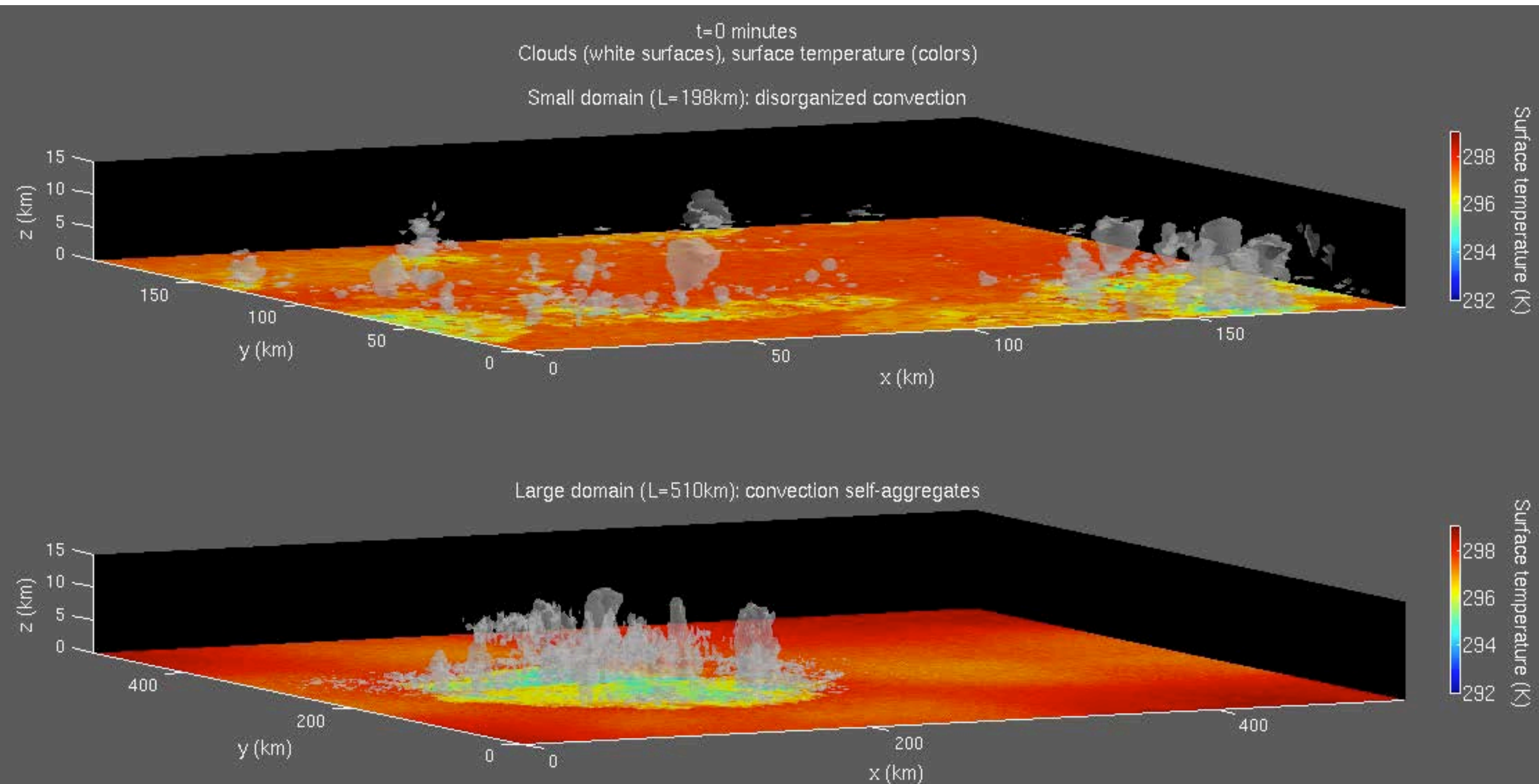
A long time ago in a galaxy far,  
far away....

... Manabe and Strickler found that RCE is a good approximation for the Earth's average vertical temperature structure



More recently, ...

... people took their idea and applied it to smaller and smaller scales to study convection on Earth



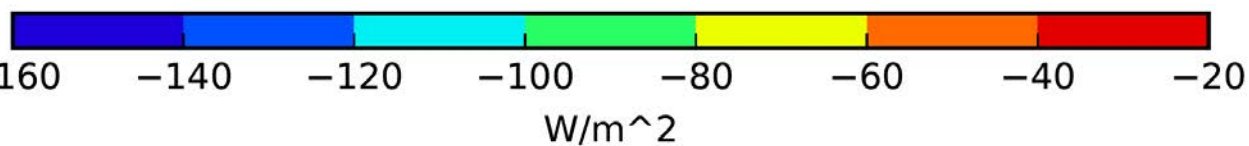
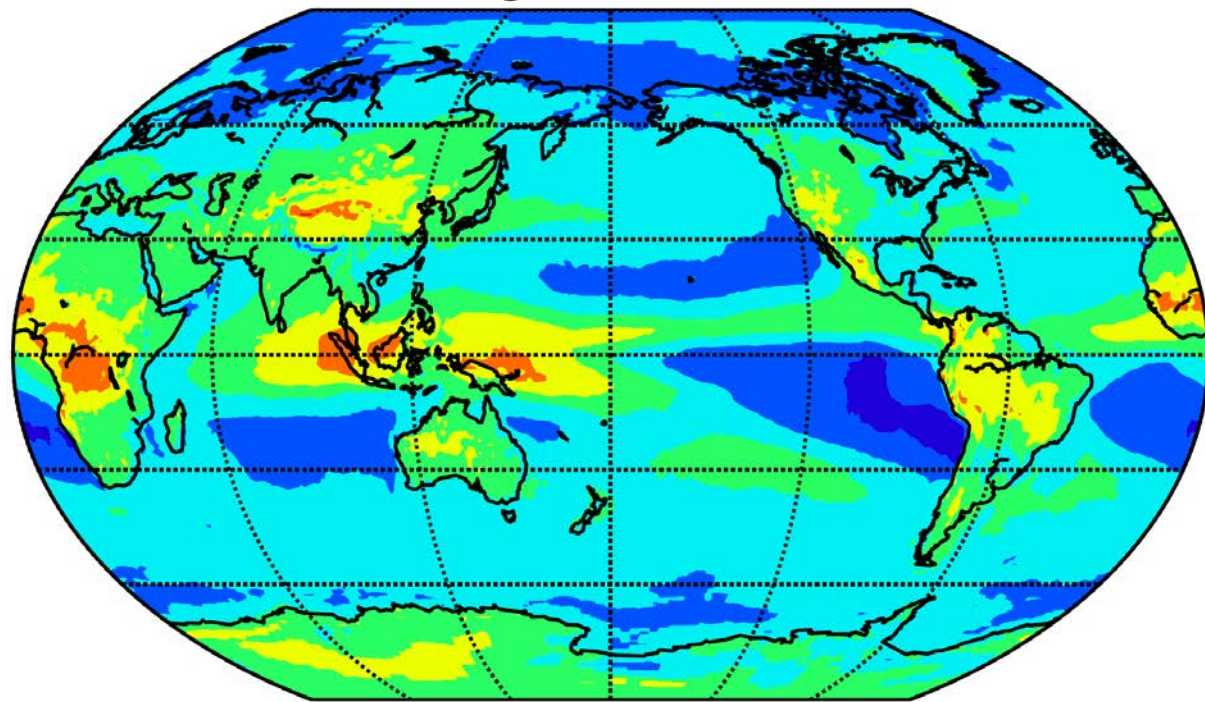
Sports friends, have you looked at observations?



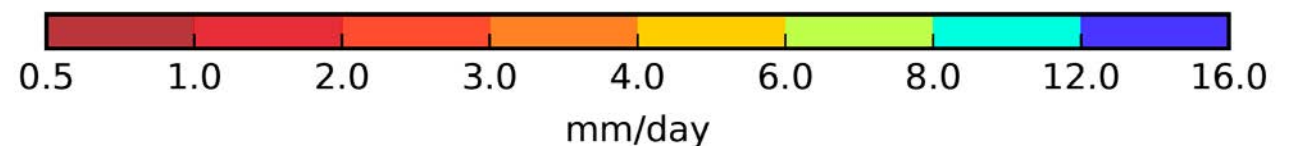
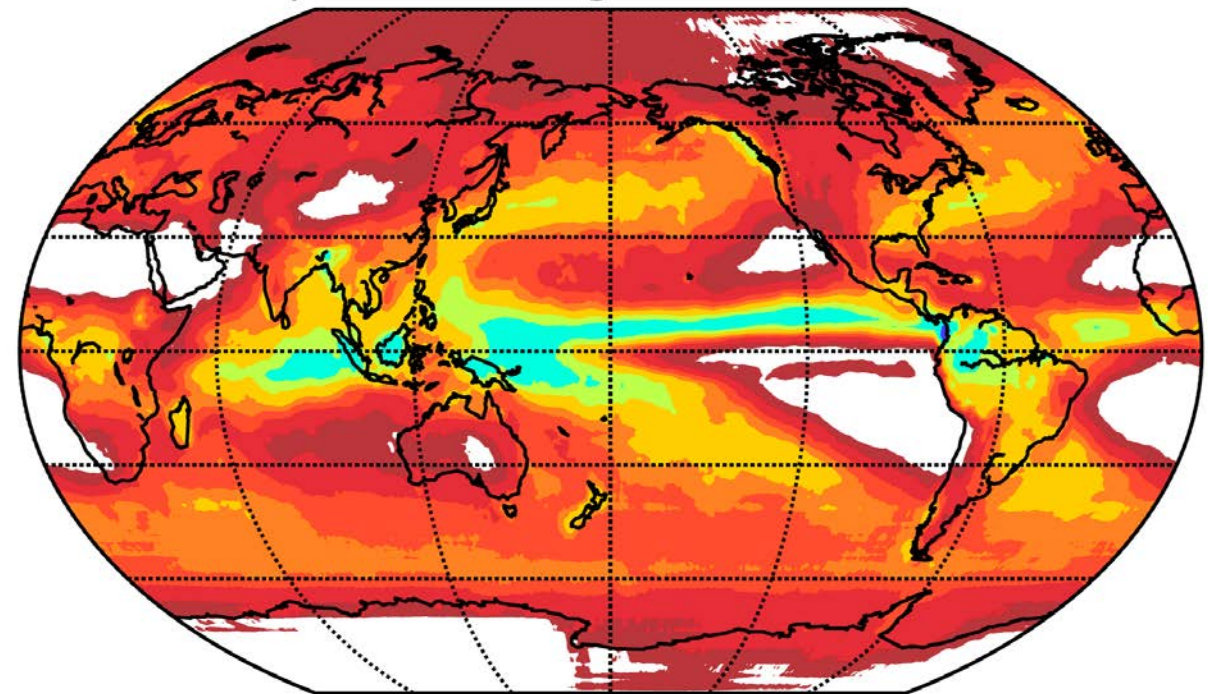
We use daily CERES TOA and surface radiative flux estimates to calculate the column radiative cooling and GPCP rainfall as our precipitation estimate.

We use ISCCP cloud regimes to characterise the state of convection.

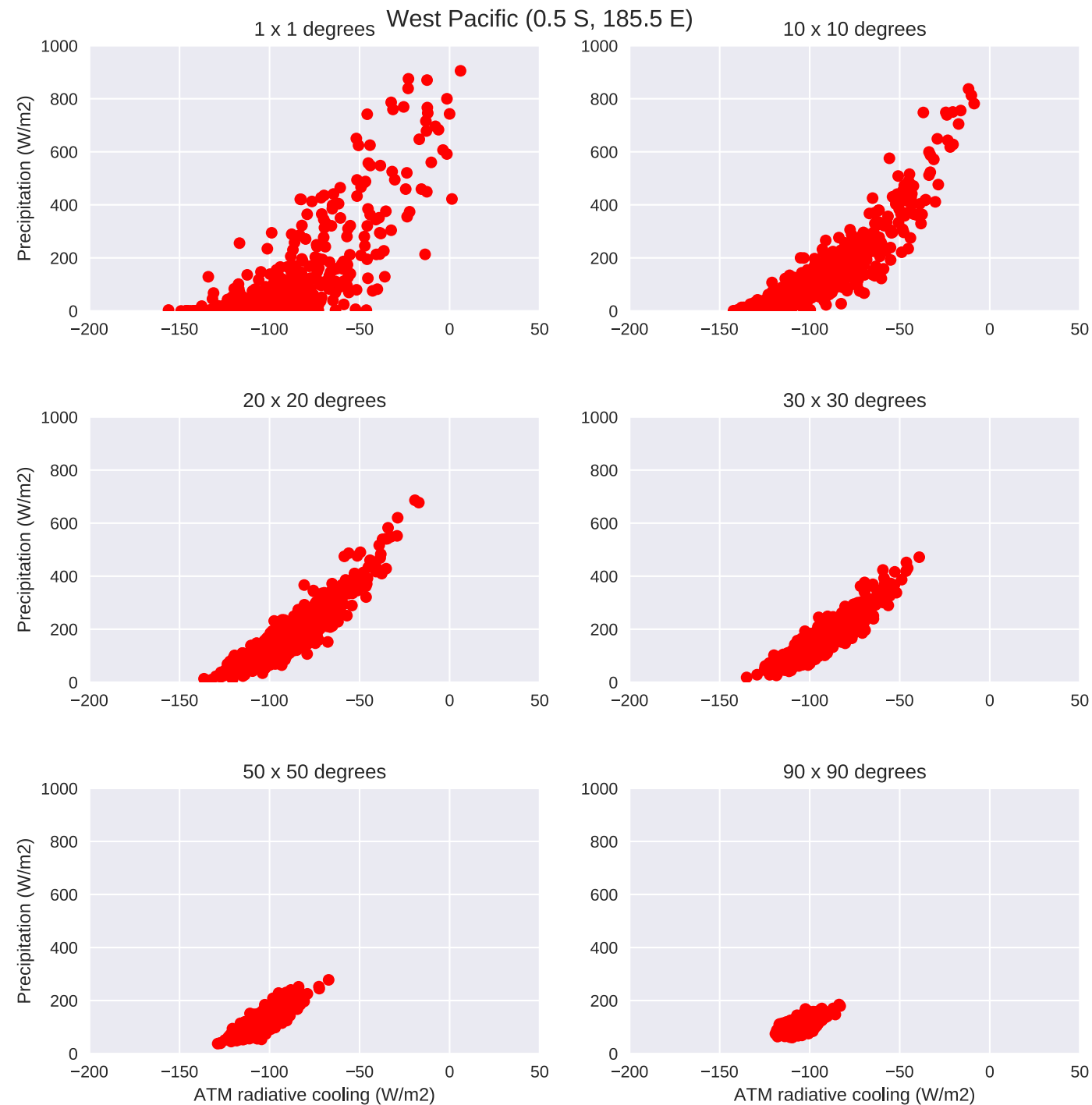
ATM cooling - CERES 2003/2004



Precipitation average - GPCP 2003/2004

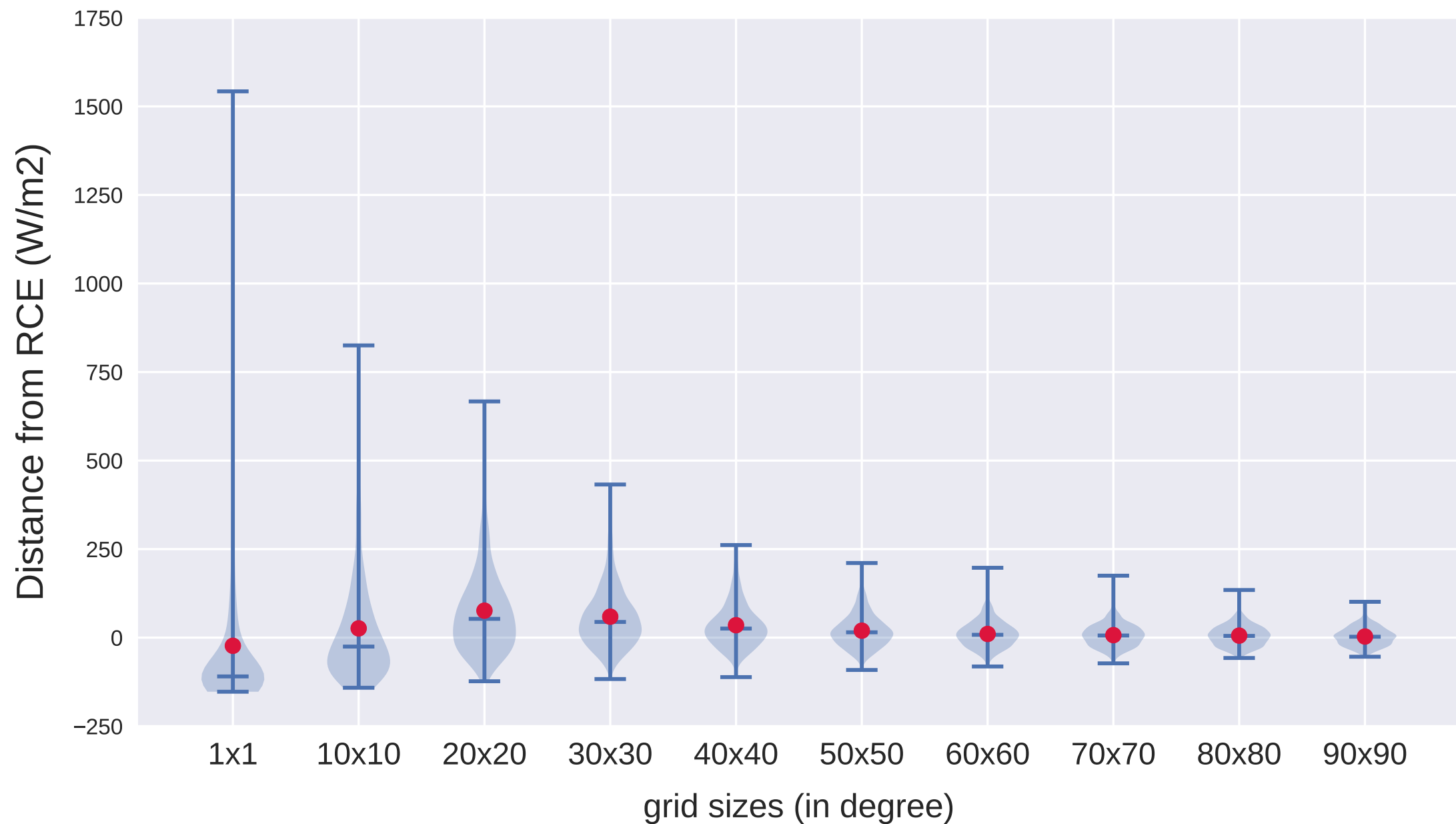


Daily analysis over the TWP reveals that the atmosphere is in Anti-RCE until we average over at least 5000x5000 km

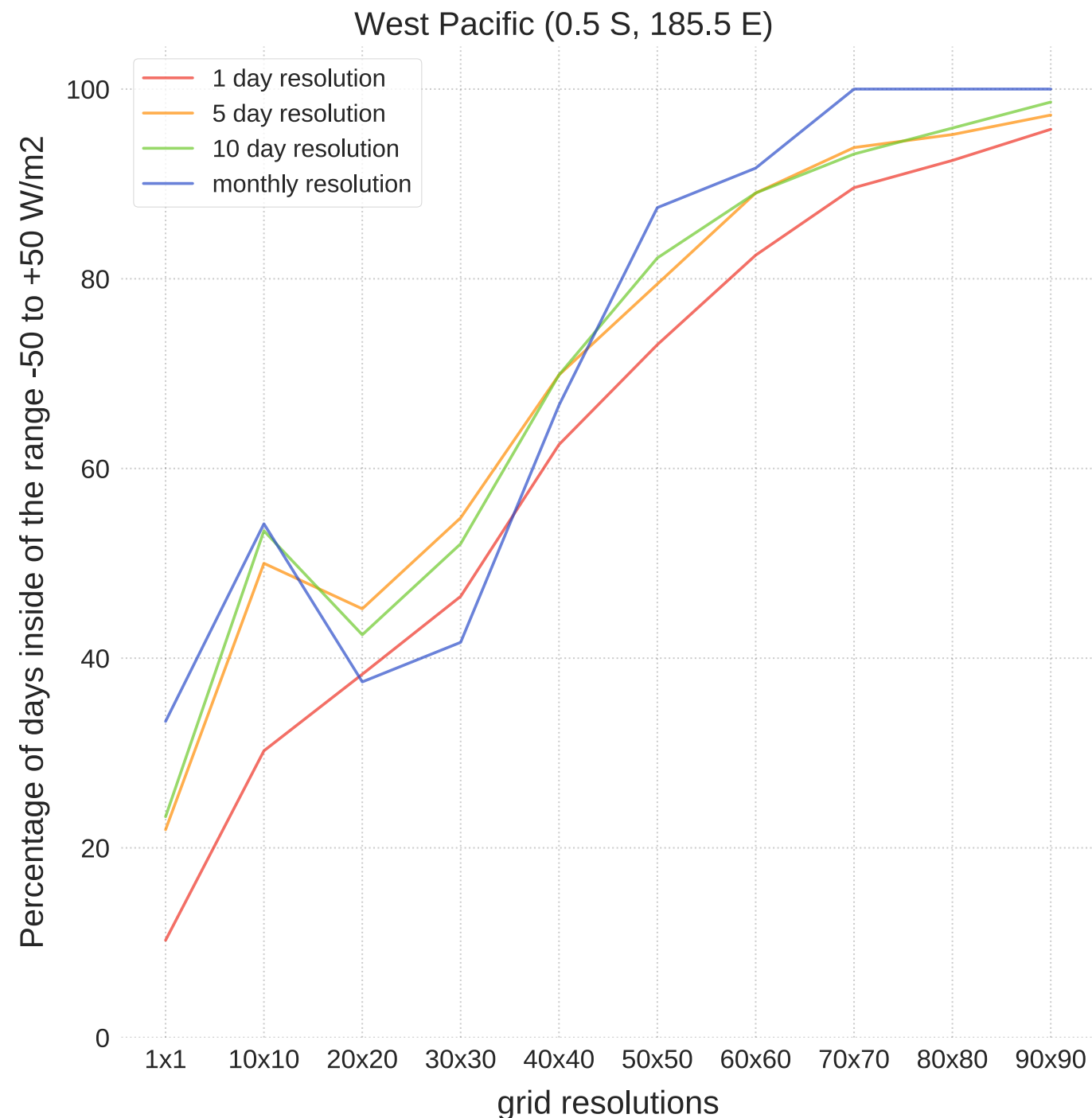




We define a “distance from RCE” as the difference between radiative cooling and precipitation

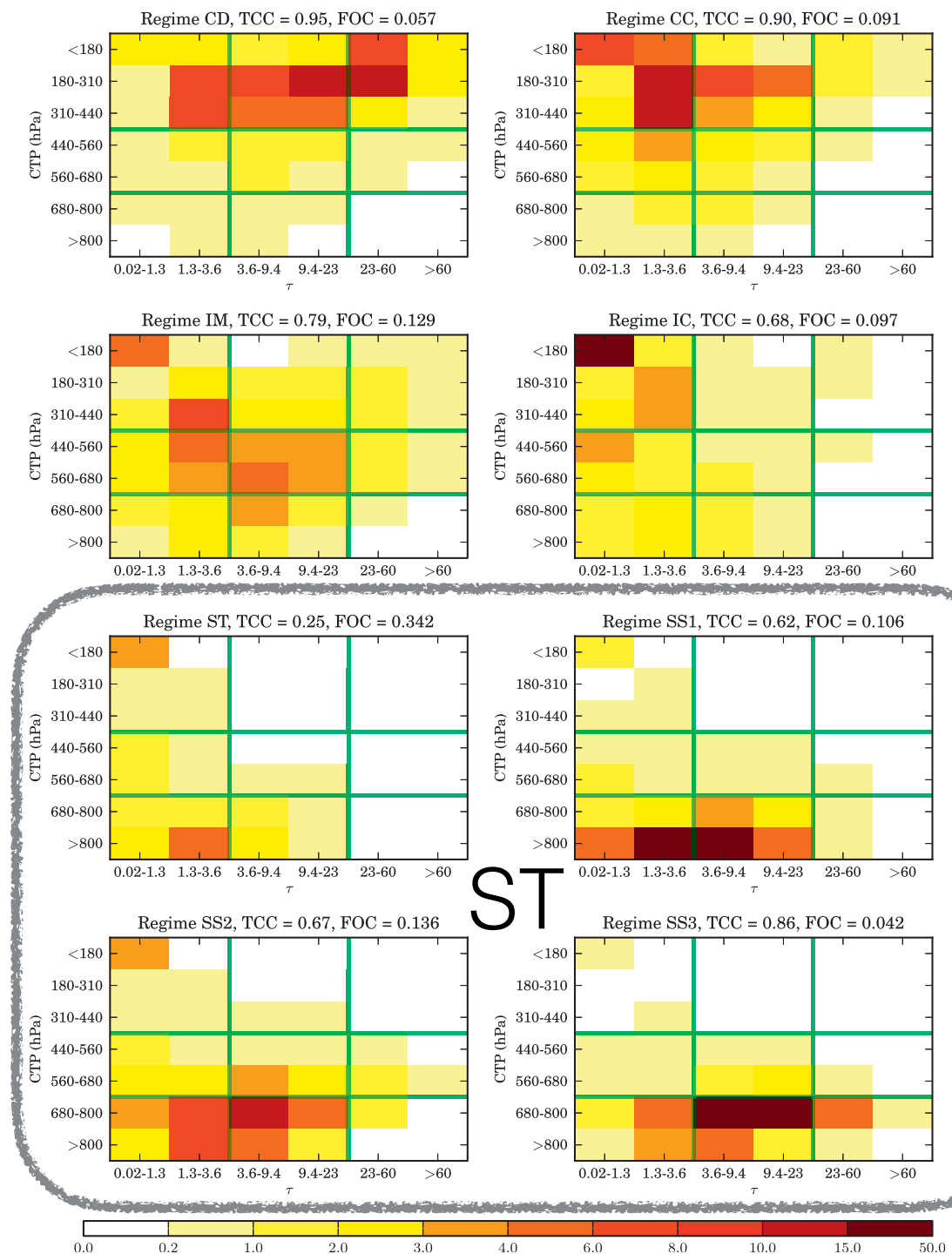
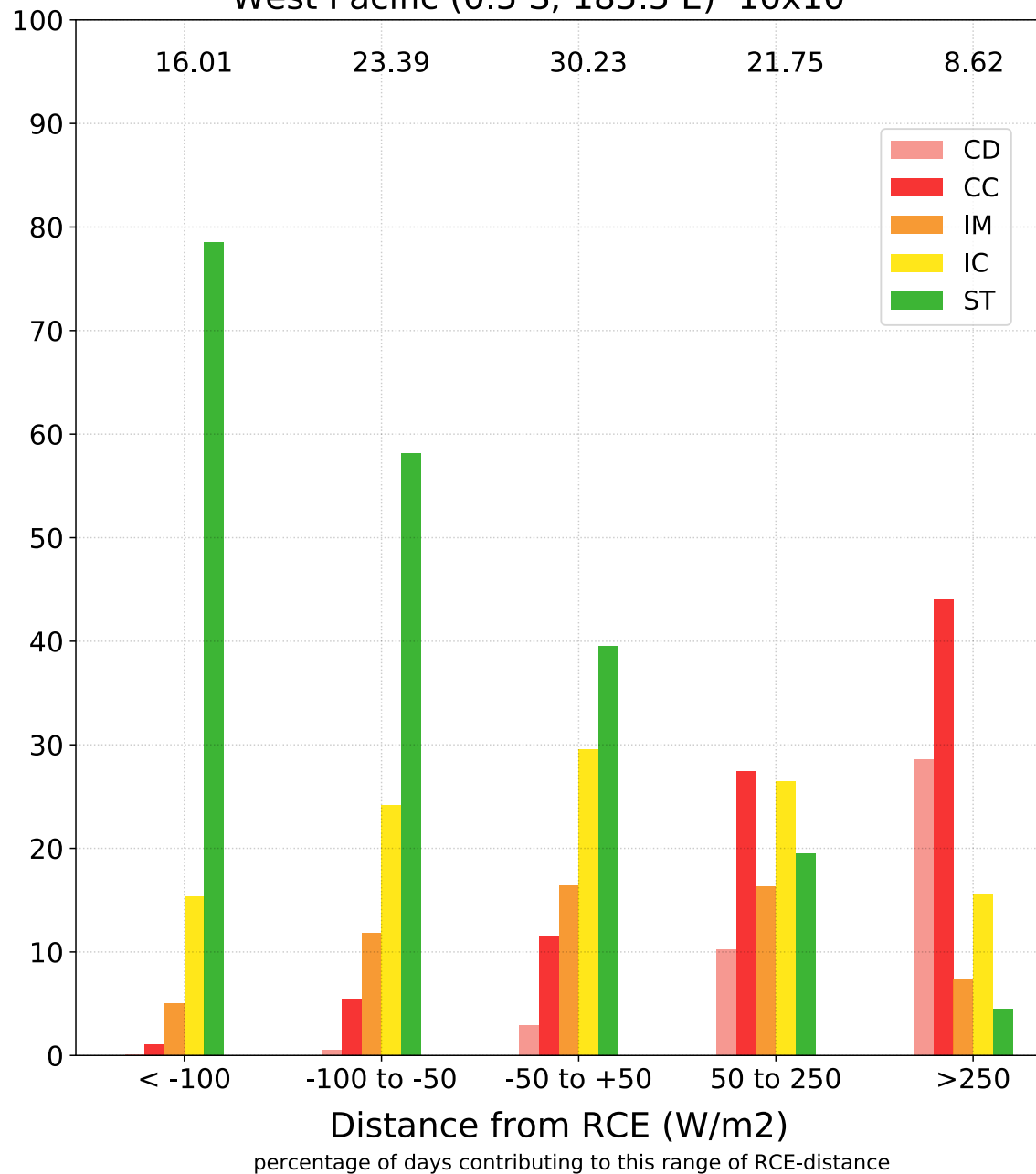


To have more than 80% of times in RCE defined as  $-50$  to  $+50$   $\text{W}/\text{m}^2$  requires large domains, even for monthly averages



# RCE and organised convection do not like each other! The most organised convection is found far away from RCE!

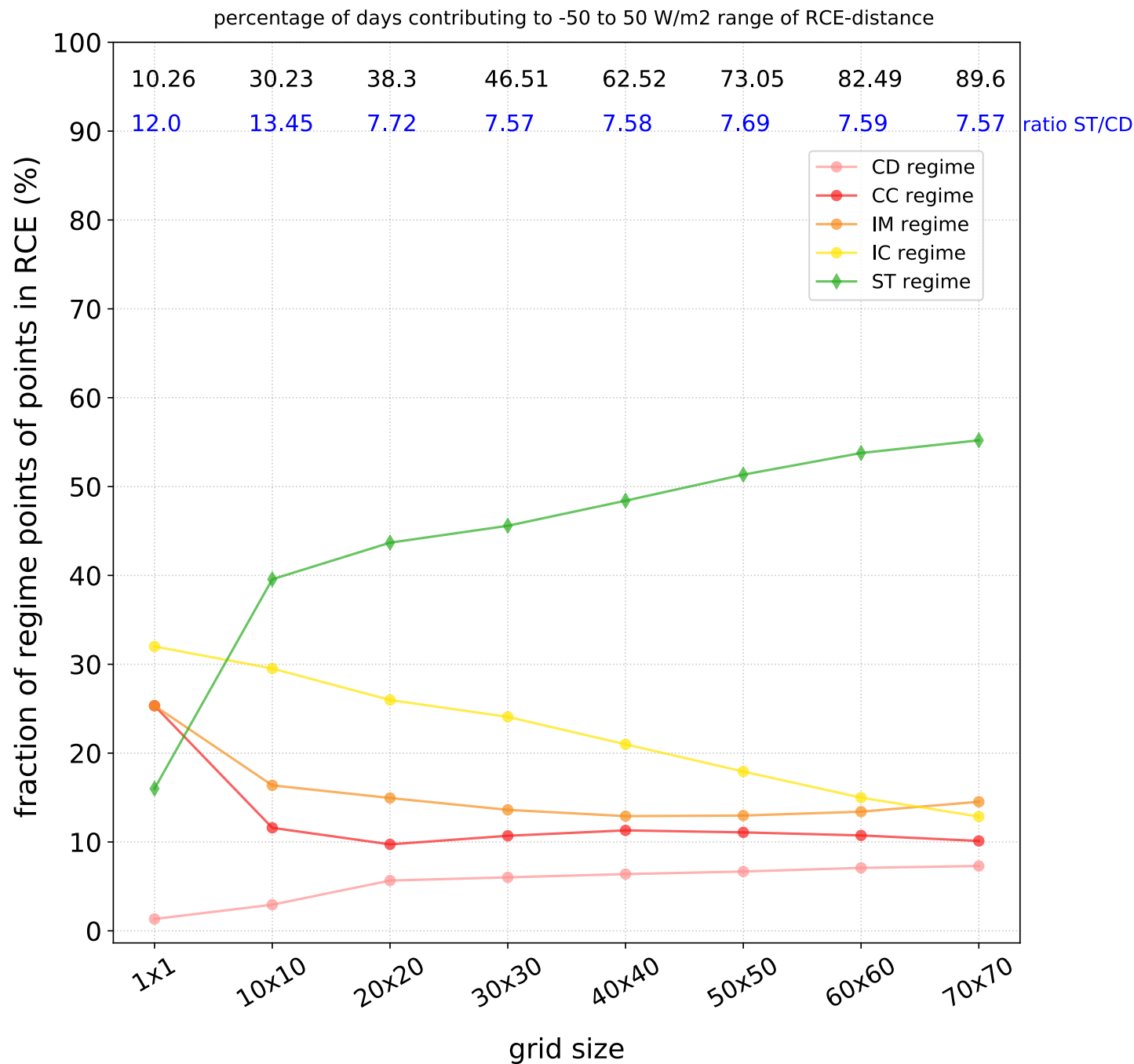
West Pacific (0.5 S, 185.5 E) 10x10



ST

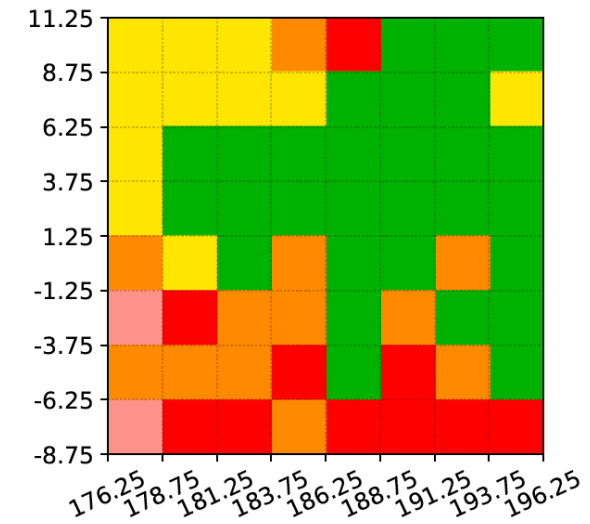
At small scales, RCE is only possible for non-organised convection. Larger scales require a perfect mix of convection and suppressed conditions!

West Pacific (0.5 S, 185.5 E)

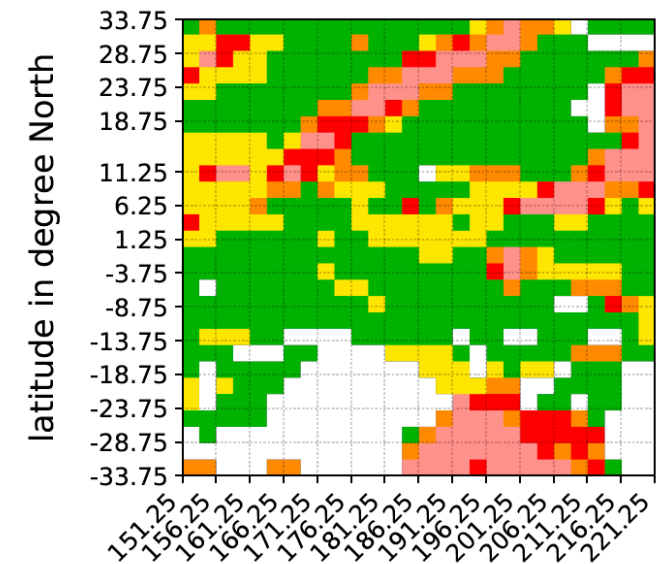


## Snapshots

Distance from RCE: 8.32373835633



Distance from RCE: -5.54540884029



# Conclusions

- Scales smaller than  $5000 \times 5000 \text{ km}^2$  are not often in RCE even for monthly averages in time. In fact, they are in Anti-RCE.
- Non-precipitating regions pull the atmosphere away from RCE, so do convecting regions, especially organised convection.
- RCE requires either an absence of organised convection (on small scales) or an “ideal” mix of organised convection and suppressed conditions.
- The ratio of suppressed to organised convection in RCE appears near-constant for scales  $> 2000 \times 2000 \text{ km}^2$