Effect of Large-Scale Condensation Fraction on Uncertainty in Modeled Projections of Rainfall

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(paper with Charles S. Jackson and Benjamin M. Wagman, in review)

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Main idea: precip partitioning important for thinking about rainfall changes with GW

1. Models partition rainfall differently →
2. $f_{LS}$ correlates strongly with spatial rainfall response patterns, tropical circulation & energy fluxes
3. Relationships vary depending on model (CAM3/CAM5 show opposite behavior)
Spatial response with fLS

• At right, CAM3 rainfall response anomalies (i.e. global warming minus control, minus average response)
• Pattern inverts over Pacific
• Local responses flip (e.g. India)
• CAM5 very similar; CMIP5 less apparent (smaller sample size, greater scatter between models, dynamic oceans)
Quantifying/confirming relationships with $f_{LS}$

“ΔR” for CAM3
(high-$f_{LS}$ bin minus
low-$f_{LS}$ bin)

$\alpha(A) = A \cdot \Delta R'$
(Anomaly maps $A$ dotted into normalized $\Delta R$)
Control rainfall patterns in CAM3 and CAM5

CAM3

CAM5

Convective rain

Large-scale rain

(Shading represents one standard deviation for that bin)
CAM3 “Short-circuit mechanism”

Low $f_{LS}$ model

High $f_{LS}$ model

VQ

VQ
Conclusions

• $f_{LS}$ is strongly correlated to important aspects of modeled circulation and precipitation, particularly the response to global warming.

• The correlations are complex, depending on model details.

• Observationally, we don’t have a strong basis for knowing the equivalent of $f_{LS}$. 
Thank you for listening to my dad!

“Seth Stephens”
(collaborative project with Sarah Stephens, 2019)