ACME V1 Capabilities and Tropics Relevant V2 Roadmap - Atmosphere

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V1 Atmosphere – Capabilities

Increased Resolution

- 25km horizontal and 72 layers with top at ~ 60km, better resolved hori/vert structures

New Parameterizations

- Aerosols
  - MAM3 → MAM4
  - Revisions to convective transport, aerosol nucleation, scavenging to transport more aerosols to high latitude, aerosol resuspension, and sea spray aerosol
- Ice Microphysics
  - Conversion to precipitation; Ice nucleation (V2)
  - Subgridscale vertical velocity; Prexisting Ice (V3)
- Elevation Class Decomposition (sub-columns for atmosphere and land) (V3)
- Simple Ozone (linearized production and loss)
- Shallow Convection/Turbulence → CLUBB
- Convective Gustiness (V2)
- Cloud Microphysics → Morrison Gettelman version 2 (MG2)

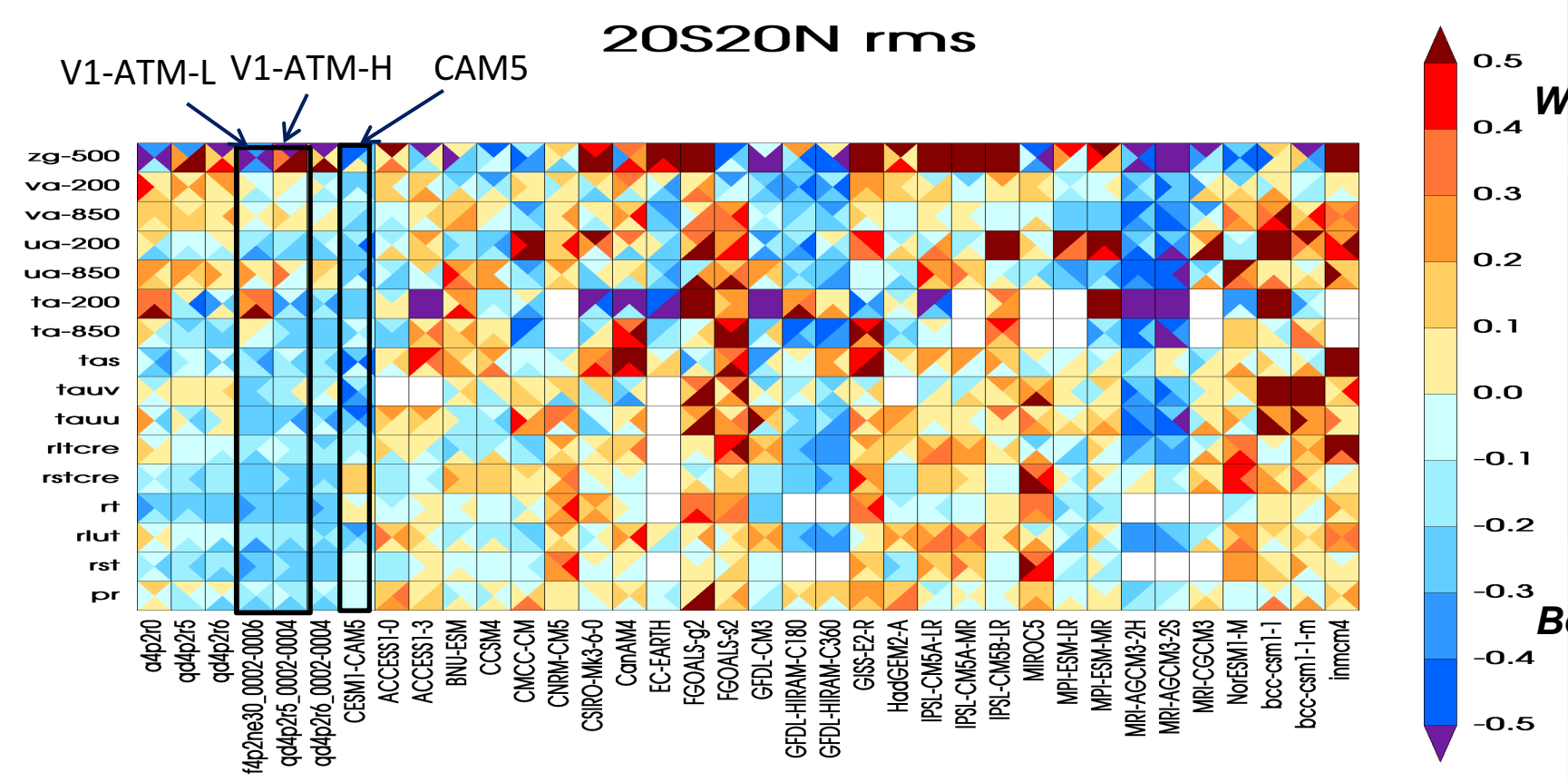
New Capabilities

- Regional Refined Model
  - RRM-CONUS
  - RRM-Arctic (V2)
- Short-term hindcast technique (CAPT) and Perturbed Parameter Ensemble (PPE)
- COSP – Satellite simulators and ARM radar simulator

New Features for V2 Atmos

- **RRM for Tropics (Erika Roesler)**
  - Create Tropics Grid, develop mapping files, topography, initial condition files, BC files
  - Perform superficial assessment of simulation fidelity for F2000 forcing
- **Potential new science developments**
  - BC/Dust in snow
  - Ice nucleation – mixed-phase clouds, code is ready (**Kai Zhang, Xiaohong Liu**)
  - Convective gustiness – tropical precipitation and variability, code in the V1 (**Po-lun Ma, Rich Neale, Bryce Harrop**)
  - Improvements originally intended for V3 that appear to be ready early, be mature, that might benefit V2 science, e.g.
    - Skewness treatment in CLUBB to improve trade-cu to strato-cu transition (**Po-Lun Ma, Vince Larson**)
    - Coupling ocean DMS and MOA emissions with the atmosphere (**Susannah Burrows, Philip Cameron-smith**)
- **Diagnostics for Tropics**
  - **Tier 1b**
  - **Other unique diagnostics specifically relevant to the Tropics science questions**

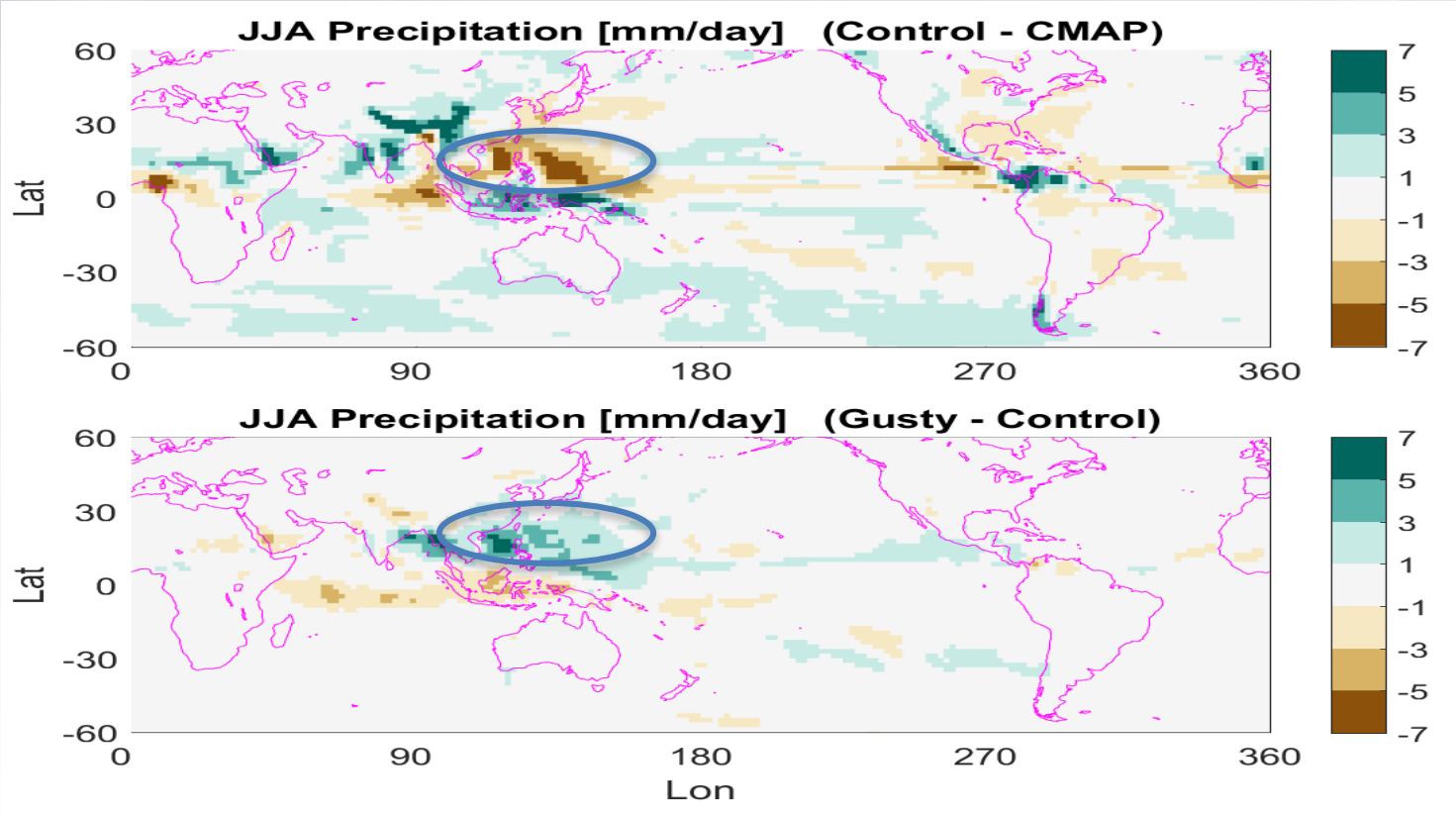
V1 Atmos – Better Than Most CMIP5 Models



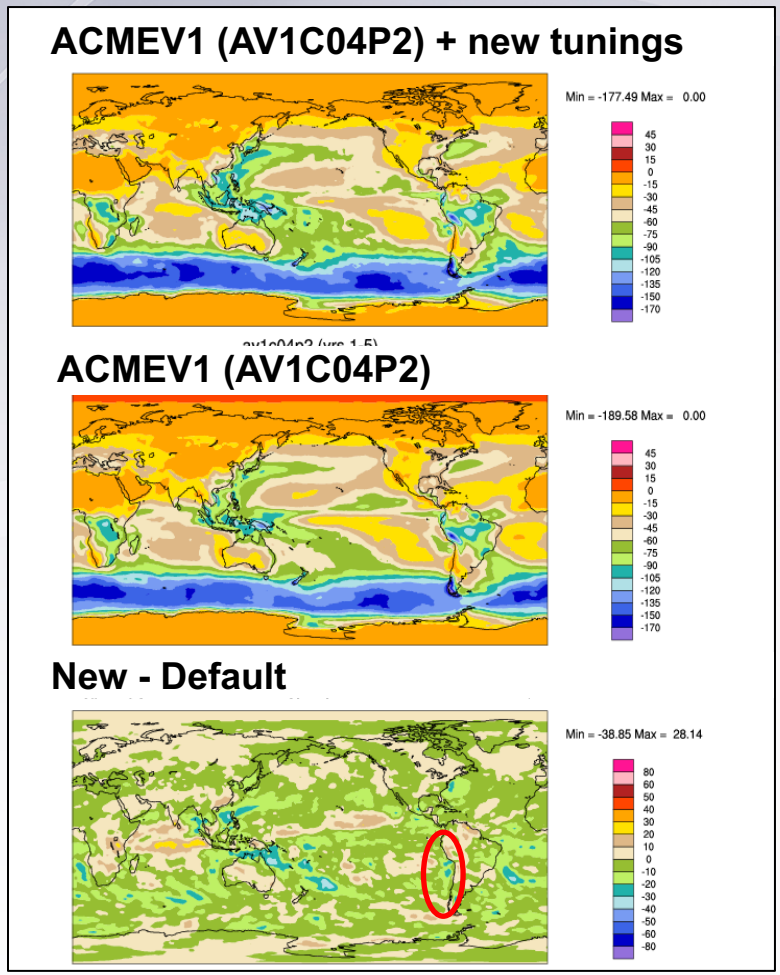
- Compared to CAM5:
  - Overall improved simulation of cloud, radiation, and precipitation
  - Slightly worse in large-scale circulation
- Better than most of the CMIP5 Models

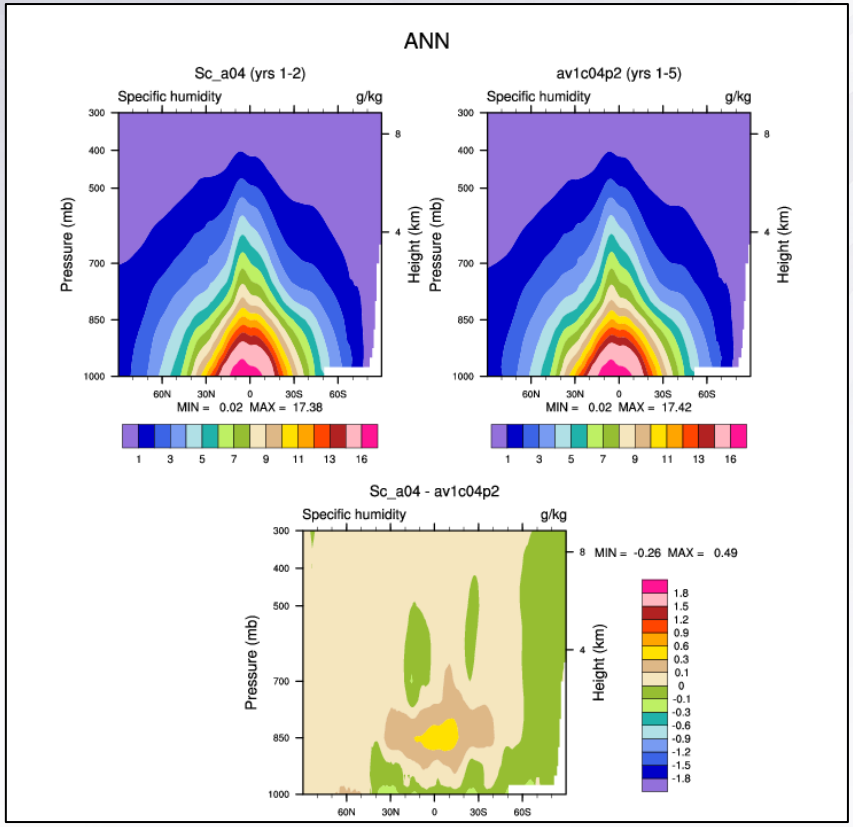
Tropical Precipitation Simulated with A Convective Gustiness Scheme

The parameterization is based on the Redelsperger (2000) empirical relationships between tropical convective activity and convective its associated mean near-surface wind.



Skewness treatment in CLUBB to improve the Coastal Stratocumulus





Bias of vertical distribution of moisture in ACMEV1 (AV1C04P2) is also reduced.

Extra Slides

ACME V2-Tropics Science Questions

- ACME V2 – Tropics (w/ NGEE-Tropics)
  - Water cycle/cryosphere: How do soil-plant-atmosphere interactions influence **water recycling in tropical forest and plant** response to the perturbations such as LULCC? What are the local and remote influence of the plant response in the **Amazon**?
  - Biogeochemistry: What are the relative influence of plant phenology and vegetation dynamics of tropical forests on cycling of carbon in the **Amazon**?

From ACME V2/V3 Plan (Lueng et al. 2017)

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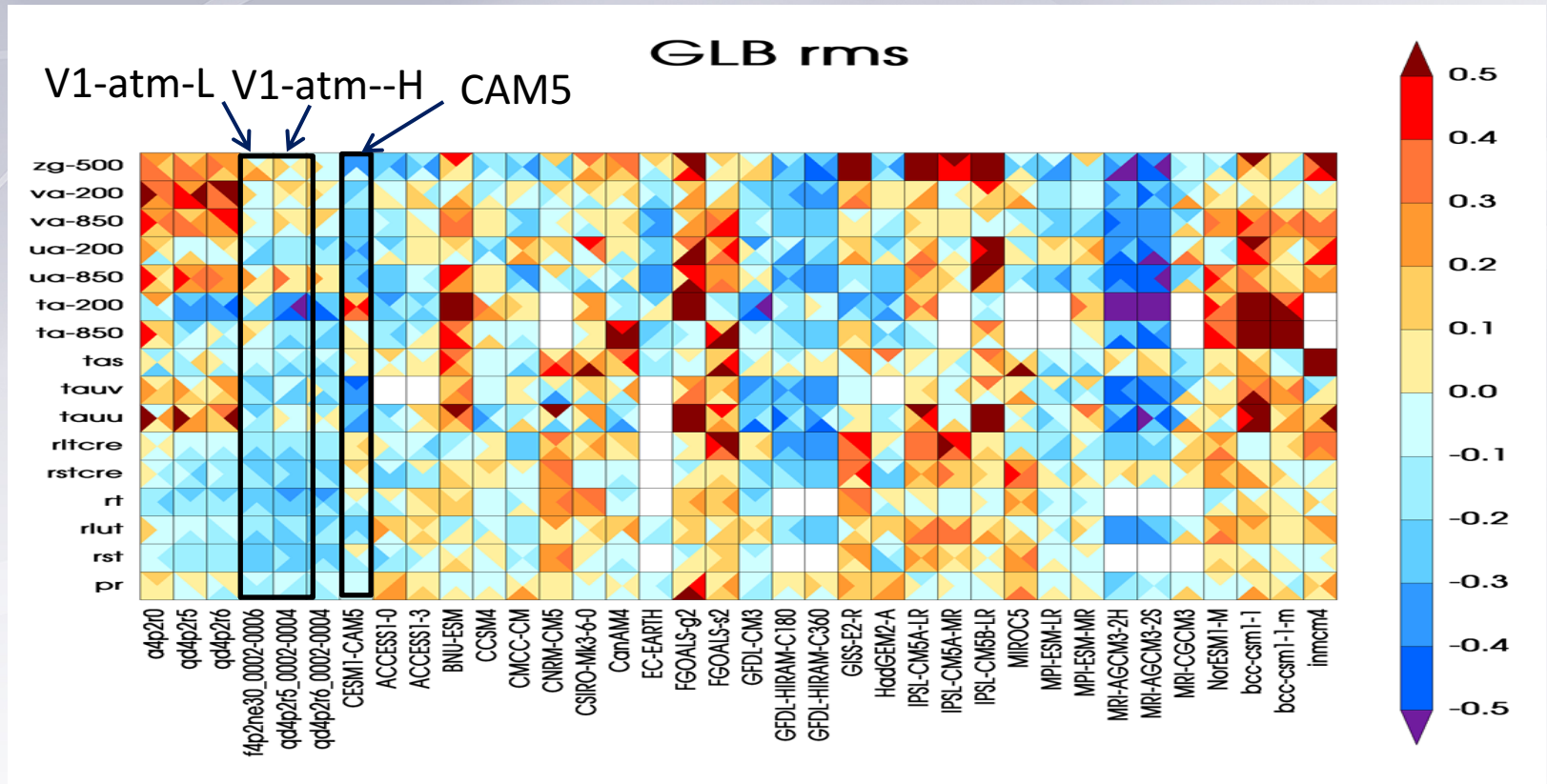

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