(Very) preliminary changes in high-resolution tropical cyclone climatology in CAM5.5

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(with Pete Bogenschutz, Patrick Callaghan, Julio Bacmeister, Andrew Gettelman, John Truesdale etc…)

Atmospheric Modeling Working Group
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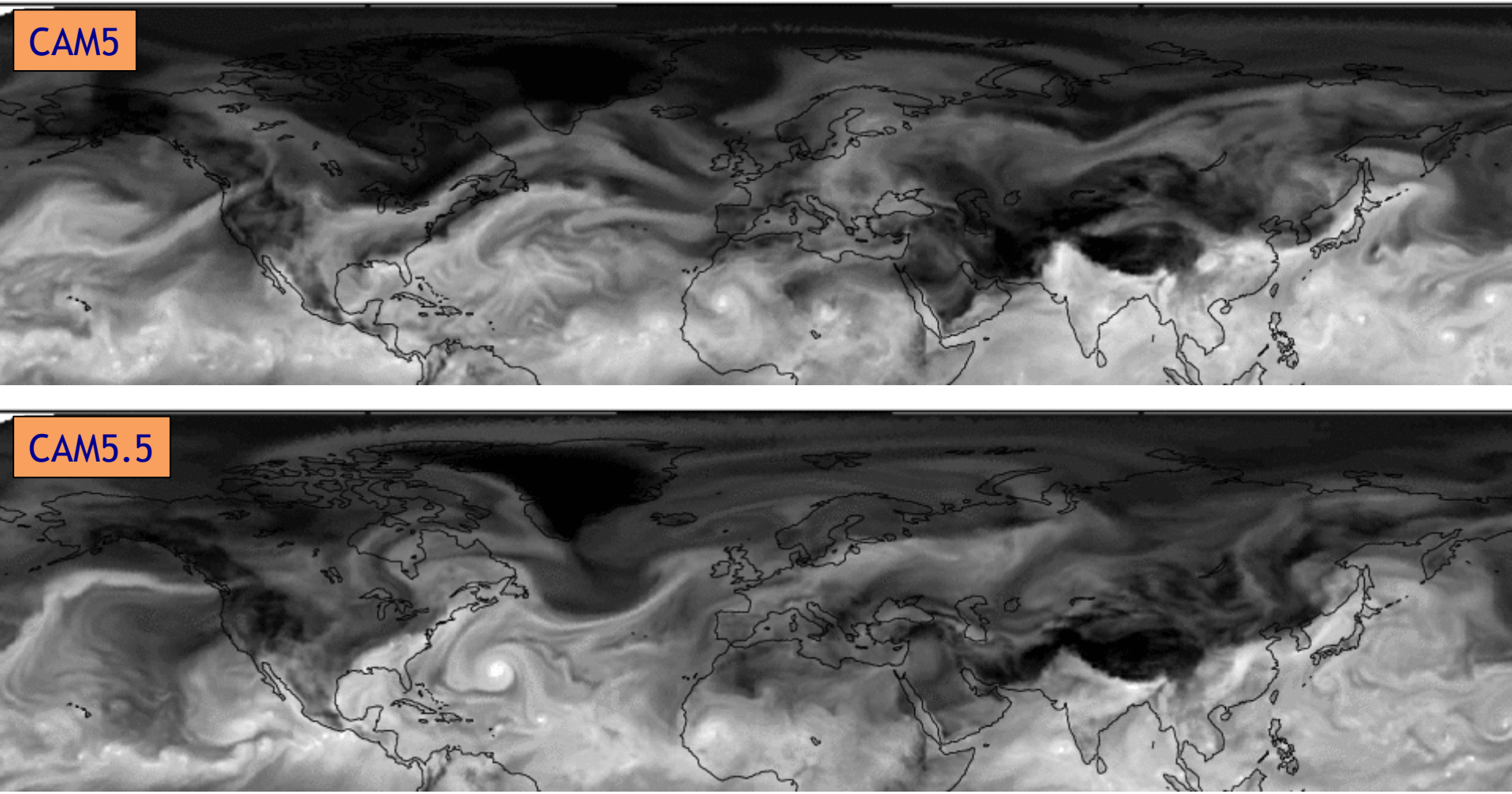
Overview

- Simulation overview:
  - AMIP configuration (F compset, prescribed SSTs)
  - CAM5(.3) – Previous AMIP simulations (20+ years)
  - CAM5.5 – 2 years of ne120 (28km) (SSS caveats!)

Physics	CAM5	CAM5.5/6/CLUBB
Deep convection	Zhang and McFarlane	Zhang and McFarlane
Shallow Convection	Park and Bretherton	CLUBB
PBL	Bretherton and Park	CLUBB
Macrophysics	Park	CLUBB
Microphysics	MG1	MG2

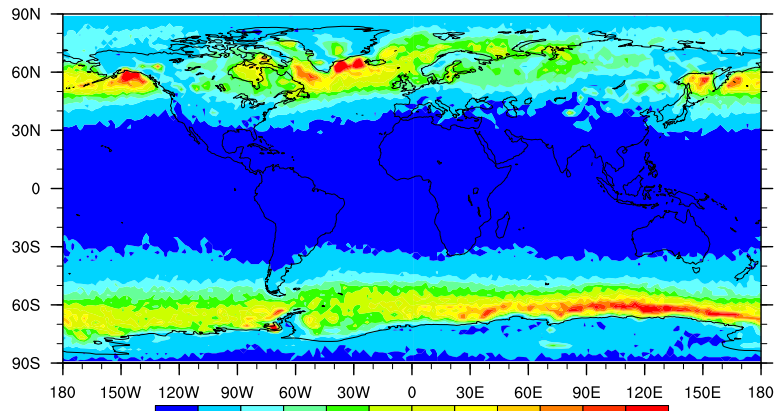
Precipitable water eye candy

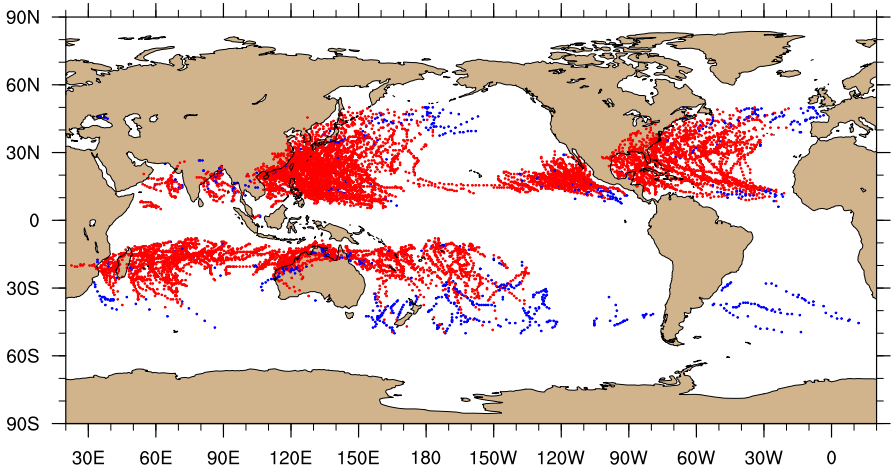


3 week TMQ loop, September

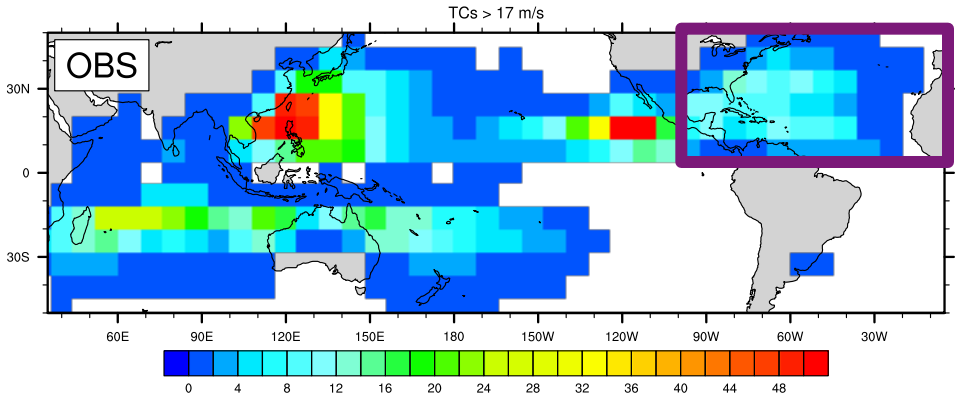
TempestExtremes

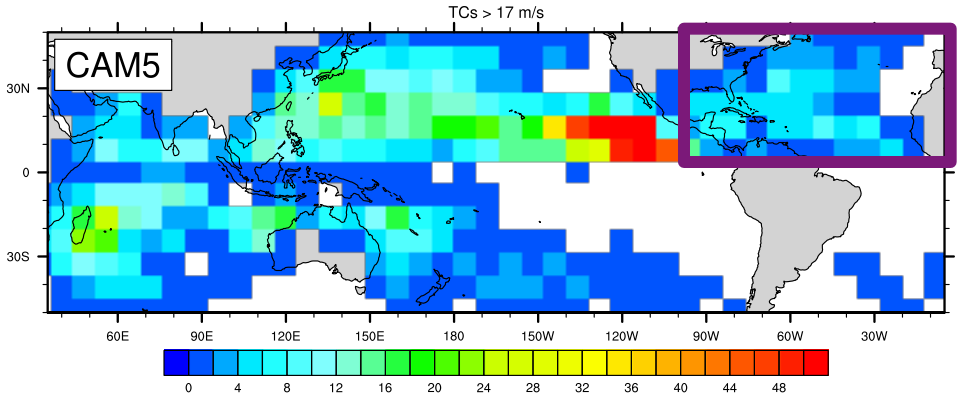
- New objective tracking algorithm for climate models (Ullrich *et al.*, in prep.)
- C++, time-parallel, lightweight
  - One year of ne120 SE data in 2 minutes (parallelized to 12 cores)
- **Runs on unstructured grids (CAM-SE, MPAS) without regridding**
- Operates on great circle distances
- Allows for local min/max, closed contour criteria, spatial offsets…
- Flexible command line inputs, user-customizable I/O
- Adding capability to do "blobs" or other area-specific features (MCCs, heat waves, atmospheric rivers)
- Ask me if interested in using on Yellowstone/Geyser
- Available at: **https://github.com/paullric/tempestextremes**

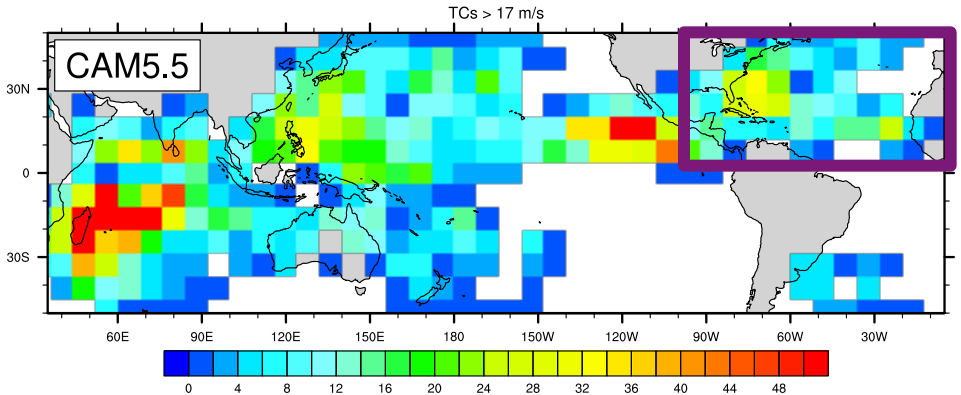




Track density







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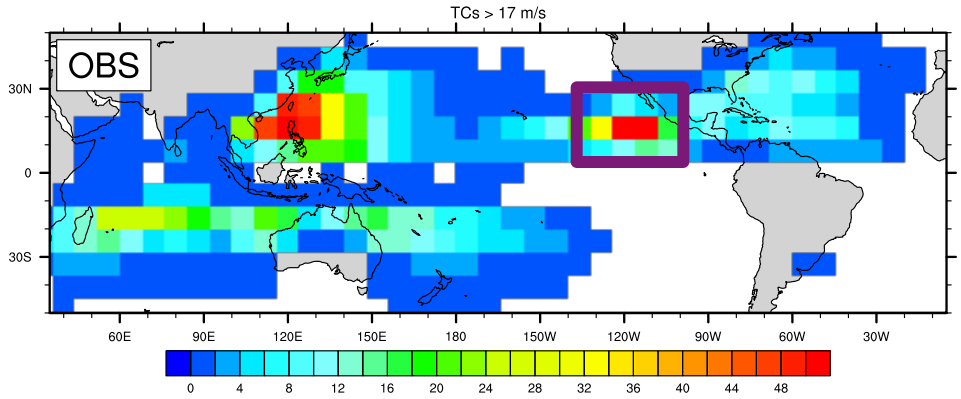

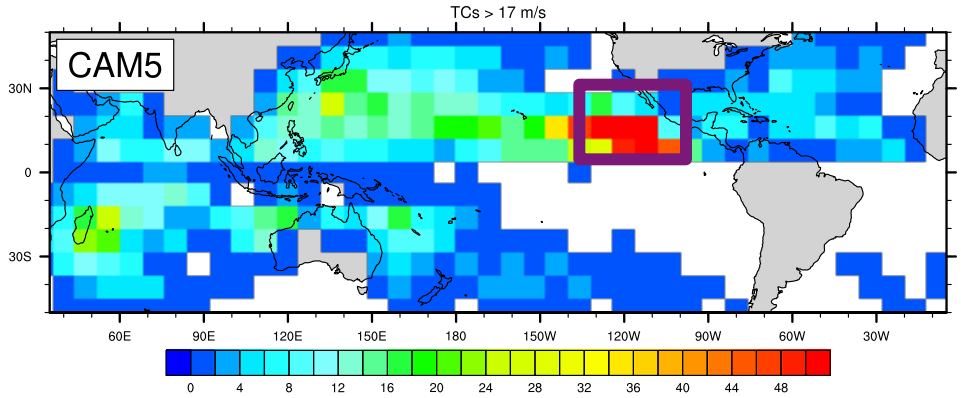

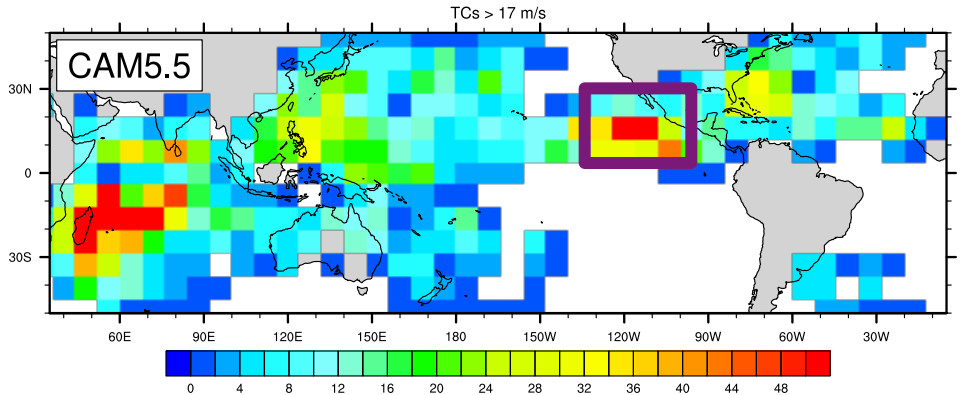

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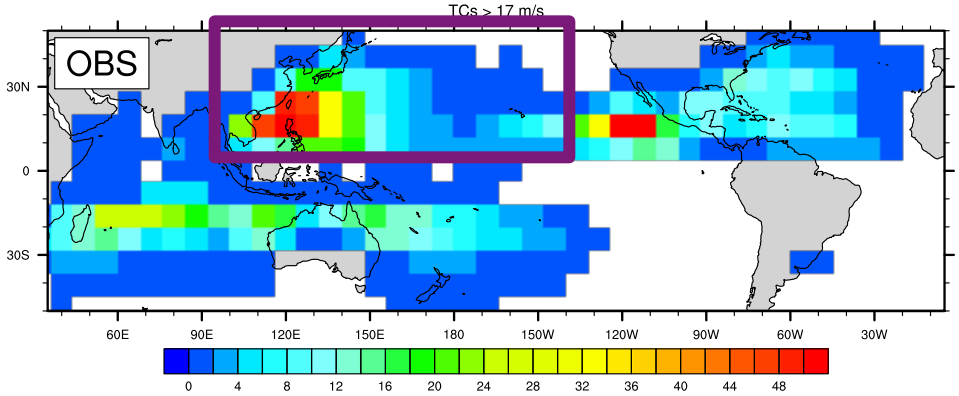

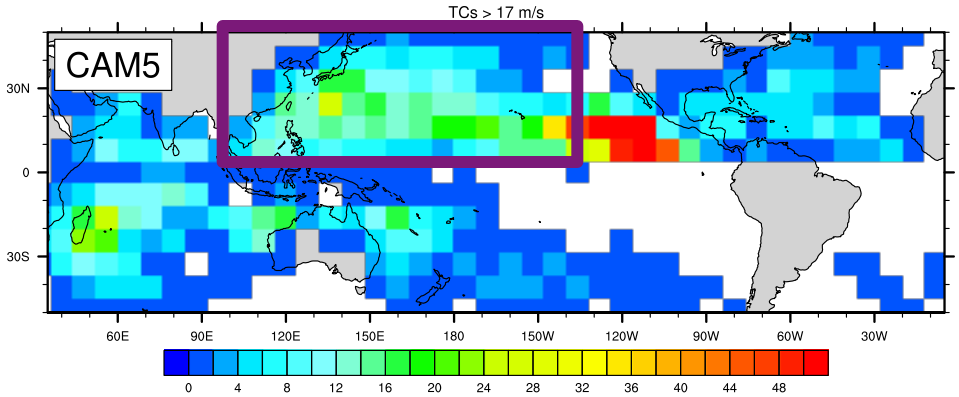

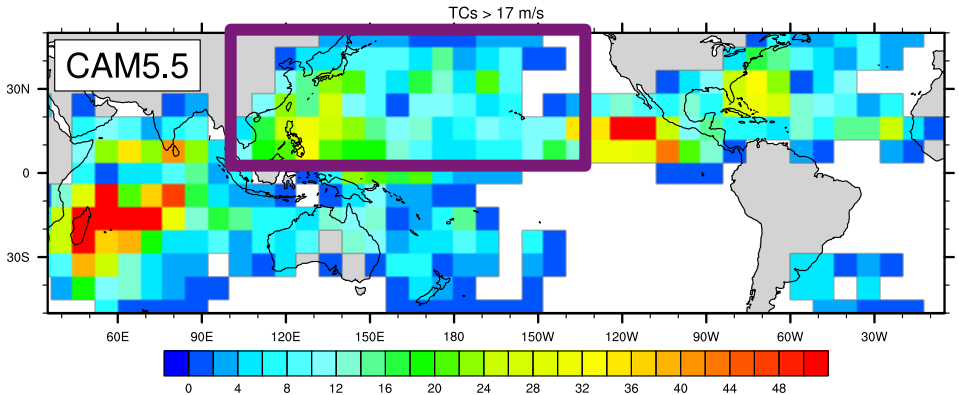

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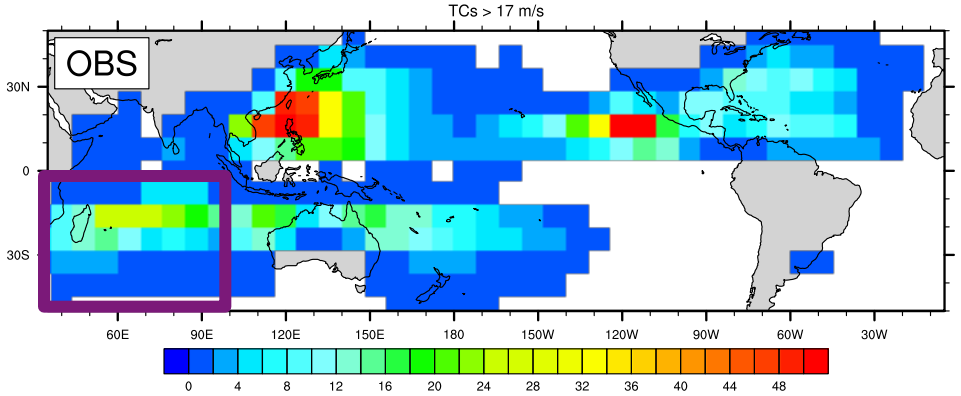

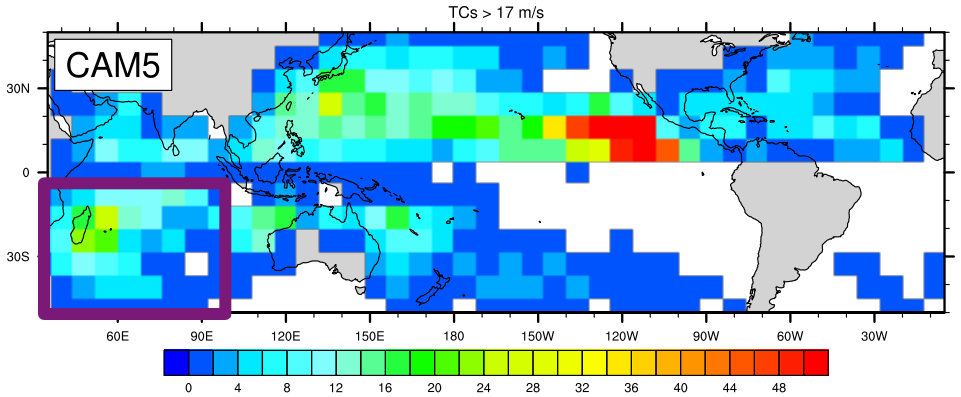

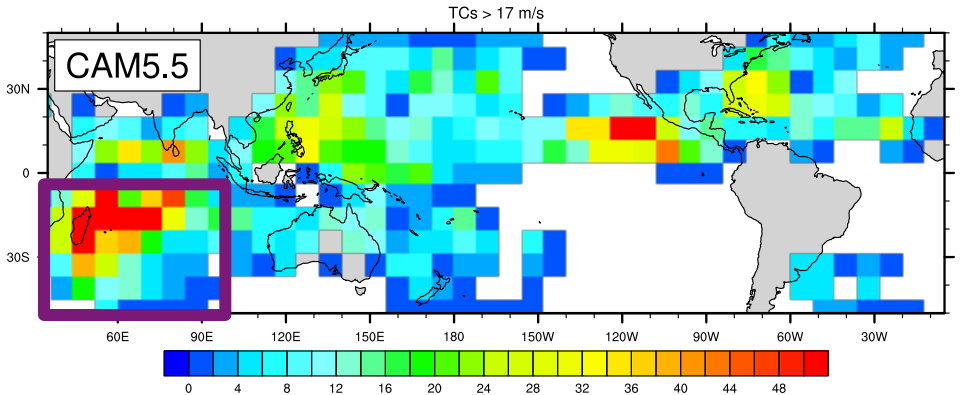

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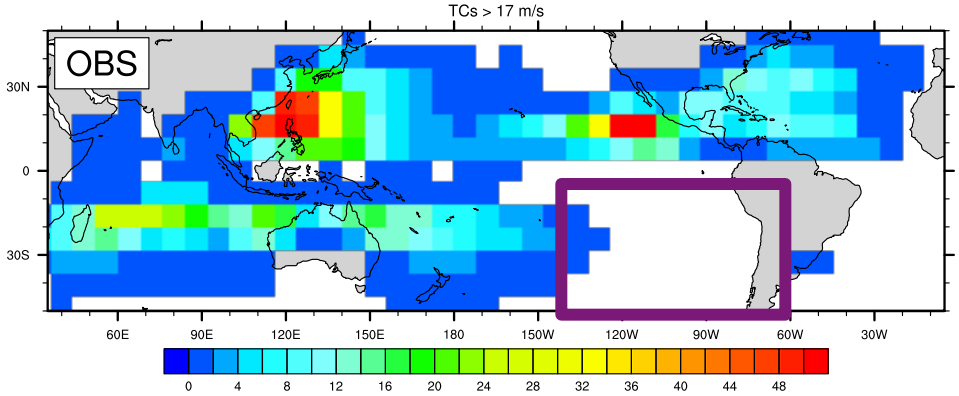
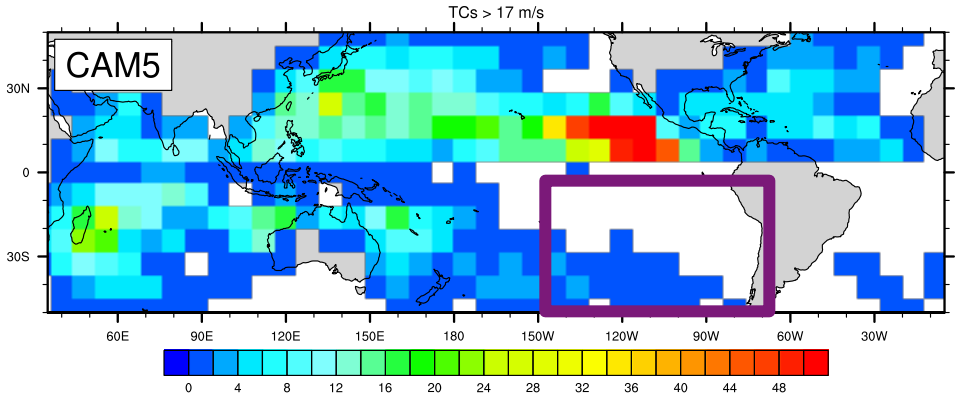
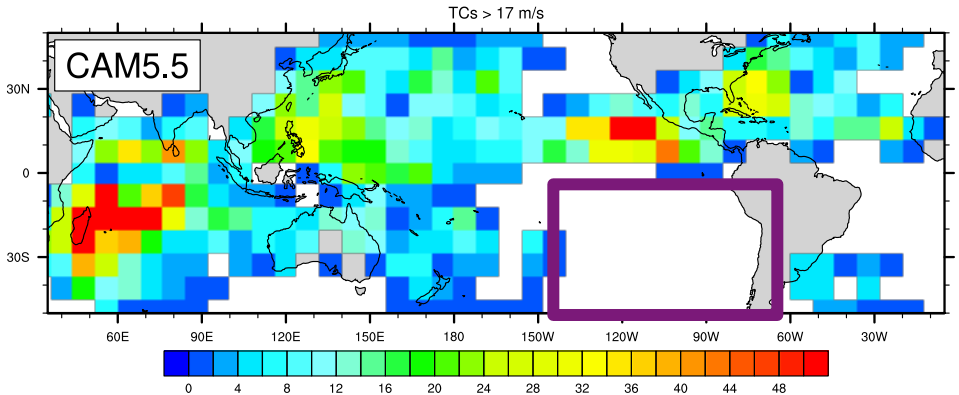
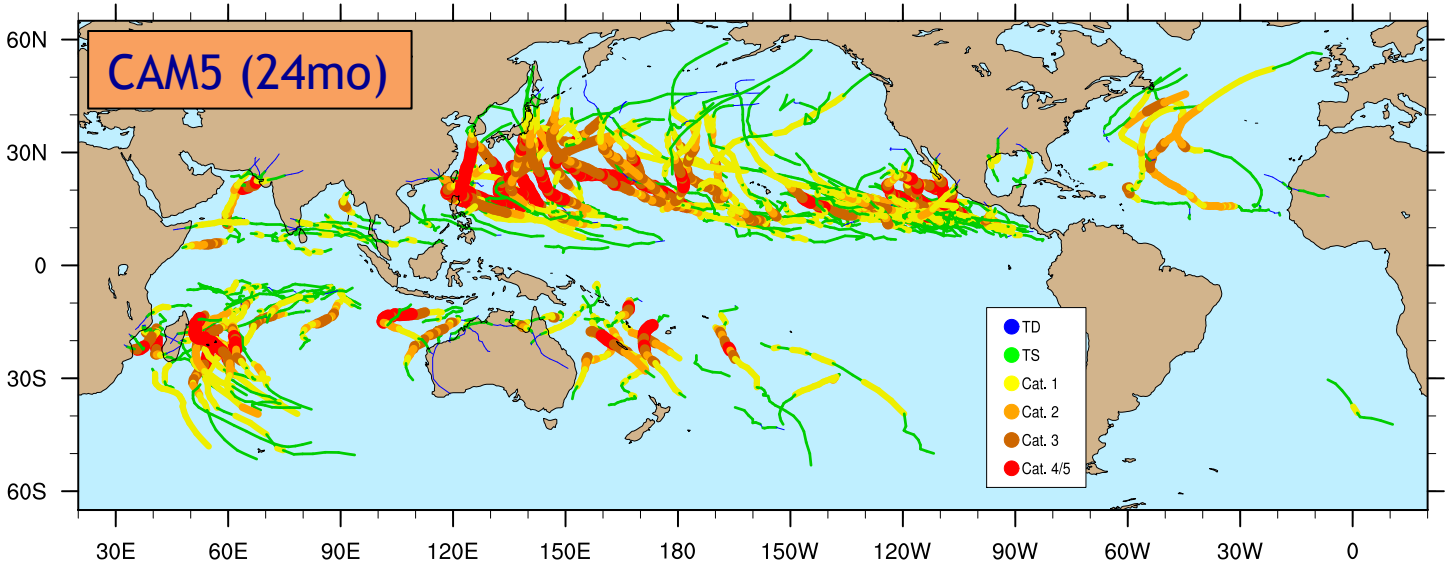
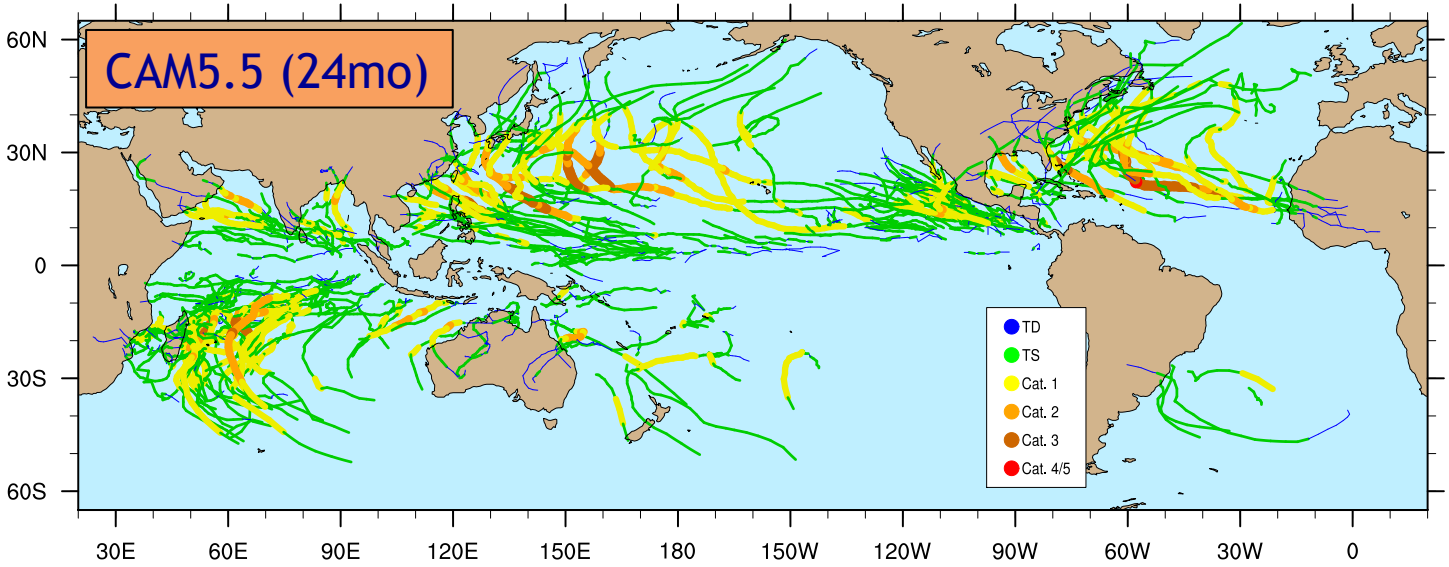






Trajectories





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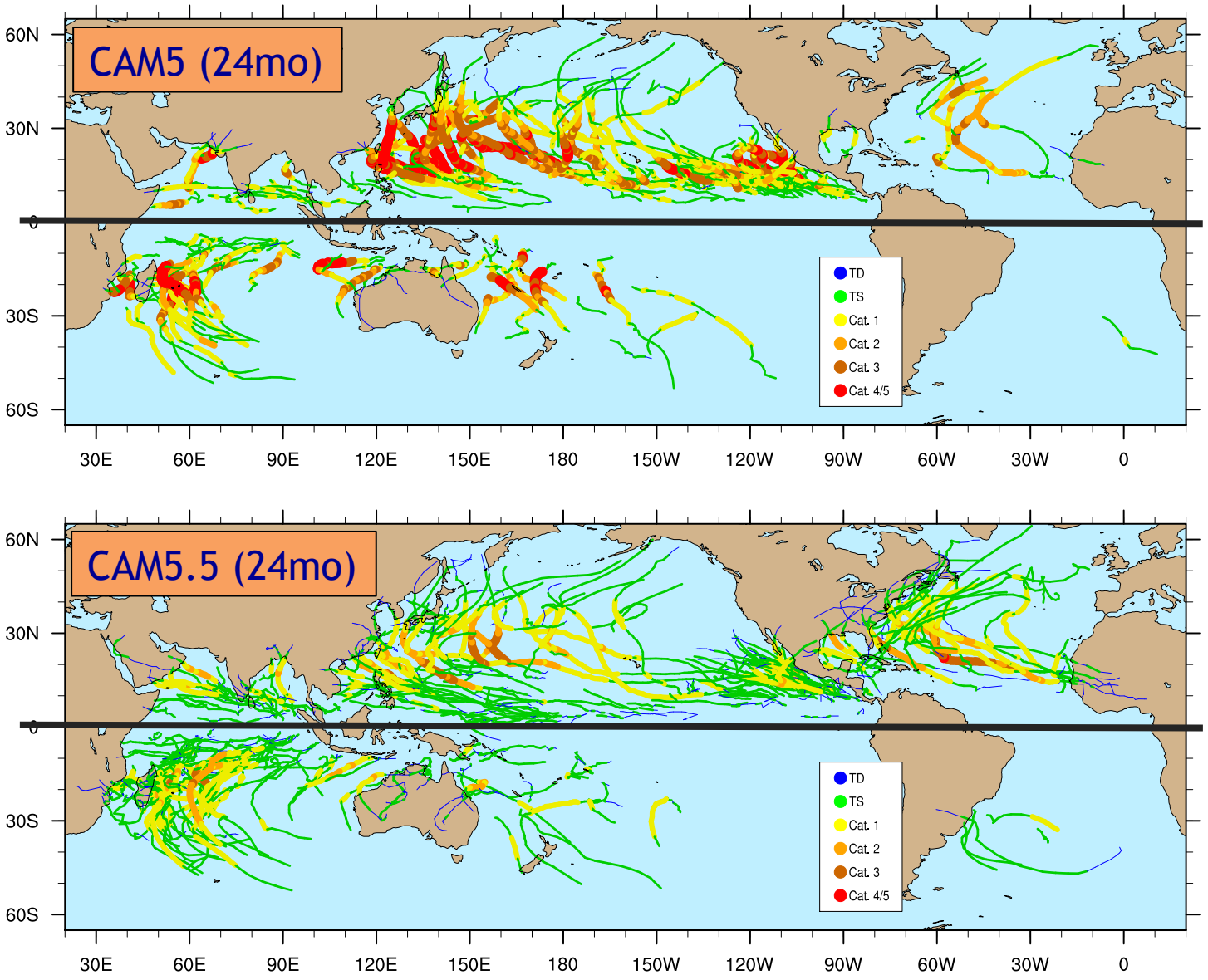
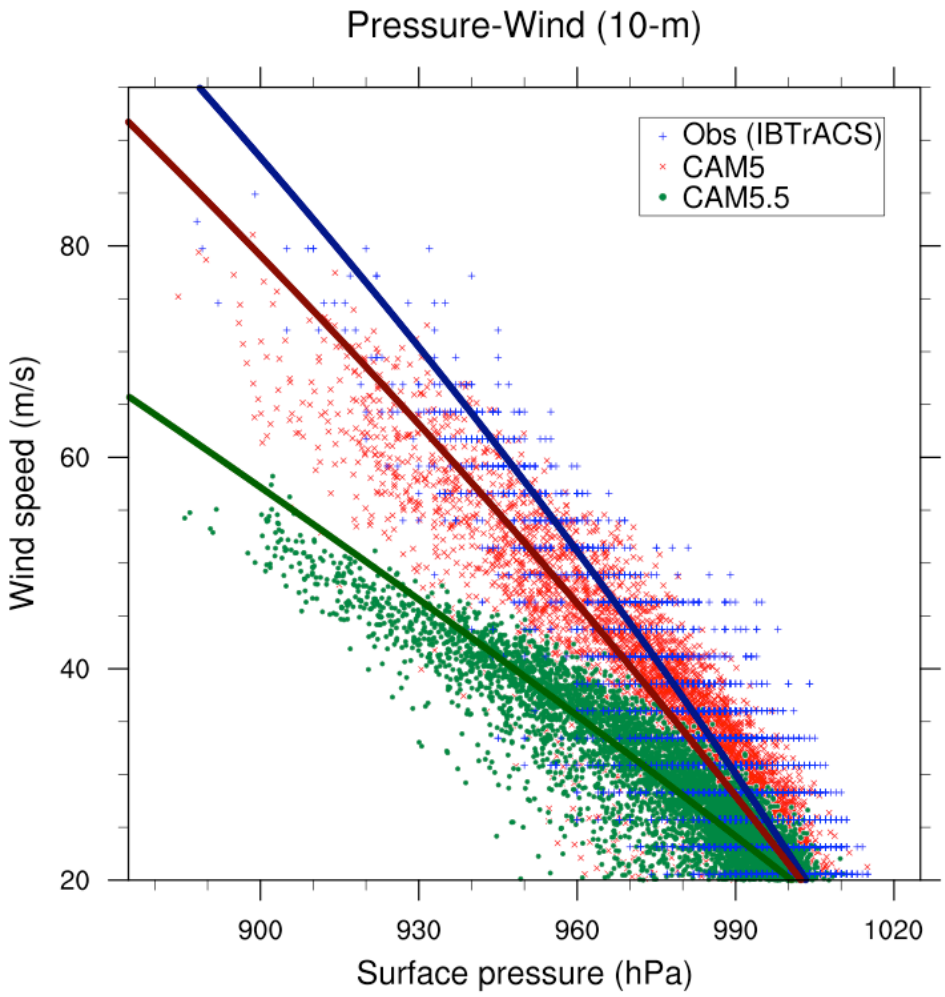


Pressure-wind curves



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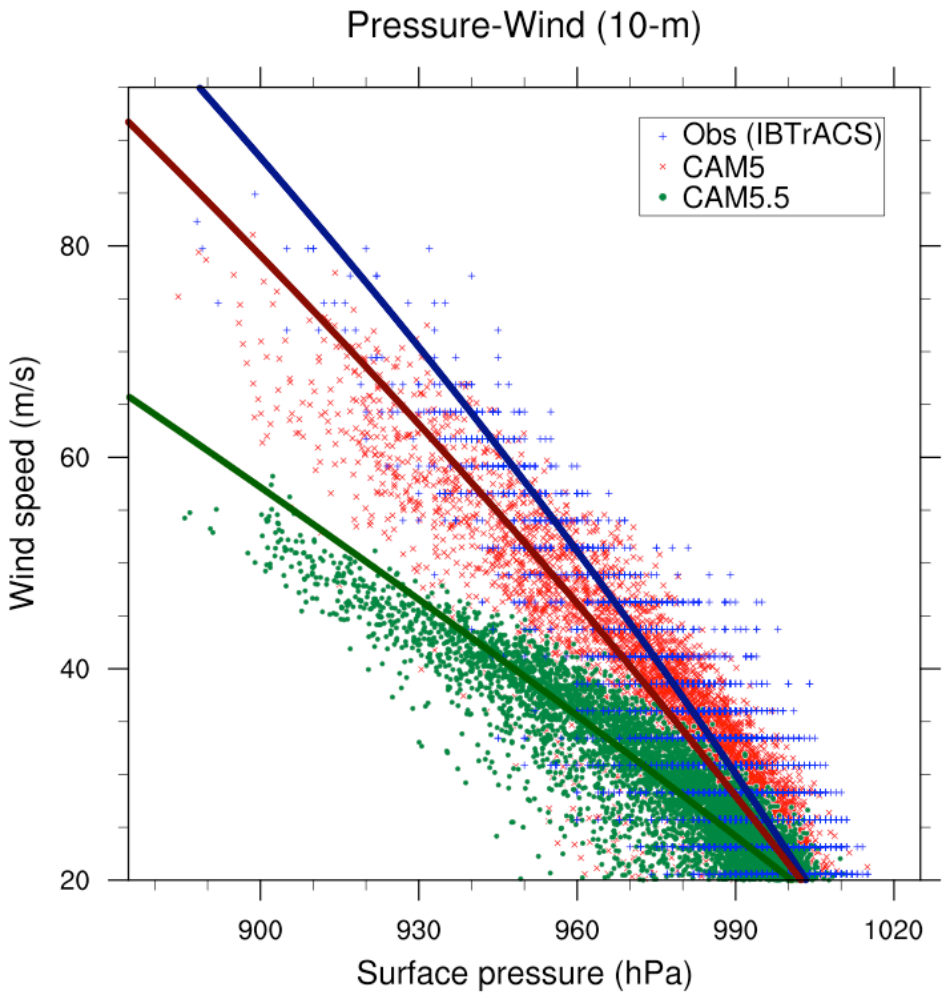
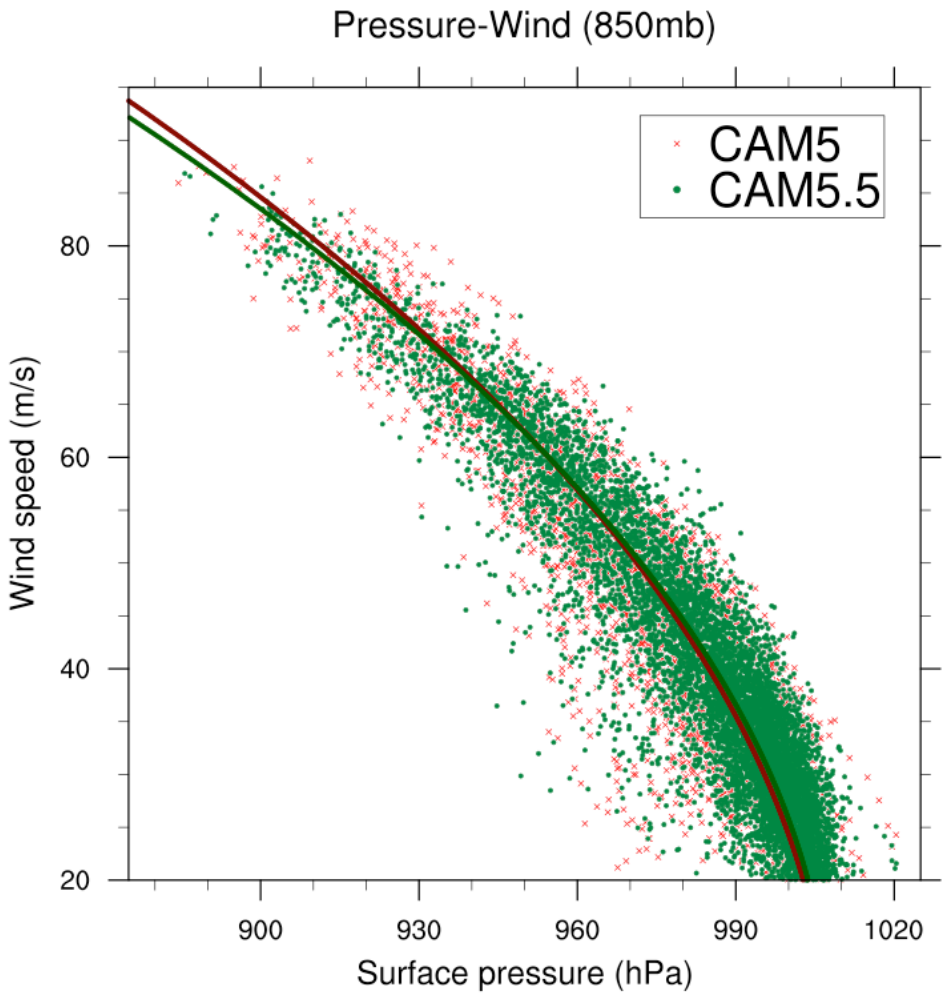
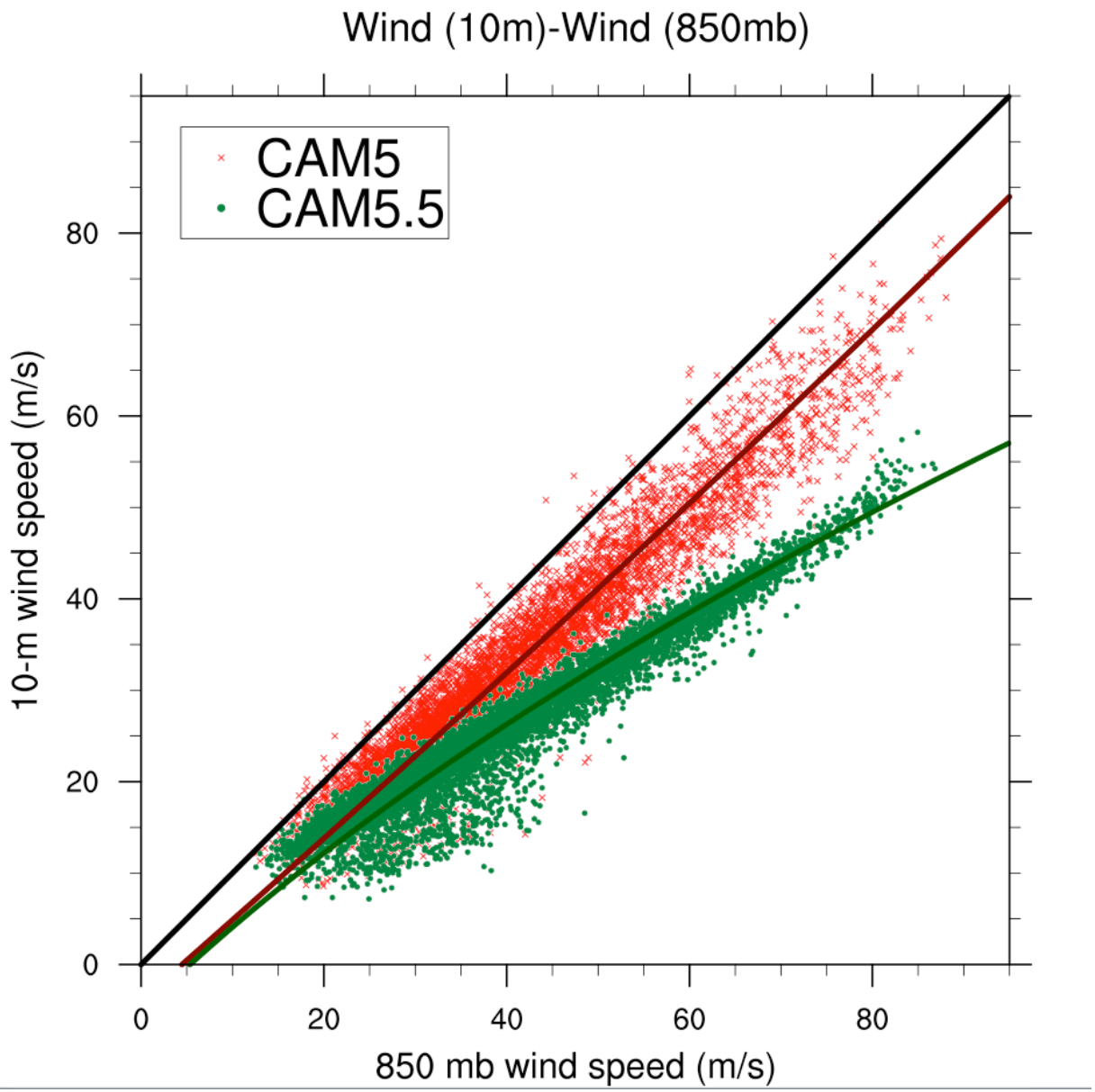


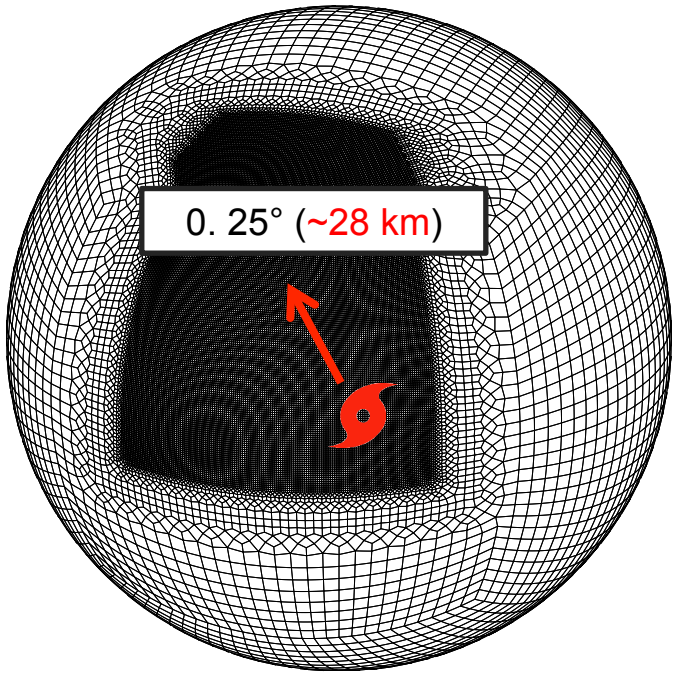


850mb-10m wind shear



Idealized sensitivity ensembles

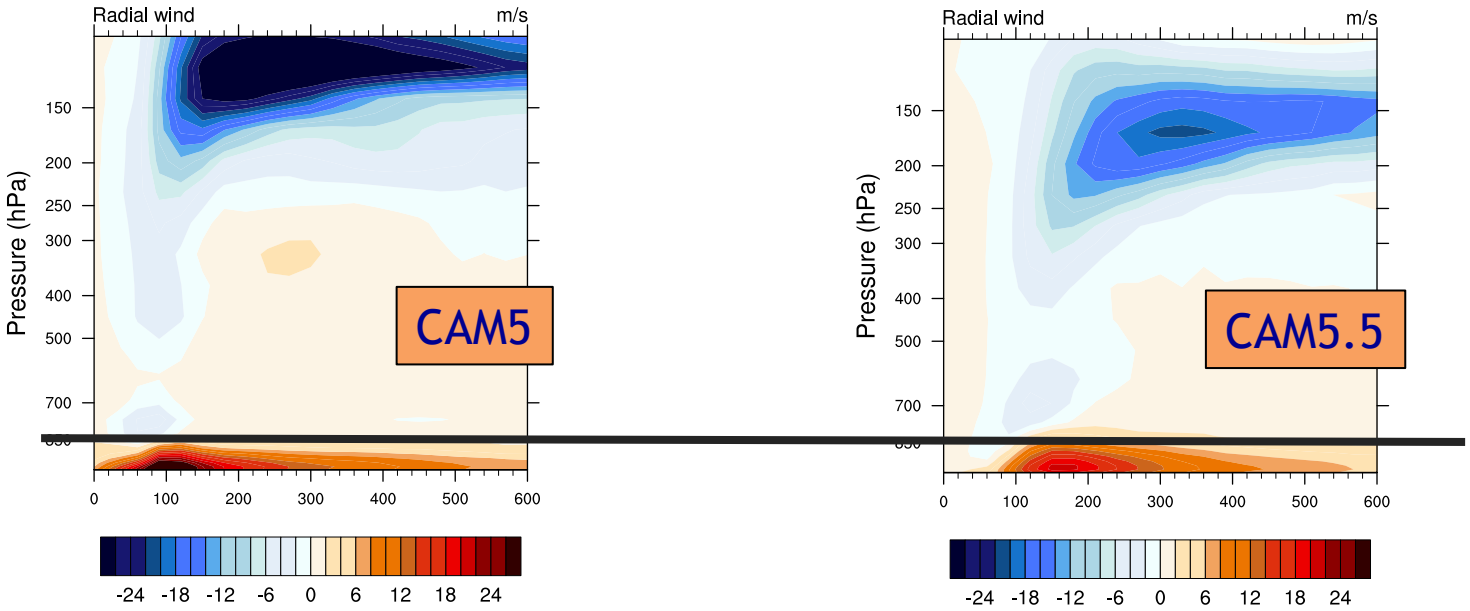
- Idealized experiment
- Initialize with warm core vortex on aquaplanet using variable-resolution CAM-SE
- Allows for deterministic experiments



Model configuration:

- Aquaplanet
- Δt = 900 sec / default tunings
- SST = 29° C
- Reed-Jablonowski (2012) DCMIP TC
- TC initialized at 10°N
- Tropical vertical temperature/moisture profiles
- No background flow, beta drift

Wind structure



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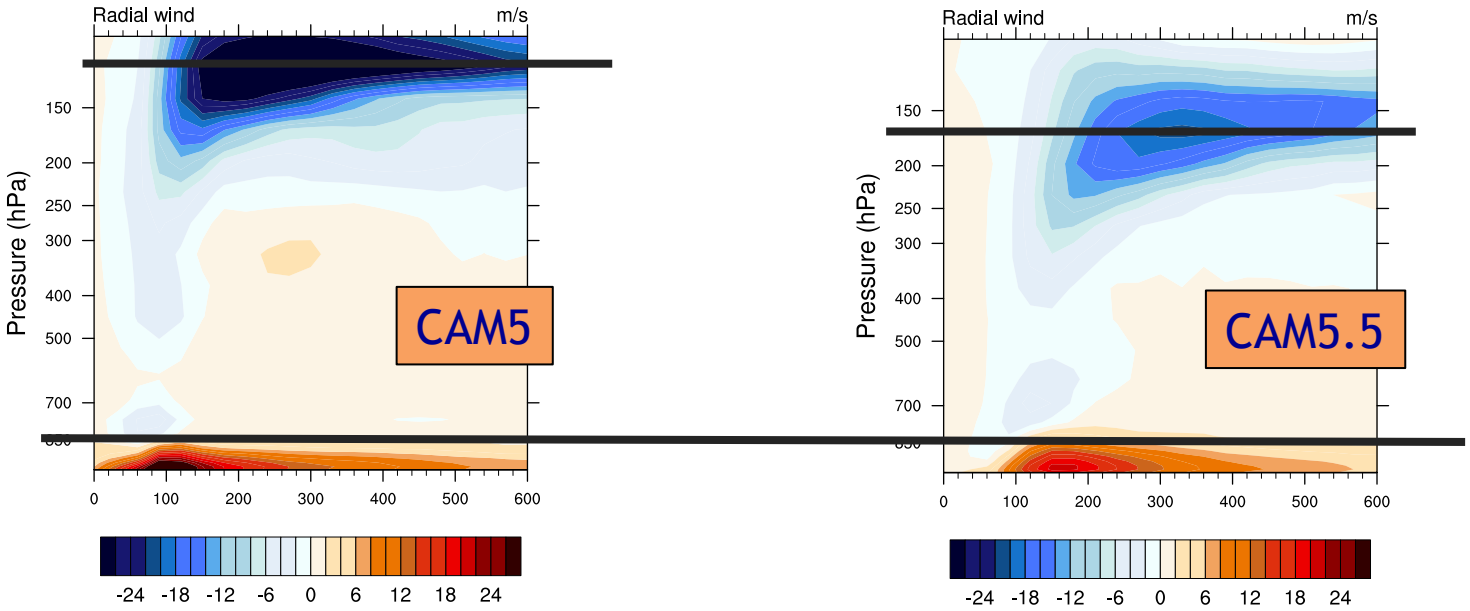
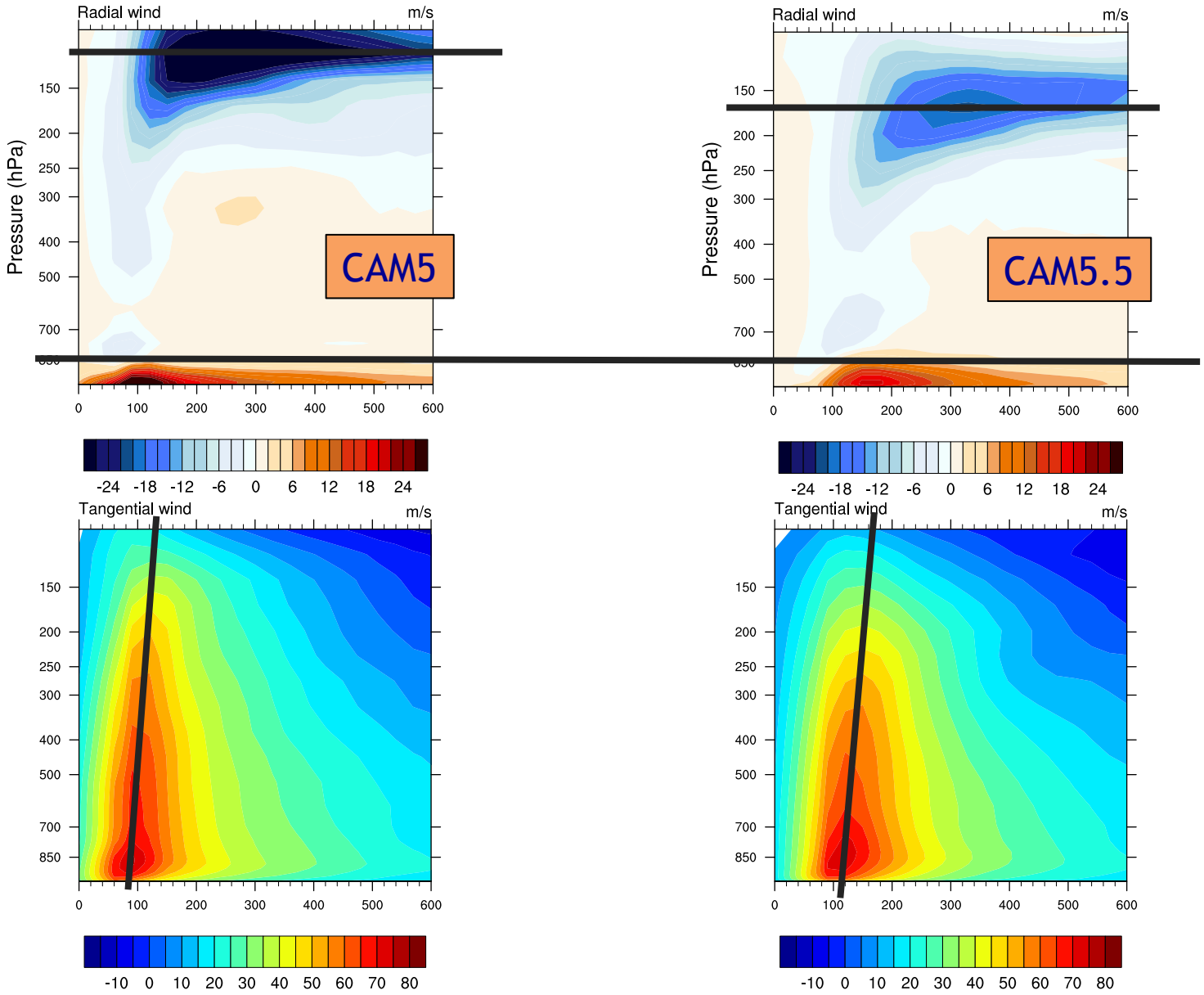
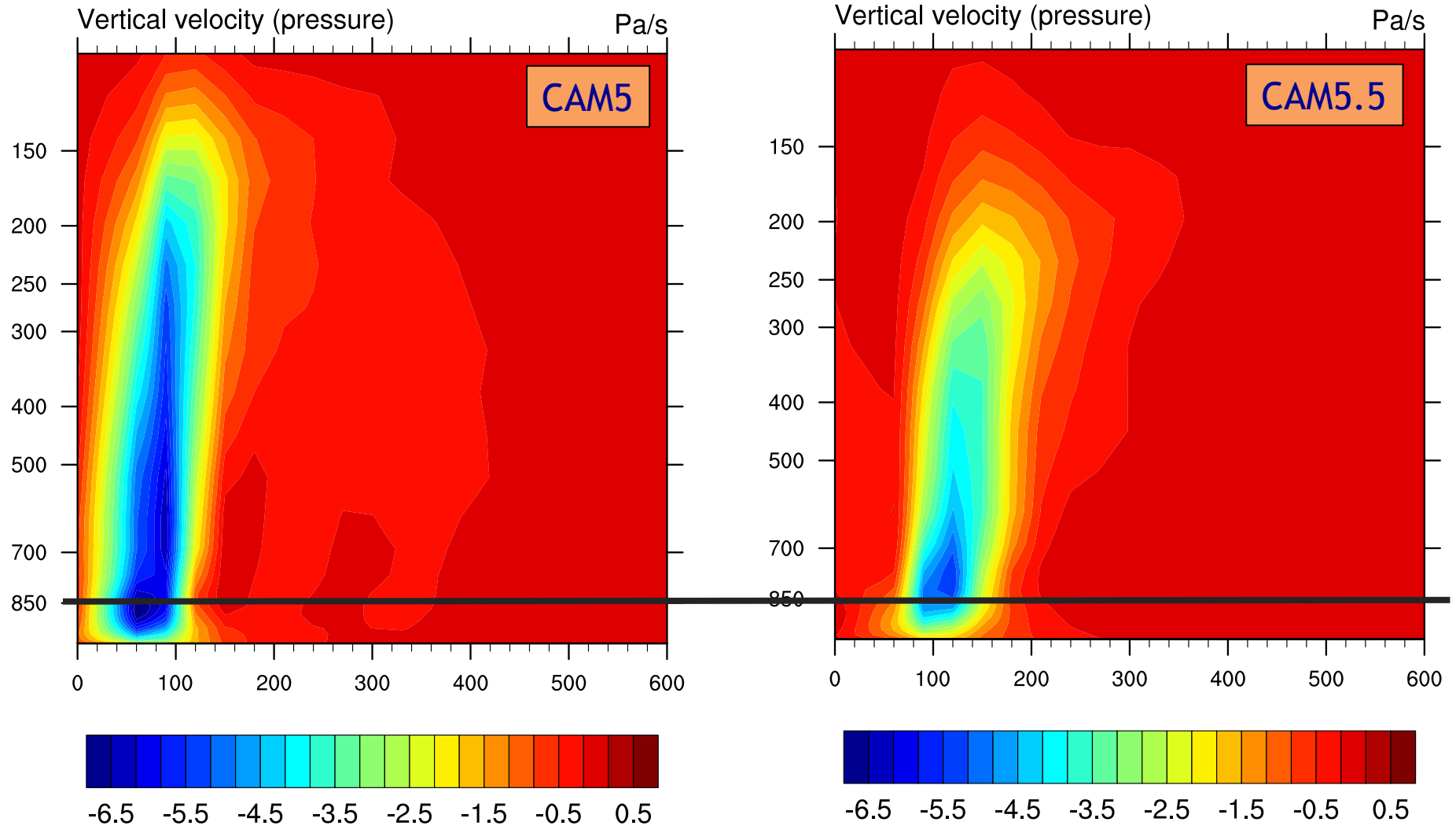


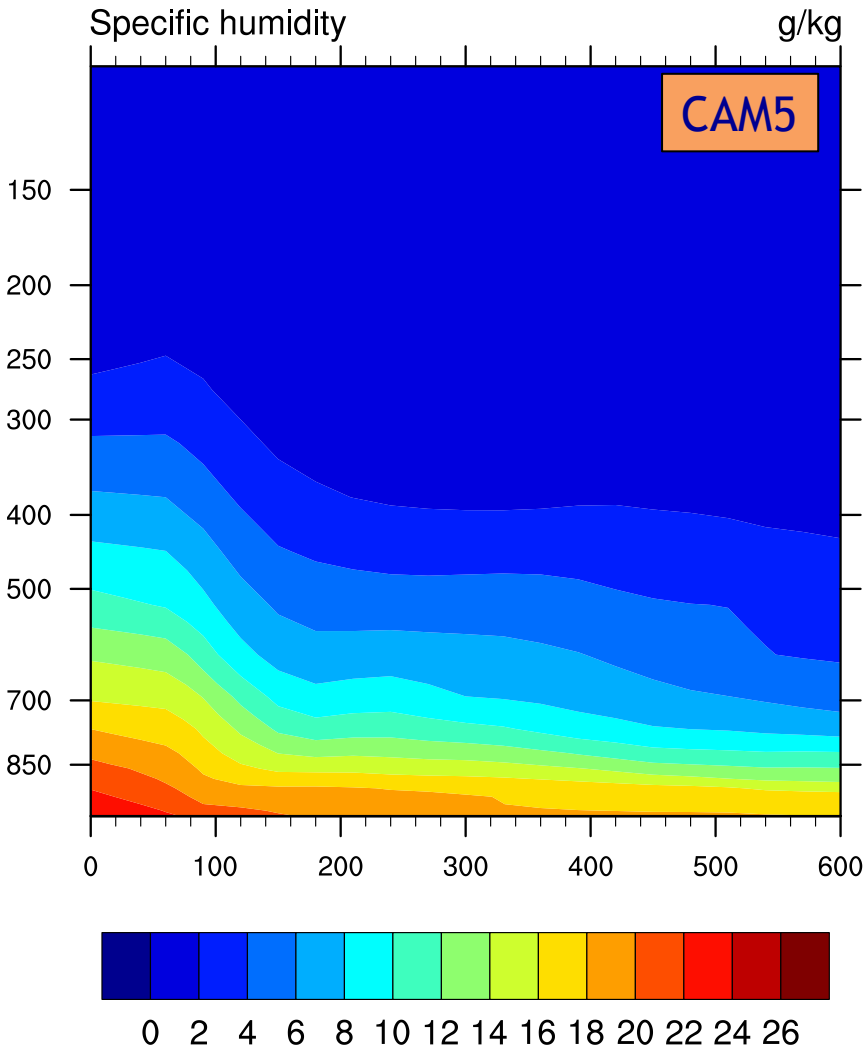
Wind structure

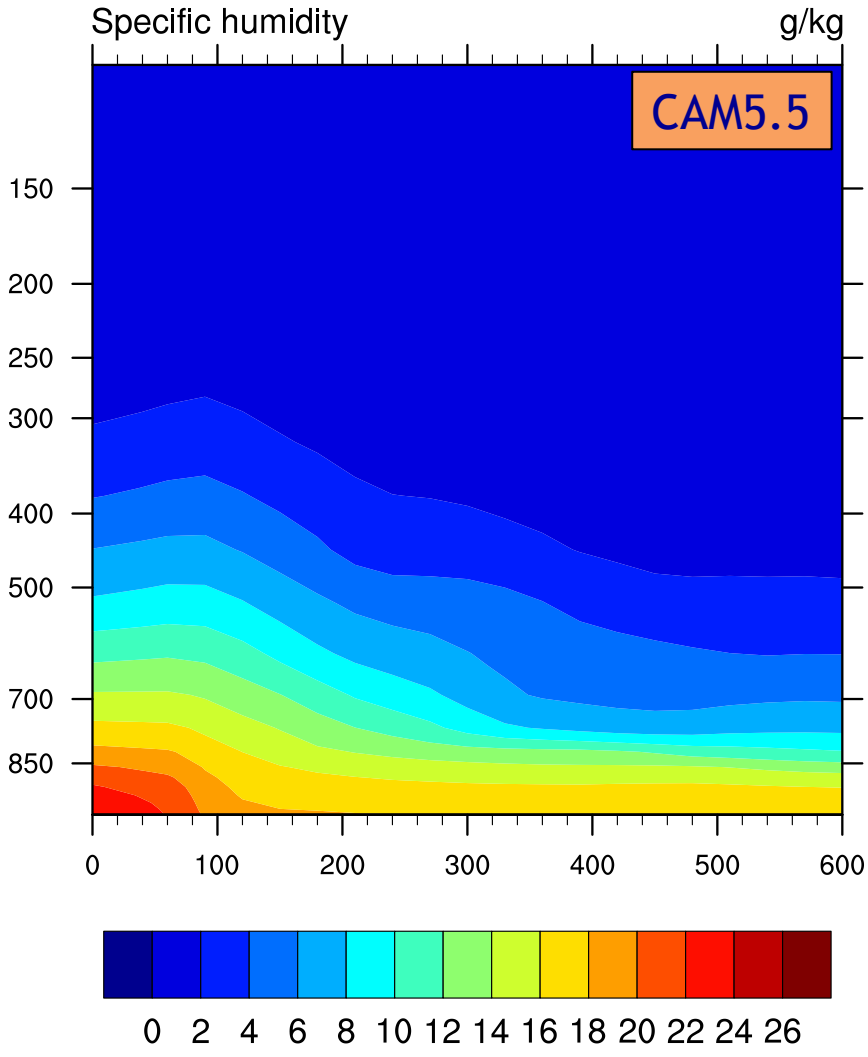


Vertical velocity

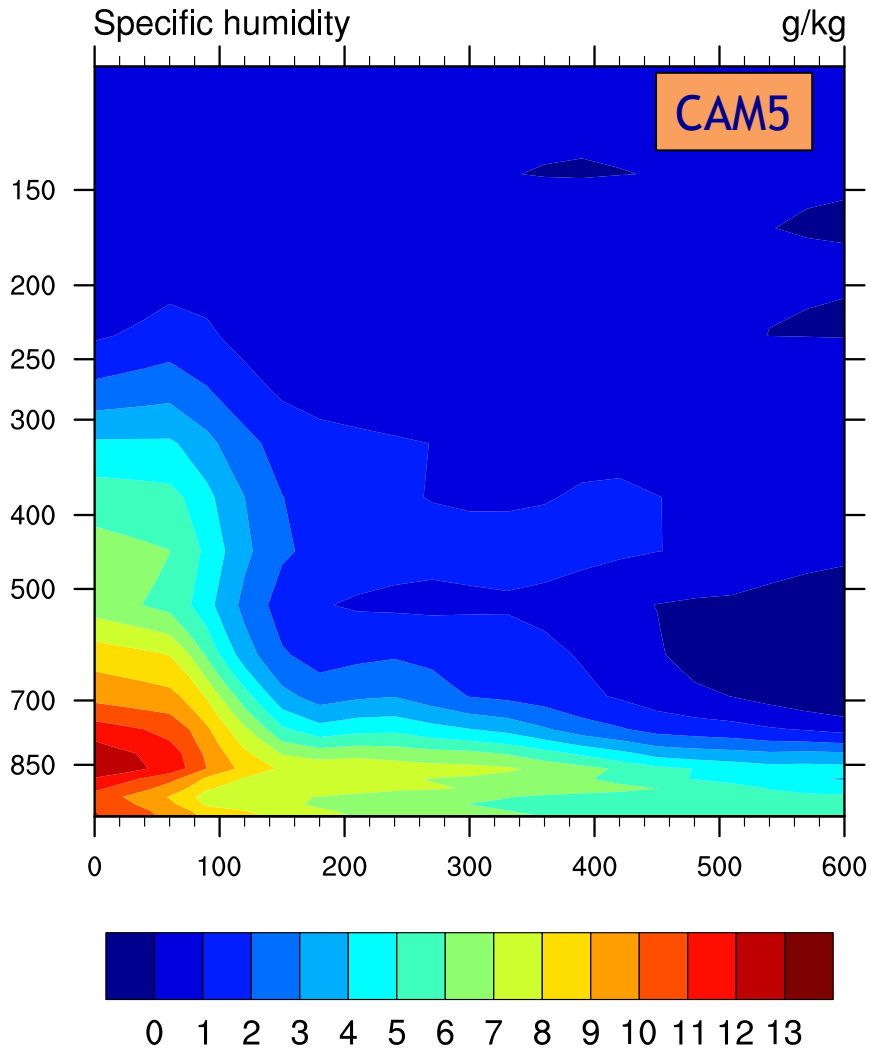


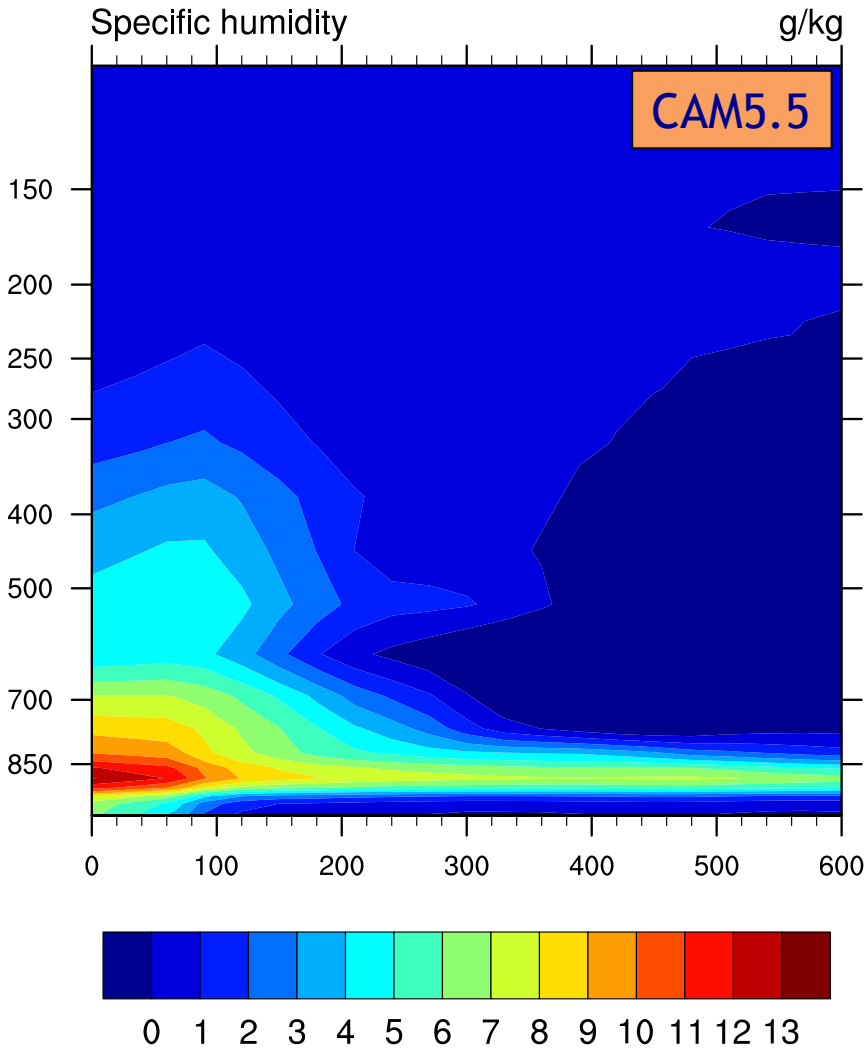
Specific humidity



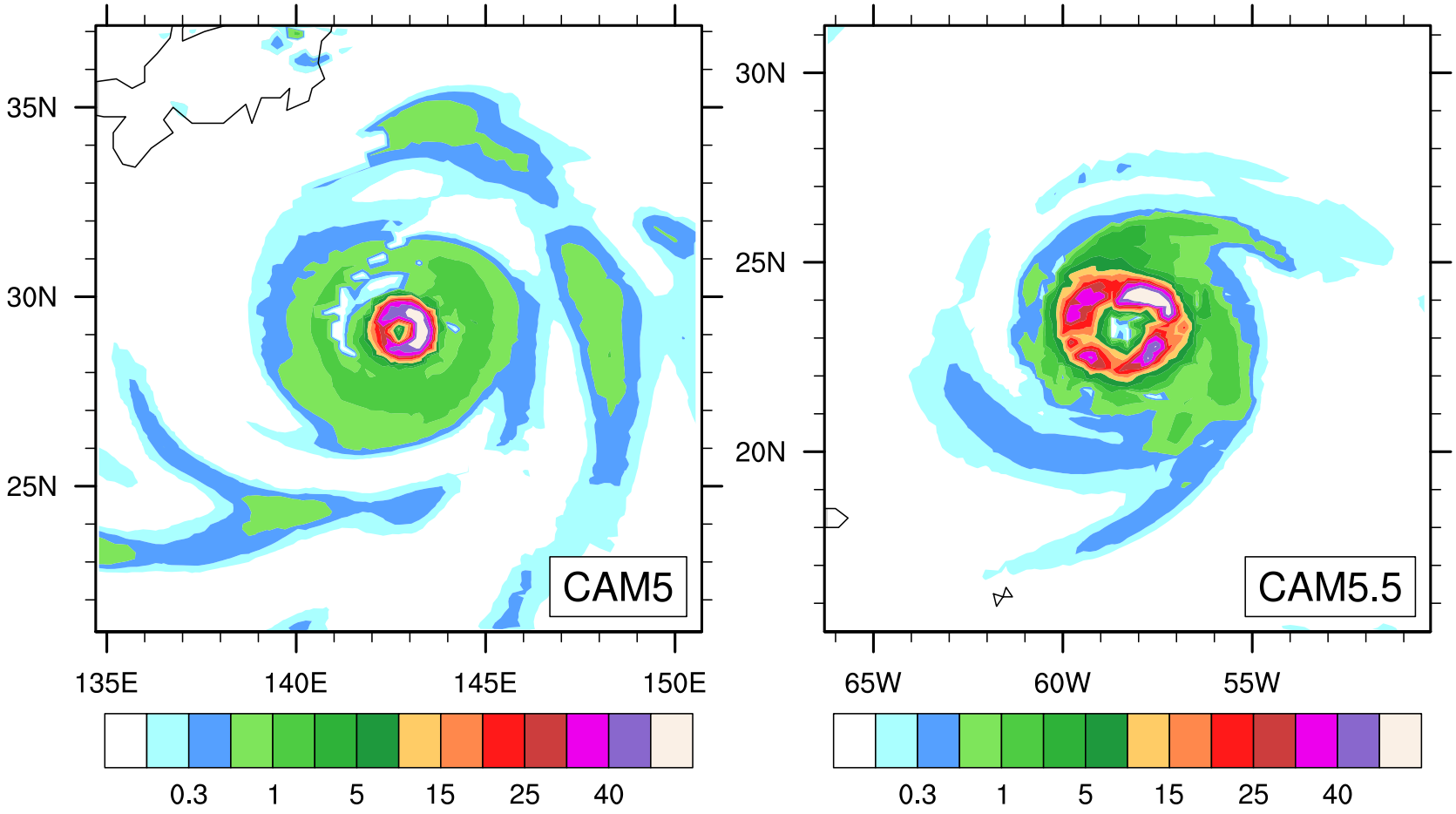


Specific humidity (anomaly)

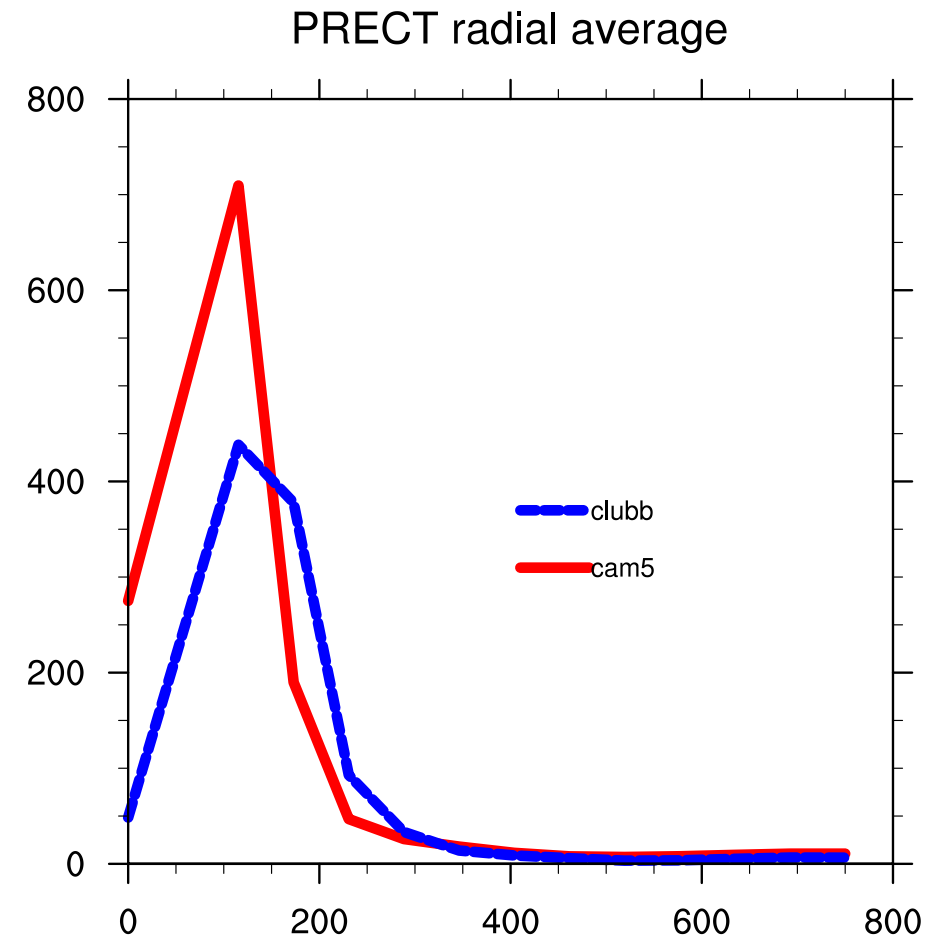


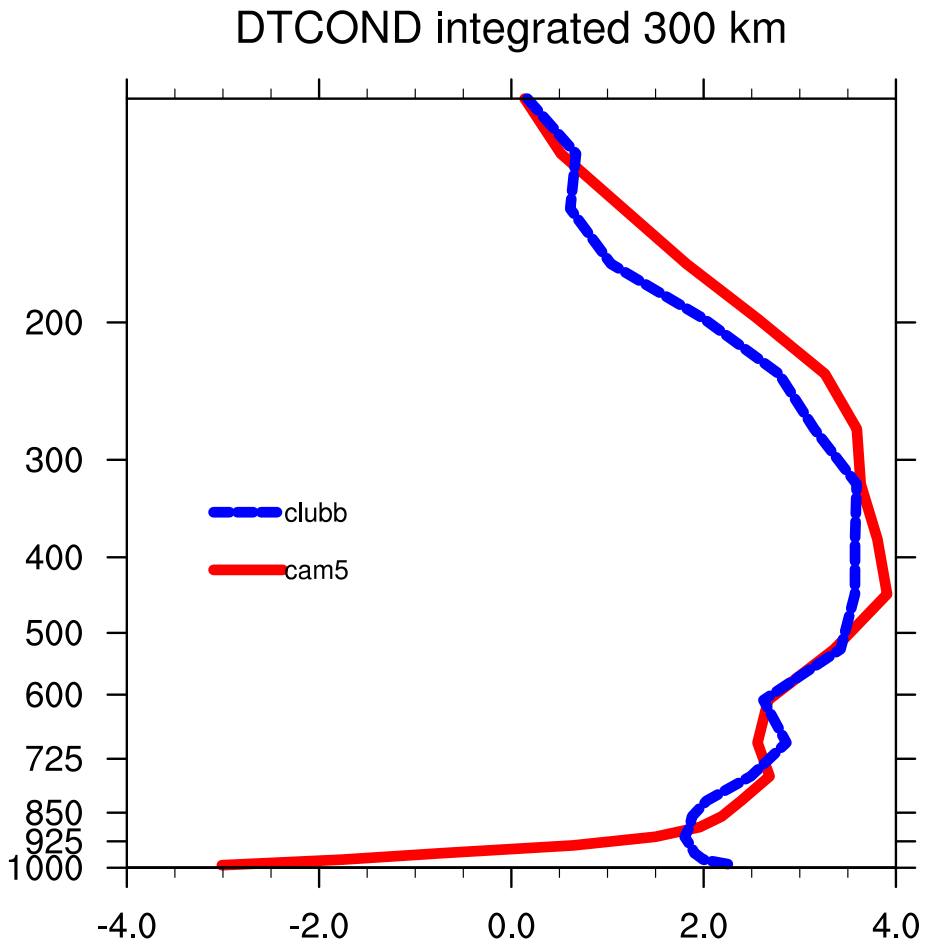


Spatial precipitation

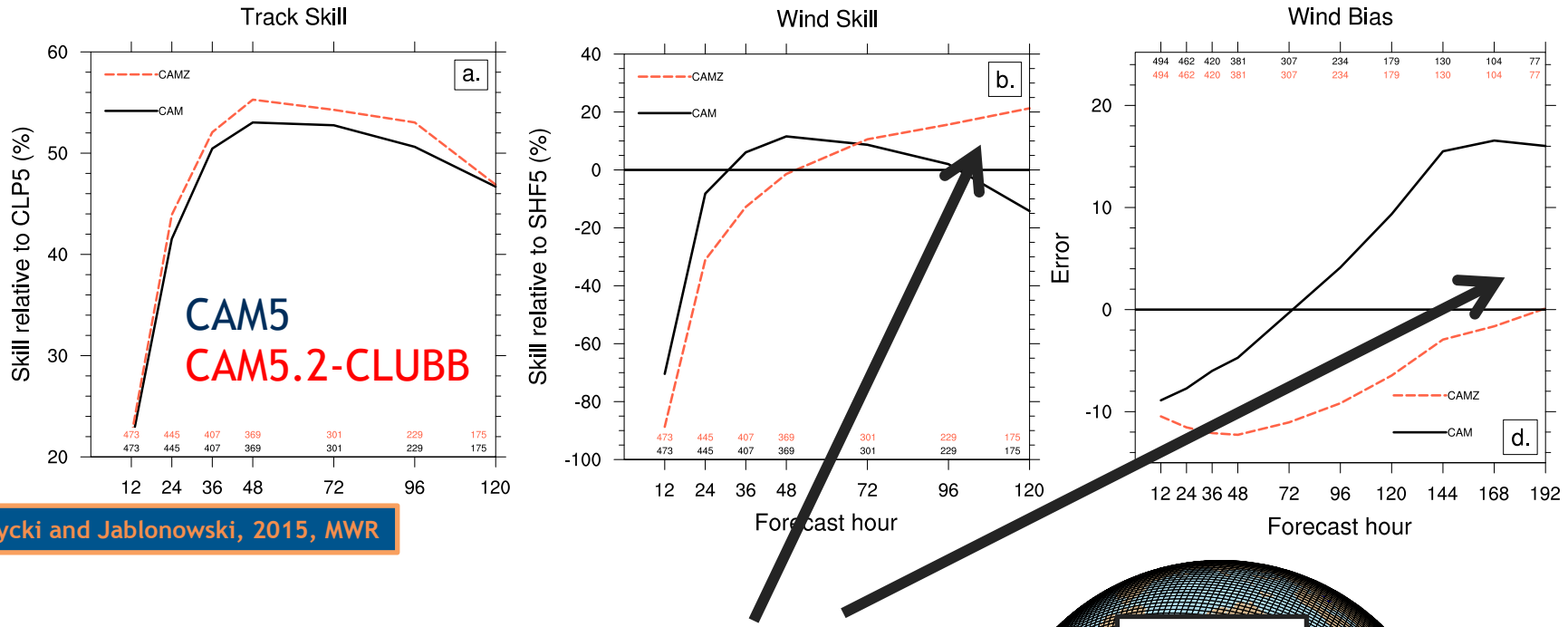


Radial precipitation



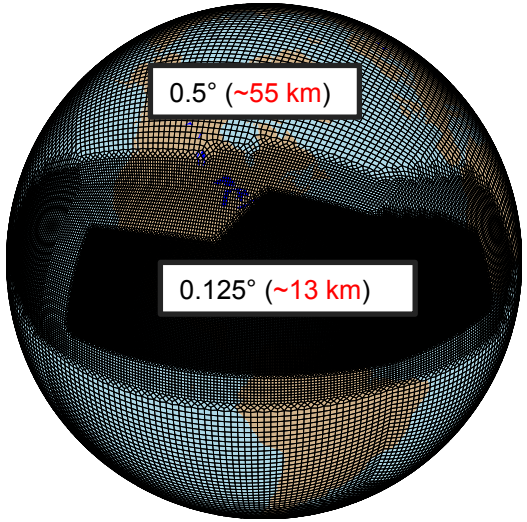


CLUBB forecasts



Zarzycki and Jablonowski, 2015, MWR

- CAM-CLUBB outperforms CAM5 with respect to intensity at lead times > 72 hours in 14 km forecast simulations



Summary

- CAM5.5 produces a higher frequency of TCs than CAM5
  - Changes in PRECT variability in tropics?
- Spatial pattern mixed bag, some improvements, some regression (internal versus external)
- Radius of maximum wind (TC core) larger in CAM5.5
- Biggest difference is 10-m wind speeds
  - **Significantly larger reduction in wind speed from top of boundary layer to surface**
  - **DTCOND + humidity profiles indicate much more efficient removal of moisture in TC BL in CAM5.5**
- Vertically and radially-integrated thermodynamics comparable despite surface/horizontal differences