Tightening the belt

investigating the impact of high resolution at reduced computational cost

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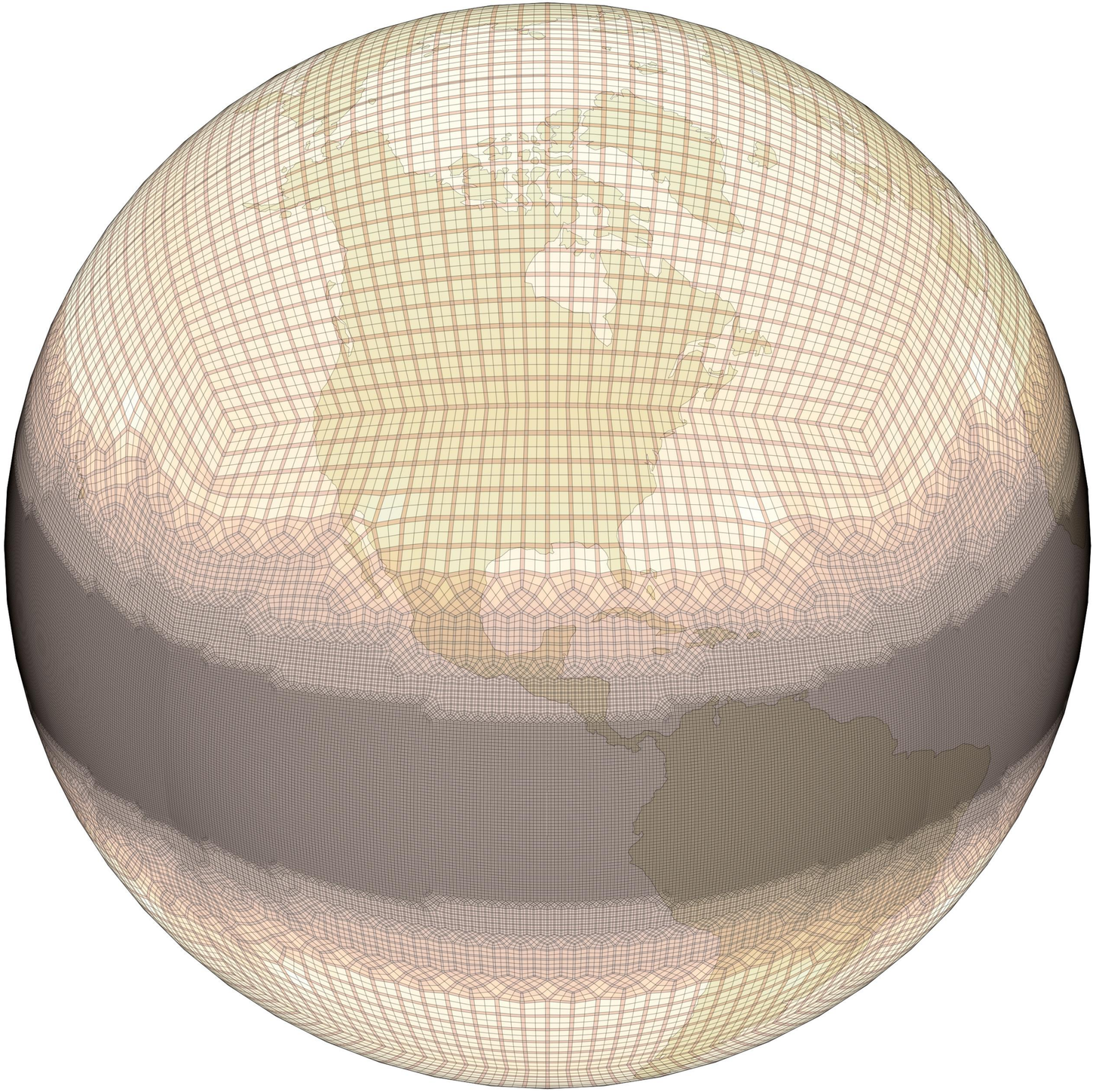
Thanks to: Max Bouman, John Truesdale, Patrick Callaghan, Adam Herrington, Rich Neale, Peter Lauritzen

NSF | NCAR | U.S. DEPARTMENT OF ENERGY | Office of Science | catalyst

CAM-SE Tropical Belt

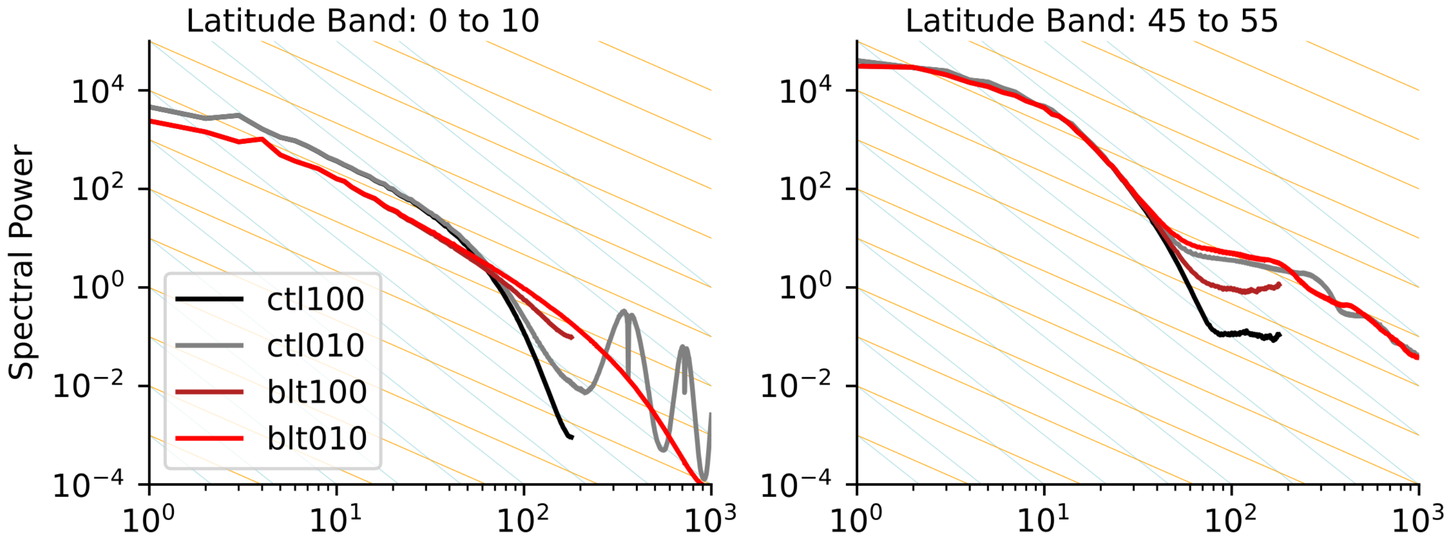
	dx	#columns
ne30	110km	48,600
ne60	54km	194,400
ne120	27km	777,600
ne240	15km	3,110,400
ne480	7.5km	12,441,600
TRBELT	100→15km	710,858



Effective Resolution

tropics vs extratropics

- Kinetic energy spectra show the expected scales of the local grid spacing
- Confirmed even when remapping to 100km grid



Example Applications

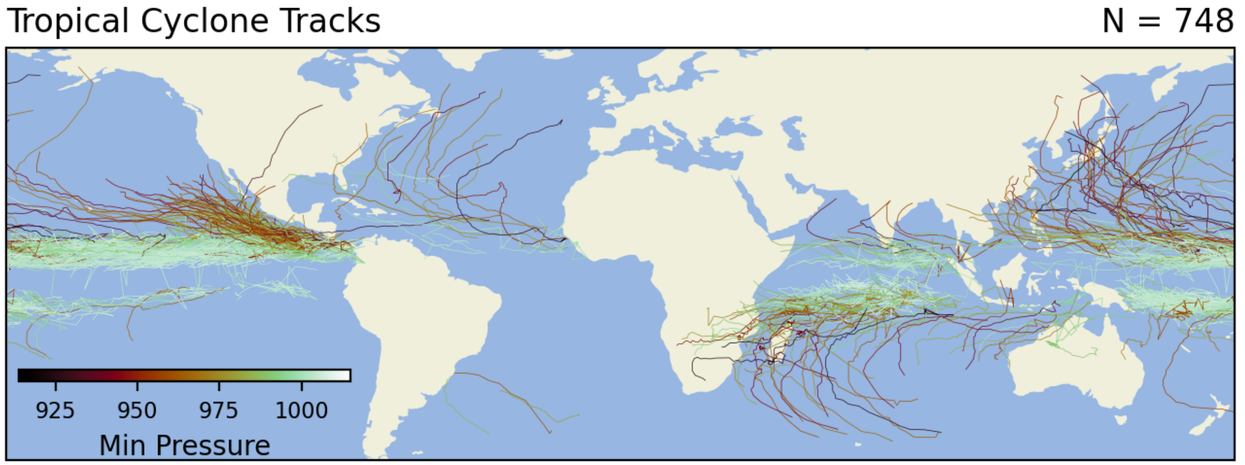
Tropical cyclones / cyclogenesis

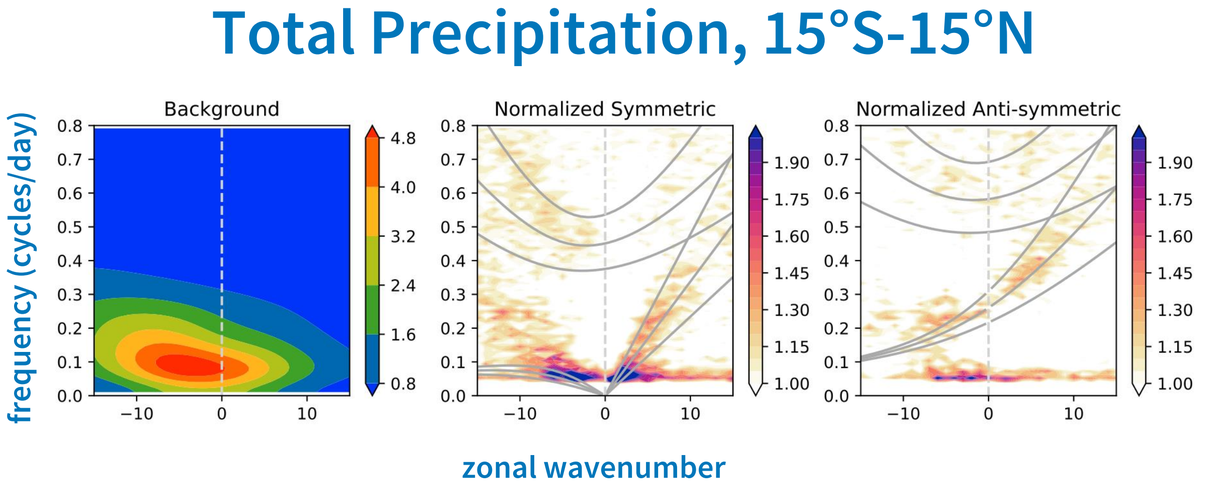
Convectively-coupled equatorial waves (and organized convection within them)

Precipitation extremes (and other extremes)

Teleconnections

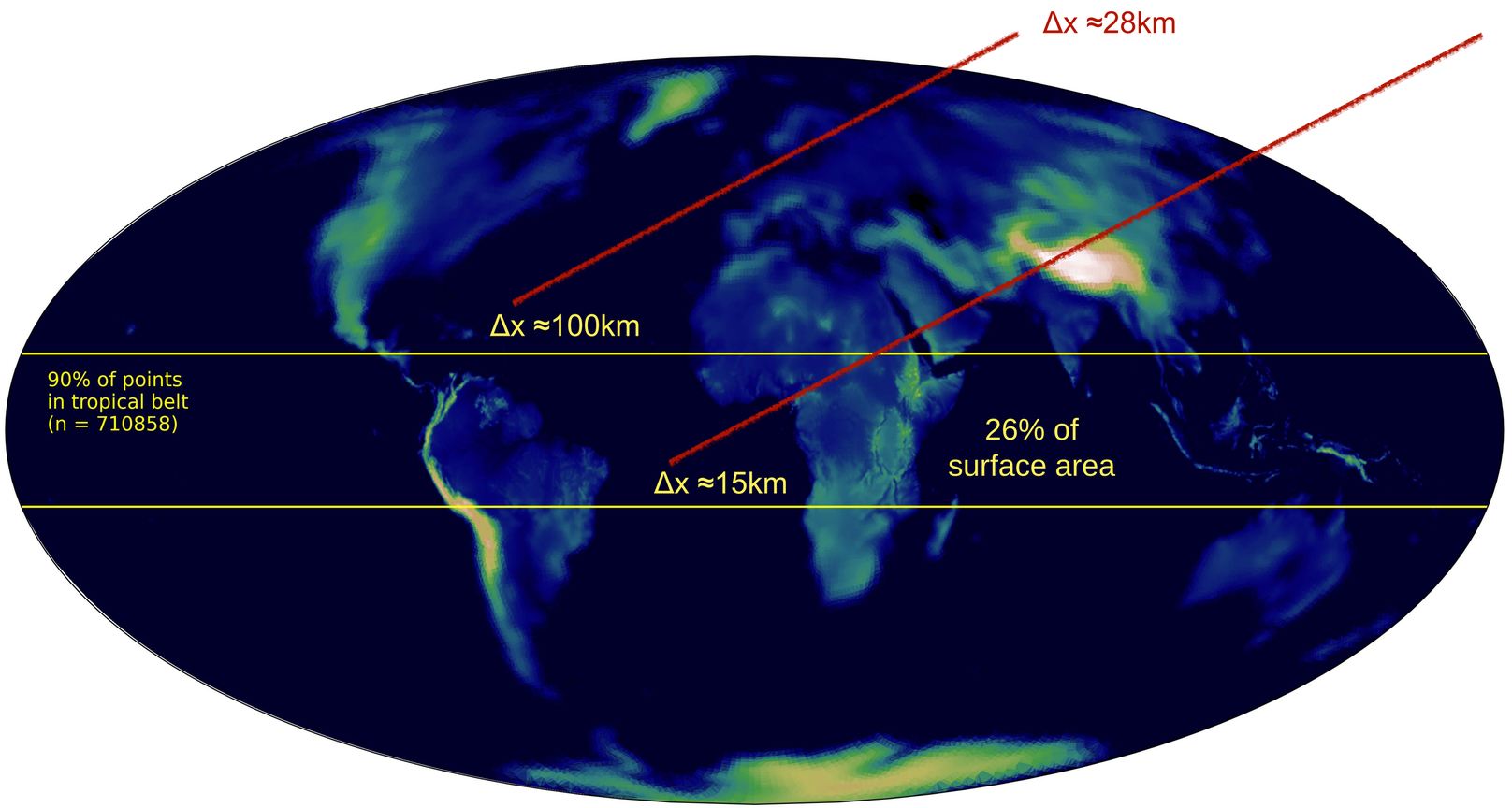
Potential coupled topics

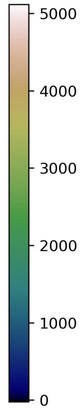


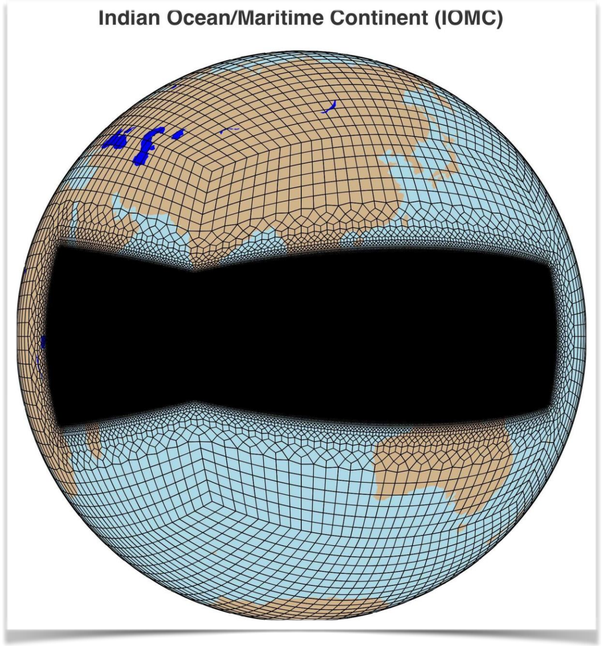


E3SM extension of TRBELT

100 → 15 / 100 → 3 / 28 → 3 ?







Hierarchy of simulations: aquaplanet → amip → coupled

Current capabilities (AFAIK)

- Coarse climate experiments
- regionally refined experiments with asymmetric configurations
- global uniform storm-resolving demonstration simulations

Toward storm-resolving climate experiments via tropical belt configuration

- Achievable storm-resolving resolution in significant fraction of globe
- Circumglobal equatorial circulation
- Idealized & realistic simulations
- Can scale to multi-year, multi-simulation experiments for research projects.