

Two-way nested climate simulations in GFDL HiRAM: Precipitation and hurricanes

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Two-way grid nesting

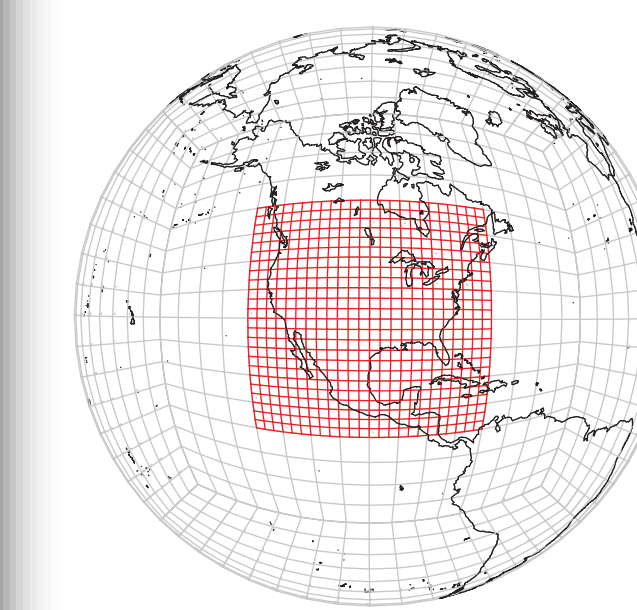
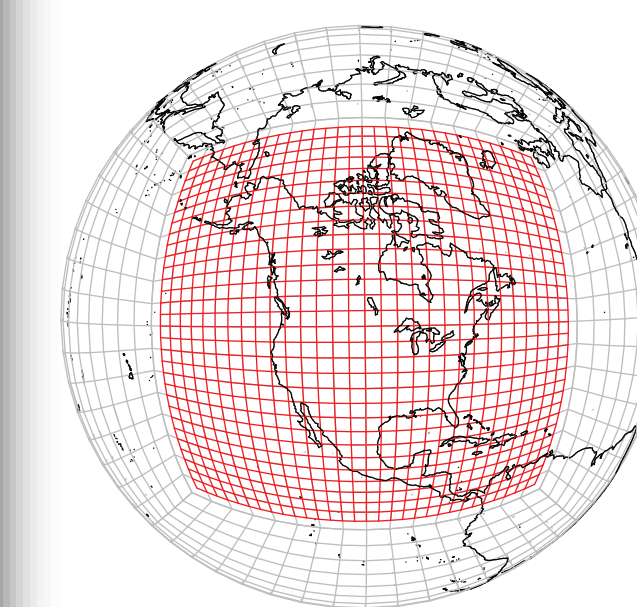
- **Global** model with **regional** refinement—efficient!
- Same solver for global and nested (limited-area grid). More consistent than dynamical downscaling!
- All variables linearly interpolated into nested-grid halo
- Only winds and temperature communicated to coarse grid. Coarse grid mass is unchanged—and so remains conserved!

Nested HiRAM configuration

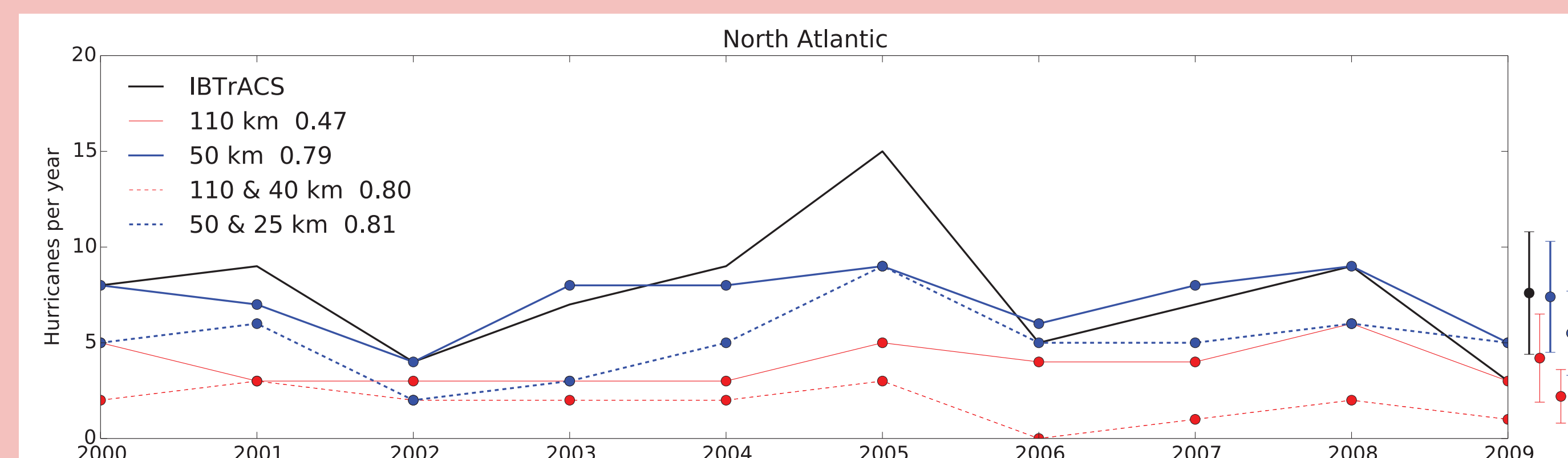
- **High-resolution Atmosphere Model:** Zhao et al 2009
- Hydrostatic model with less-intrusive UW deep convection and six-category Lin-Lin microphysics
- All simulations use 32 vertical levels
- Model climatologies from 30-year AMIP simulations
- Hurricane simulations: three 2000–2009 ensembles for each resolution depicted

Model resolutions

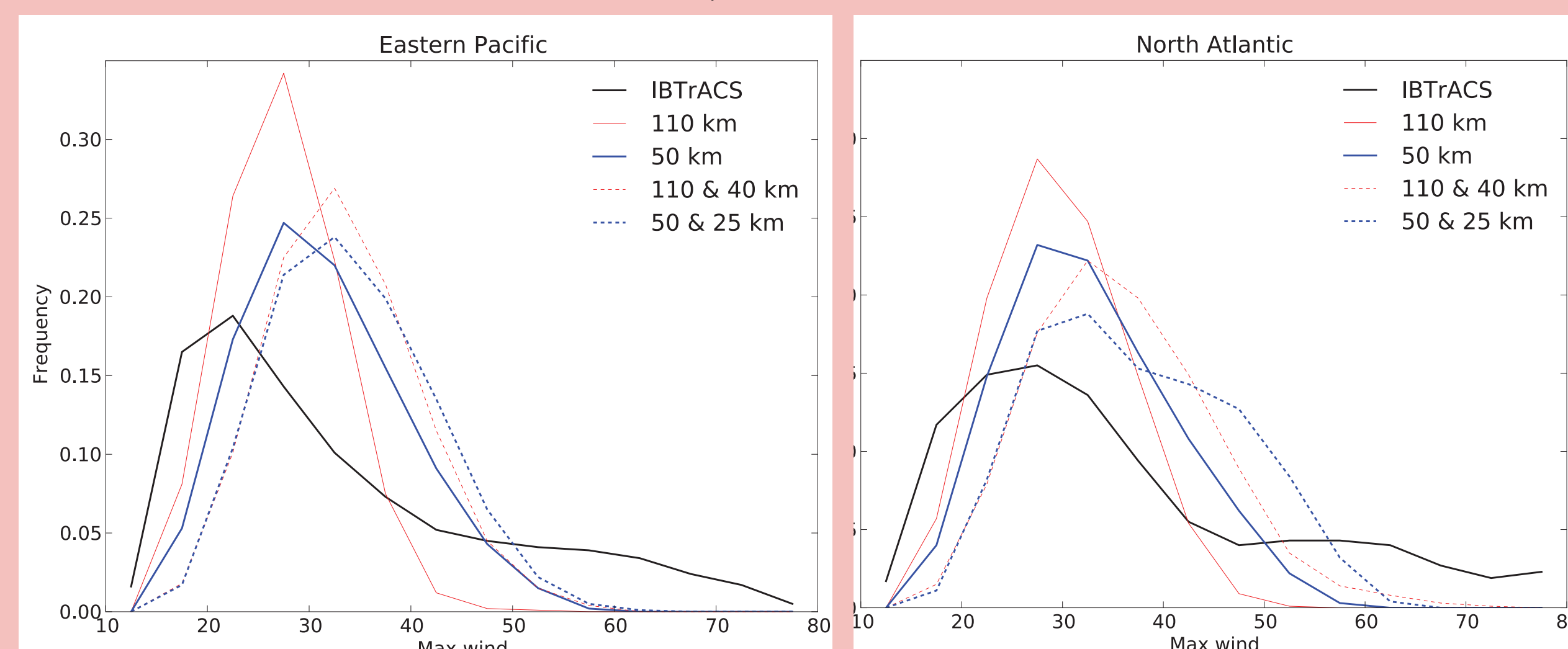
c90	110 km
c90n3	... and 40 km
c192	50 km
c192n2	... and 25 km
c384	25 km
c384n3	... and 8 km



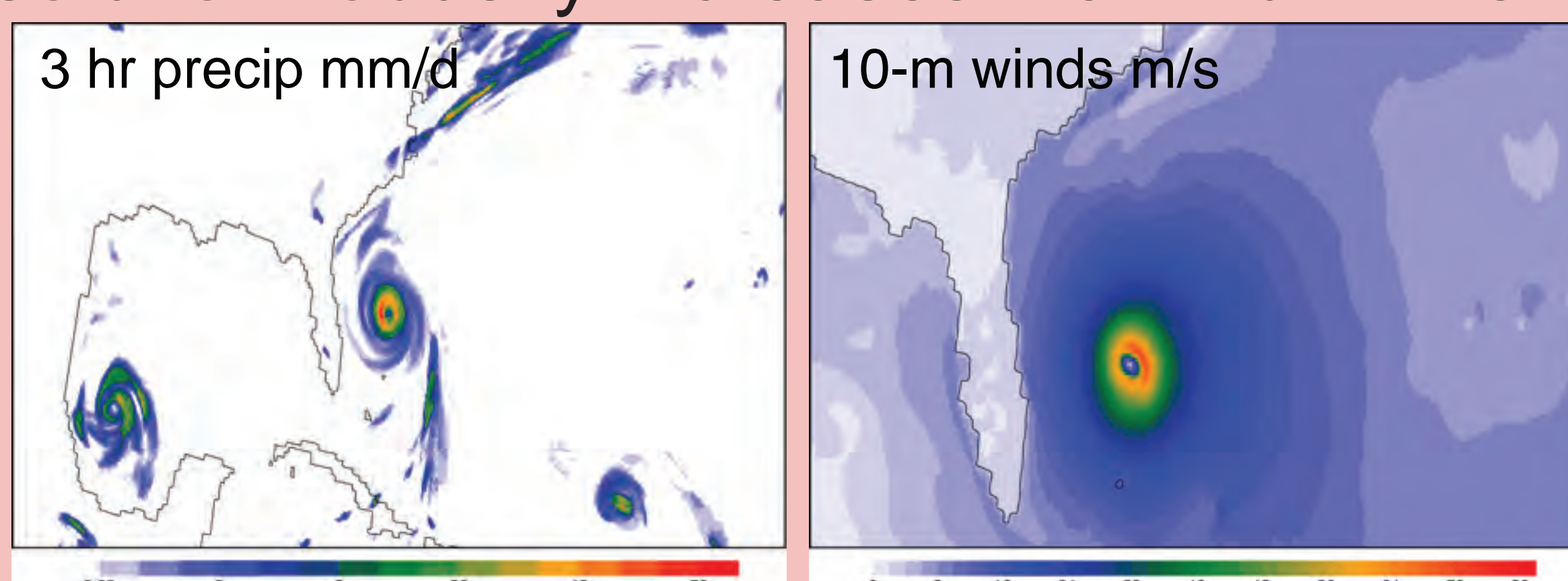
Tropical cyclones and Hurricanes



Low numbers, but same correlation!

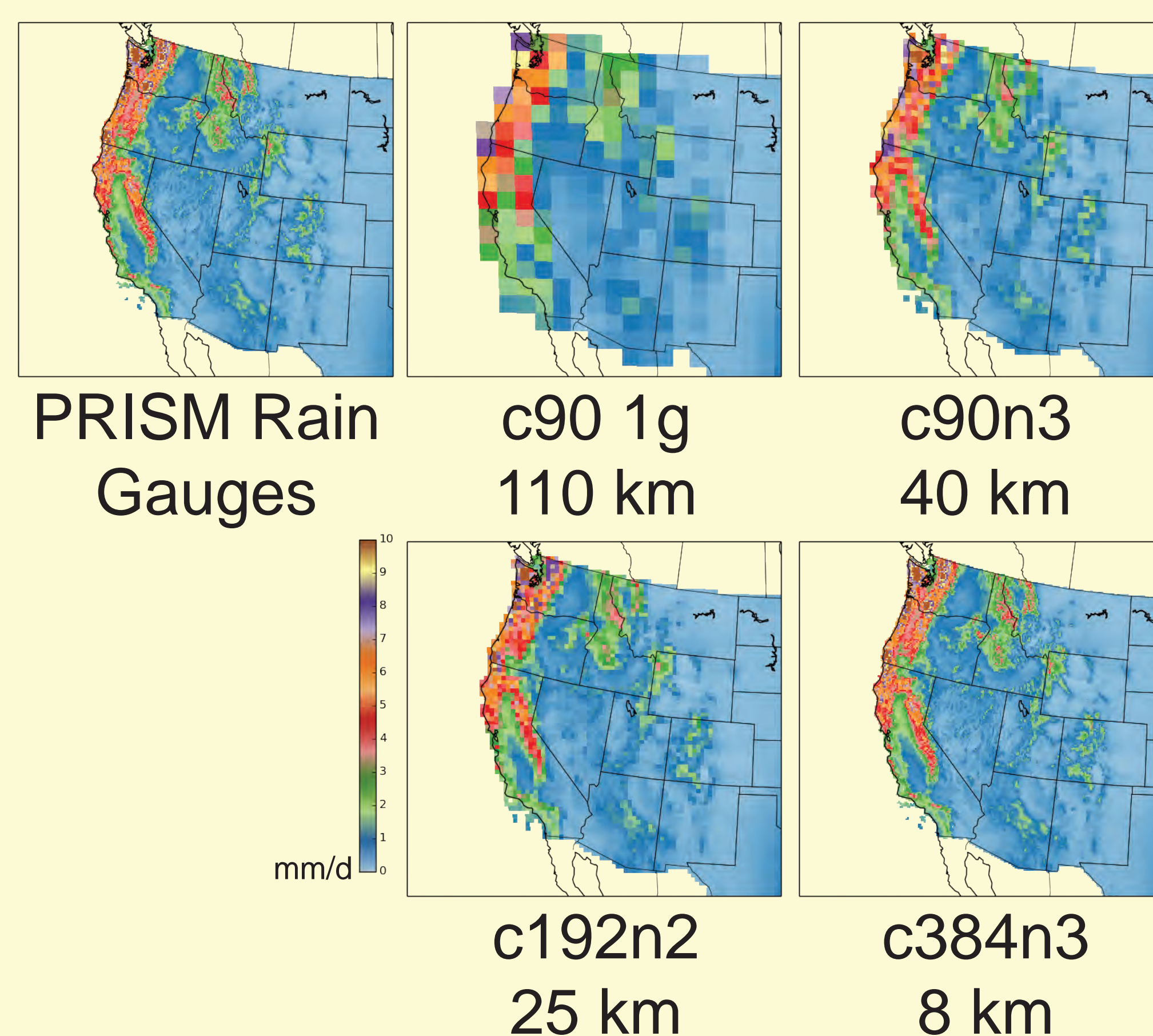


Resolution robustly increases maximum intensity!



Prototype c384n3: 72m/s

DJF orographic precipitation



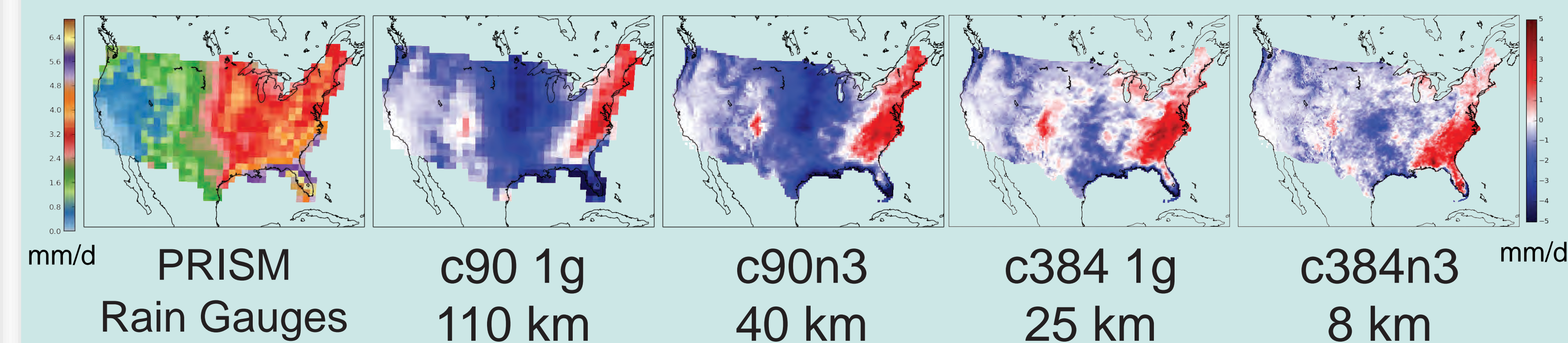
More detail at higher resolution

In mountainous regions, resolution is paramount!

References:

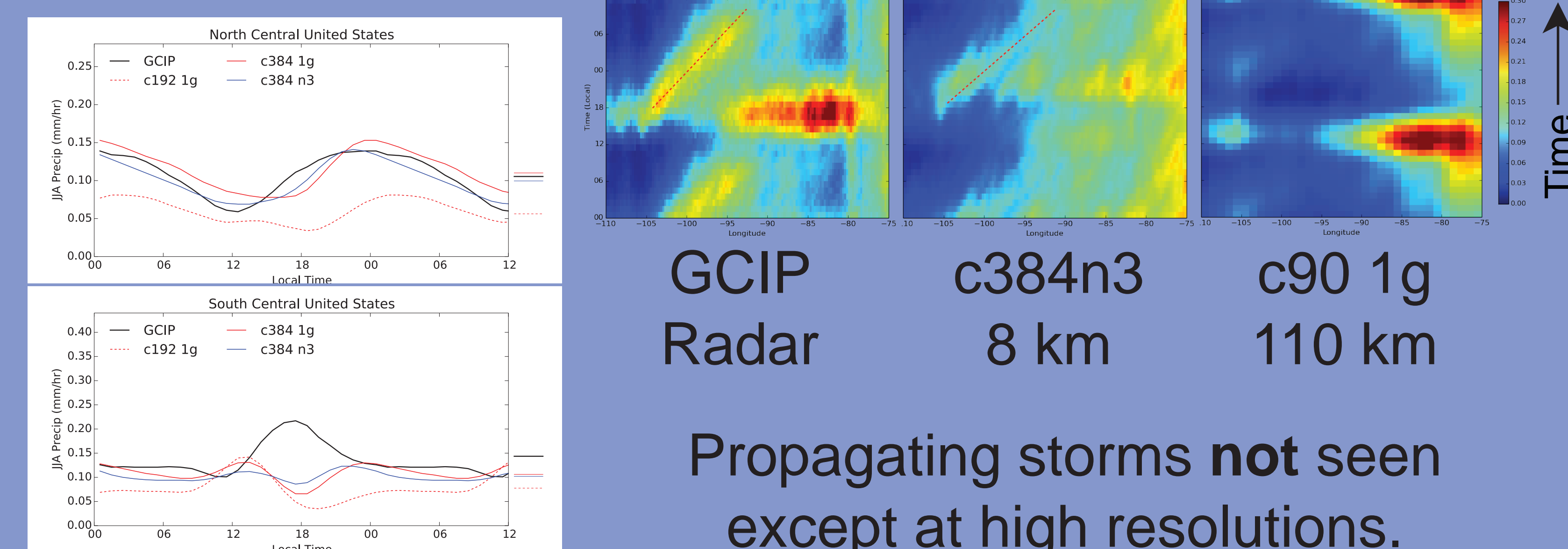
Harris and Lin, 2013, MWR
Harris and Lin, in press, J. Clim.
Other manuscripts in prep

JJA Plains Precipitation Biases



Not so good. Need very high resolution!

JJA Diurnal cycle (tied to mean precipitation?)



Propagating storms **not** seen except at high resolutions.

8 km c384n3 gets an excellent diurnal cycle over Northern Plains! But not so well in Southern Plains. MCSs in north better resolved?