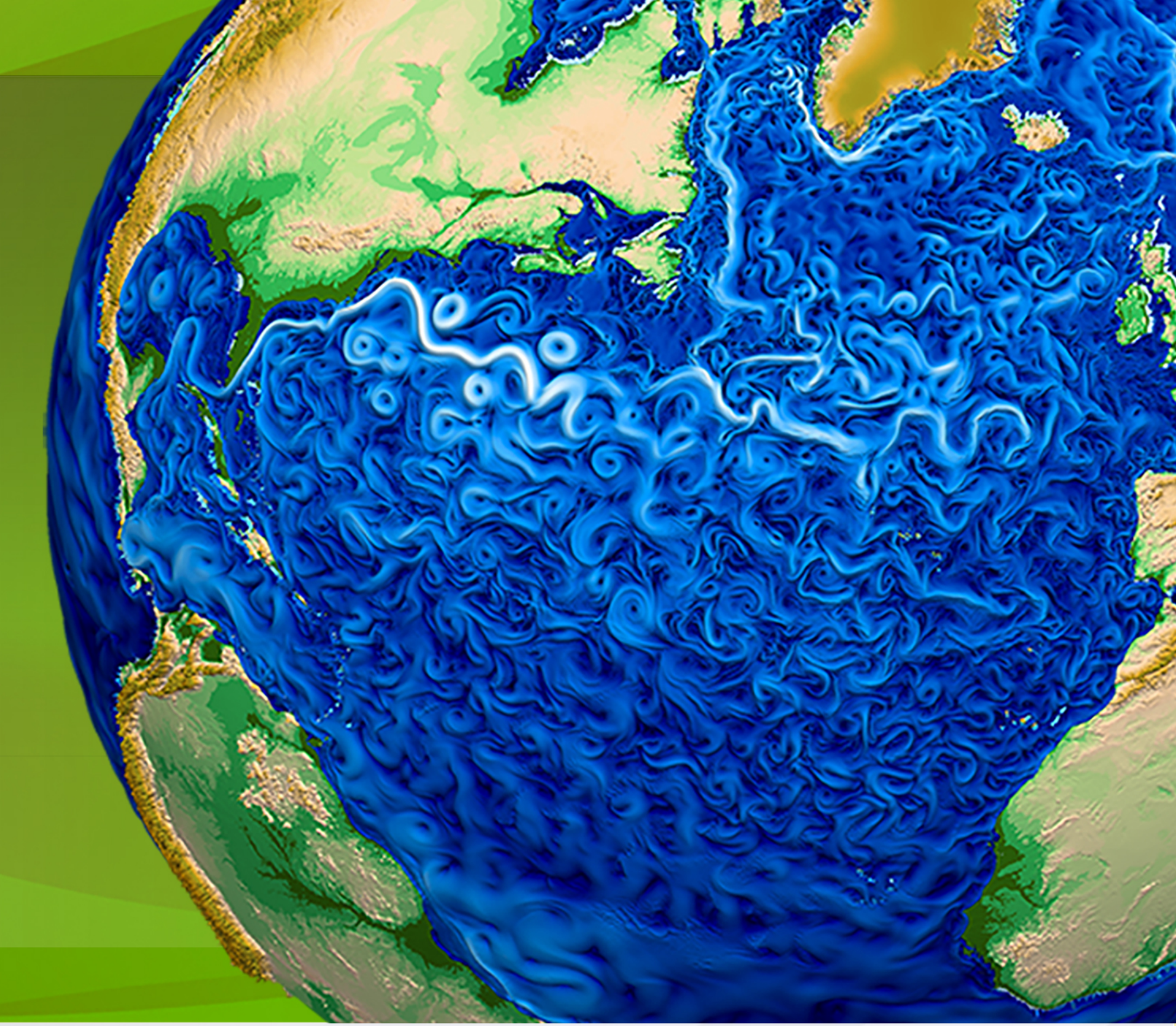


R: Regional Refinement over the Continental United States in the ACME model

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Objective

Objective of this Task:

- Create and test the first prototype of regional refinement in the ACME model
- Continental United States (CONUS) was chosen because of interest in changes to water cycle at ACME's target resolution.
- RRM is less expensive way to test new parameterizations to gain insight on high resolution model output
- Zarzycki et al. (2015) compared a 23-year-long AMIP simulation of an RRM ne30→ne120 with a uniform ne30 region and found the RRM region **does not negatively impact global circulation**.
- **Here**, we will compare the CONUS RRM grid (the ne30→ne120) with a uniform high resolution (ne120) simulation and a uniform low resolution (ne30) simulation.

Simulation Approach

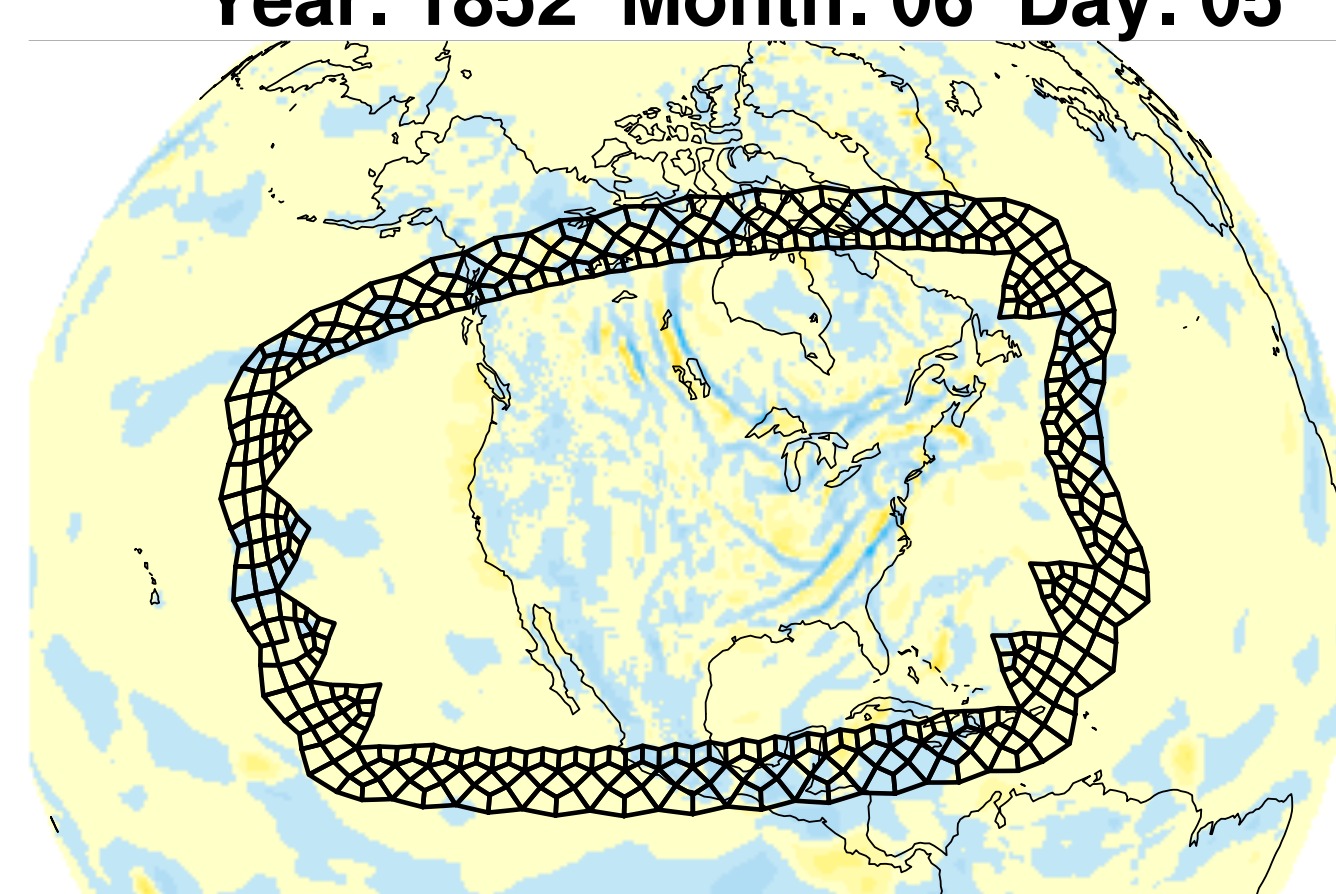
Configuration:

- To make the grid, followed same procedure as Klein et al for the CSSEF project.
- 5-year pre-industrial simulations for each grid: ne30, ne120, and RRM CONUS
- Same tuning parameters as the ACME v0.1 AMIP and fully coupled baseline simulations.

Quick Comparison of Low Res and RRM

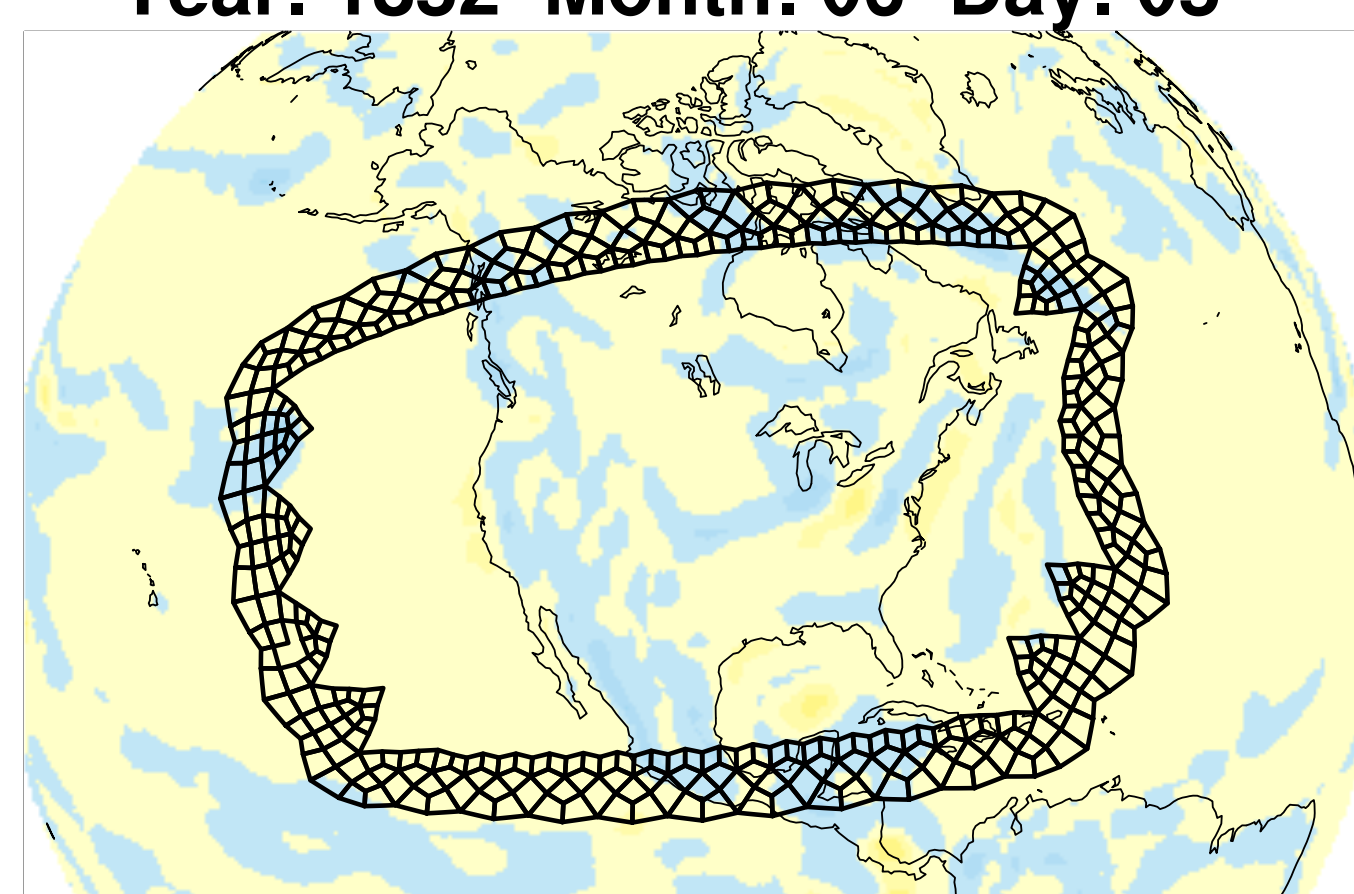
- Variability of vertical velocity increases in high resolution (ne120) domain.
- Maxima (minima) of vertical velocity increases (decreases) by factor of 3.

CONUS Variable Resolution: 1° to 1/4°
Vertical velocity at 850 mbar pressure surface (Pa s⁻¹)
Year: 1852 Month: 06 Day: 05



-5.8 -3.8 -1.8 0.2 2.2 4.2 6.2

Low Resolution: 1°
Vertical velocity at 850 mbar pressure surface (Pa s⁻¹)
Year: 1852 Month: 06 Day: 05

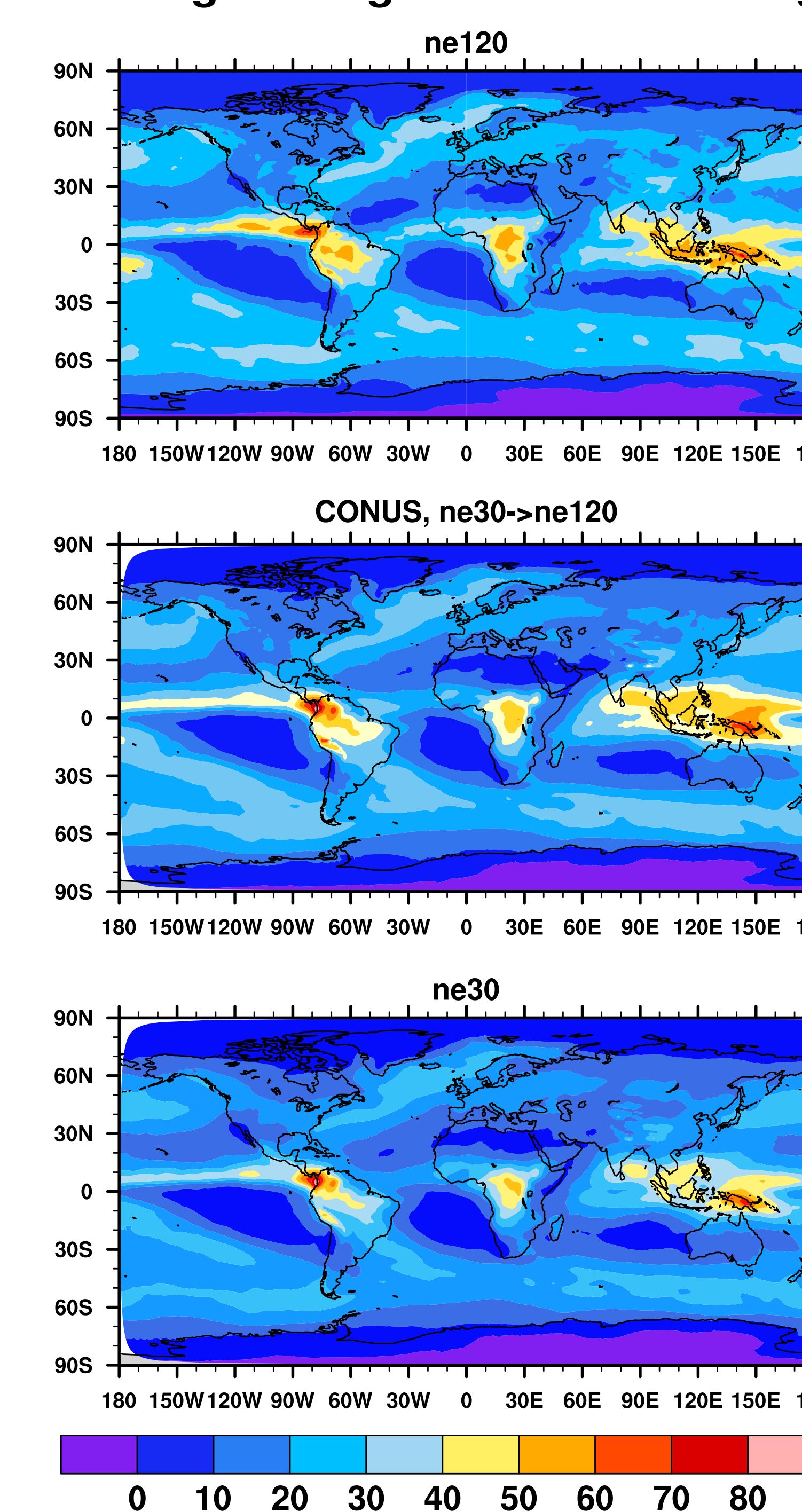


-5.8 -3.8 -1.8 0.2 2.2 4.2 6.2



Resolution	Number of Elements	SYPD (400 cores)
ne30 (1°)	5,400	3.31
ne120 (1/4°)	86,400	n/a
CONUS, ne30→ne120 (1°→1/4°)	9,905	0.90

Annual Averaged Longwave Cloud Forcing (W m⁻²)



Global Climatology

Climatology:

- Clouds, precipitation, winds, and temperature of the RRM CONUS compared to the ne120 simulation in table below.
- Much agreement between simulations in temperature, sensible, and latent heat fluxes.
- Biggest differences in longwave and shortwave cloud forcing.

Variable	CONUS	ne120	CONUS-ne120	% Diff
Total cloud fraction	64.307	64.486	-0.179	-0.28%
Surface latent heat flux (W m ⁻²)	88.605	89.268	-0.663	-0.74%
Total precipitable water (mm day ⁻¹)	3.029	3.053	0.024	-0.79%
Surface Pressure (Pa)	985.284	985.265	0.019	0.00%
Surface sensible heat flux (W m ⁻²)	19.448	19.865	-0.417	-2.10%
200-mb temperature (K)	215.57	215.73	-0.16	-0.07%
850-mb temperature (K)	280.50	280.69	-0.20	-0.07%
2-m temperature (K)	286.65	286.54	0.11	0.04%
Longwave cloud forcing (W m ⁻²)	23.812	22.190	1.623	7.31%
Shortwave cloud forcing (W m ⁻²)	-48.809	-47.532	-1.278	2.69%
200-mb U wind speed (m/s)	15.790	14.428	1.362	9.44%