A Comprehensive Understanding of the Effects of Two Missing Longwave Physics on the Climate and Its Projected Changes Simulated by the E3SM v2 (Poster: Wed-078)

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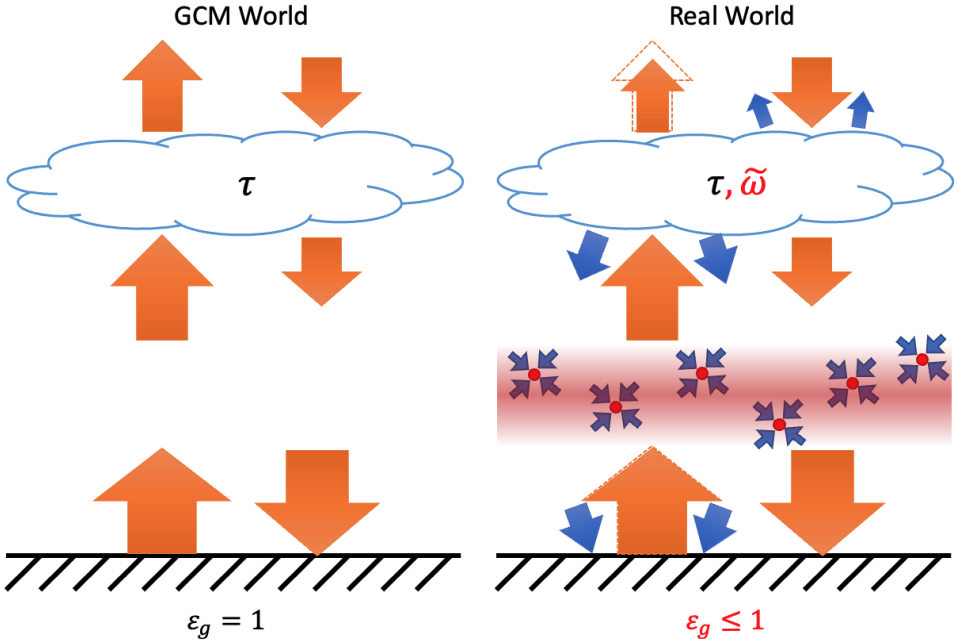

Increase in surface air temperature (pi-Control)

	Emis	Scat	ScatEmis
Global Mean	0.37 K	0.66 K	1.05 K
Arctic Mean	1.42 K	1.92 K	3.09 K

1. Assumptions used in the ESMs might not hold over time (20-30 years ago, polar climate was not a focus in GCM development).
2. Surface spectral emissivity and cloud longwave scattering are missing in >90% of current ESMs
3. By physical arguments, both are more important for high latitudes than for low latitudes; both would keep more longwave radiation within the climate system.

Question: Taking feedback into account, how important are these two processes for simulated mean-state climates and climate change projections?

Action: We have implemented both processes into the E3SM v2 and v3 test version (4-5% additional computational cost)

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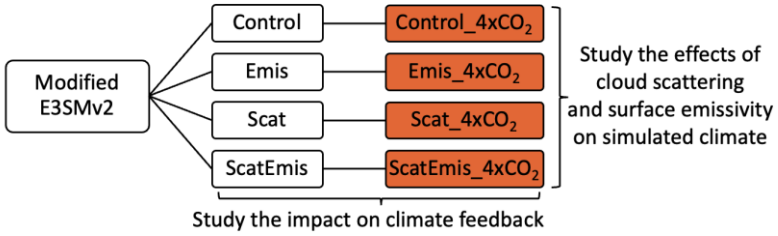
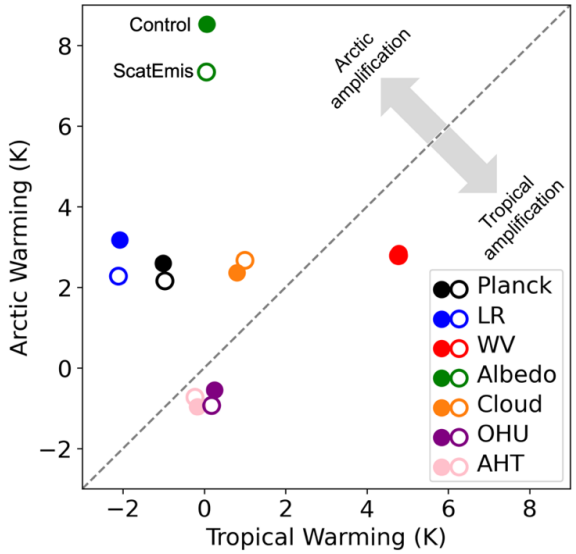
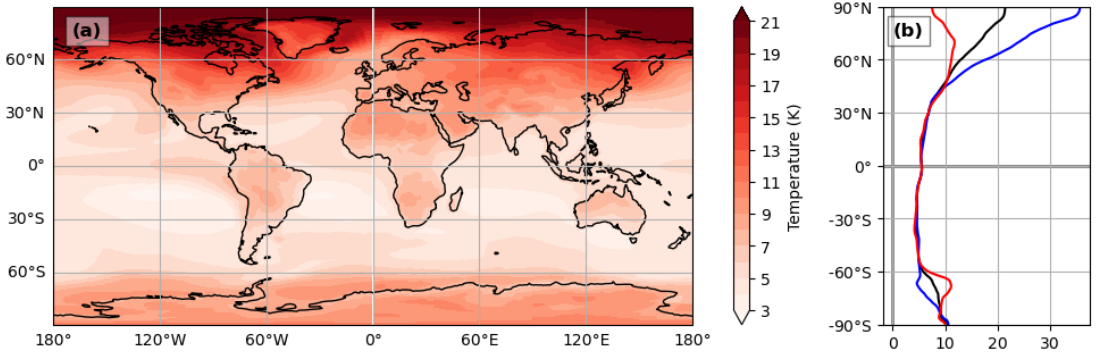




Temperature Increase Caused by $4xCO_2$ in Control run



Difference between ScatEmis - Control