Equilibrium Climate Sensitivity (ECS) estimates

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ECS Uncertainty largely due to Clouds...

Figure 1: Estimates of ECS based on a process-level approach of Equation (1), Monte Carlo sampled from distributions derived from climate models [37]. The blue shading shows the range of ECS when cloud feedback is assumed to equal zero. Uncertainty ranges are the 5-95 percentiles.

Mauritsen, HighECS
Can we constrain ECS using paleoclimates and extreme cloud feedbacks?

- If models with varying ECS can all simulate the historical period, how can we differentiate them?

- Build alternative climate models which incorporate extreme cloud feedbacks and have a high ECS. These are then tuned to match instrumental record warming and then run for past climates.

- Using MPI-ESM (CMIP6 Model).

- LGM, Pliocene (and Eocene) climates.
Cloud Feedback Mechanisms

Mid-high latitude mixed-phase cloud feedbacks

Tropical low-level cloud feedbacks (inversion strength, adiabatic thickening, convective valve, dry air top-entrainment)

Tropical deep convective cloud feedbacks (FAT, iris effect)
Mixed Phase Clouds

Vergara-Temprado et al., 2018 (PNAS)