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# How does natural climate variability impact radiative feedback estimates?

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A lot of attention has been focussed on the inter-model spread in equilibrium climate sensitivity and the radiative feedbacks that contribute to it as a measure of our uncertainty of the climate system's response to external forcing. But how accurate is an estimate of this uncertainty derived purely from model-to-model differences?
Recent work has highlighted the importance of factors such as differences resulting from methodology (Klocke et al., 2013) as well as internal climate variability (Deser et al., 2012), which have historically not been included in multi-model assessments of feedbacks and climate sensitivity.
While an increasing number of models participating in Coupled Model Intercomparison Projects (CMIPs) provide several ensemble members for certain simulations, the ensemble sizes are generally not large enough to fully sample climate's intrinsic variability. Here we use a large 40 member ensemble of simulations performed with the National Center for Atmospheric Research Community Climate System Model Version 3 to asses the impact of internal variability on radiative feedback estimates. On average, the spread in individual feedbacks among ensemble members corresponds to 25% of CMIP3 inter-model spread. For all feedbacks, there are regions where the uncertainty from natural variability is as large or larger than that from the CMIP3 ensemble. Since CMIP models use different initial conditions, internal variability is already sampled to a degree in multi-model ensembles, complicating efforts to isolate uncertainty due solely to model differences from that due to natural variability.

Deser, C., A. Phillips, V. Bourdette and H. Teng (2012): Uncertainty in climate change projections: the role of internal variability, Clim. Dyn., 38, 527-546.

Klocke, D., J. Quaas and B. Stevens (2013): Assessment of different metrics for physical climate feedbacks, Clim. Dyn., DOI 10.1007/s00382-013-1757-1