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Causes of differing climate model feedbacks and sensitivities to doubled CO2

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The sensitivity of global mean temperature to doubled CO2 is strongly modeldependent, as are sensitivities of other quantities, such as global mean precipitation and regional temperature. The sensitivity of the real climate system has not been inferred with sufficient accuracy to limit the range produced by the models.

Results will be presented for the causes of the model-dependence of the feedbacks that lead to sensitivity differences between two AGCMs: ECHAM4 and CCM3. Differences in global mean temperature sensitivity can be attributed to differences in parameterizations of short wave radiation and cloud droplet size distribution. However, differences in global mean precipitation sensitivity are not affected by those parameterizations. The manifestations of the parameterization differences on the various feedbacks is described.

Experiments were conducted to determine the origin of differences in midlatitude northern hemisphere DJF regional temperature sensitivity between the CMIP coupled models that contain the ECHAM4 and CCM3 AGCMs. In the Pacific sector, the differences are attributed to the remote influence of differences in tropical coupled air-sea feedbacks, while in the Atlantic sector the effects of differences in internal atmospheric dynamics dominate. Differences involving midlatitude ocean dynamics feedbacks (including thermohaline circulation) appear to be of secondary importance.