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*Stochastic treatments of cloud - radiation interactions in climate models.*

Climate models suffer from uncertainties associated with representing the feedback effects of clouds and the interaction of clouds with radiant energy from both the Earth and the Sun. We investigate the use of stochastic radiative transfer theory (Lane-Veron and Somerville, J. Geophys. Res., 109, D18113, 2004) to develop a new class of parametric representations of cloud-radiation interactions and closely related processes for atmospheric simulation models. The theoretical advantage of the stochastic approach is that it can accurately calculate the radiative heating rates through a broken cloud layer without requiring an exact description of the cloud geometry. Unlike cloud-resolving models and Monte Carlo cloud models, stochastic cloud models do not depend on specific realizations of the cloud field. Instead, they calculate the transfer of radiation through a cloudy atmosphere whose properties are known statistically in the form of probability density functions characterizing cloud geometry and cloud optical properties. The advantage of the stochastic approach is its theoretical generality and its potential for representing a complex cloud field realistically at modest computational cost. (Received September 14, 2007)