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Radiative transfer in three-dimensionally inhomogeneous cloud layers

G. Petty
United States (gwpetty@wisc.edu)

Petty (2002) described a new conceptual and computational basis for parameterizing the bulk scattering and absorption properties of a three-dimensional cloud volume with randomly distributed inhomogeneities. It was shown that an excellent match could be achieved between the area-averaged fluxes (reflectivity, diffuse and direct transmittance) from the simplified 'cloudlet' model and detailed Monte Carlo simulations for stochastically generated cloud fields.

A hypothesis posed at the conclusion of that paper is that realistic cloud layers in which both 2-D and 3-D inhomogeneities occur on varying scales might be effectively modeled via a hybrid of the 'cloudlet' model and the independent pixel approximation (IPA). This paper reports on the preliminary results of experiments with this hybrid approach.