Geophysical Research Abstracts, Vol. 7, 05852, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05852

Analysis of scale coupling in 3D radiative transfer through high-resolution CRM cloud fields

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This study addresses the question of the adequacy of radiation calculations used in Cloud Resolving Models (CRM's). We know that, at the outer scale, (e.g. over a GCM gridbox) the Independent Pixel Approximation (IPA) is sufficiently accurate to compute radiation fluxes (Barker et al.,1998; Zuidema and Evans,1998). However, at much smaller scales commensurate with those used in CRM's, we question the accuracy of the IPA hence extend the aforementioned studies. At smaller scales we anticipate the radiative transfer to exert its influence on various processes that span the range from photochemistry to radiative-convection interactions.

To begin to answer our question, we present the results of a study of scale couplings

in 3D radiative transfer through the use of a high-resolution CRM cloud field. We use a multiresolution radiative transfer code developed by Ferlay et al. (2005) that is based on a wavelet technique that allows for an analysis and quantification of scale couplings in radiation fields.

We quantify interactions between neighboring 1 km-pixels in a CRM cloud field and the effects of cloud subpixel fluctuations (down to $\sim$40m), explicitly represented in CRM, on the pixel-scale radiation fields. In analyzing the multiscale aspects of radiative transfer in CRM cloud fields, we will discuss the implications for the representation of cloud radiation processes in CRM, and their validation.