Geophysical Research Abstracts, Vol. 8, 03192, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03192

Global perspective on horizontal cloud inhomogeneity from modis

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Advanced cloud parameterizations in Large Scale Models have recently begun to address subgrid cloud variability, while the Multi-Scale Modeling Framework ("super parameterization") explicitly resolves cloud fields at scales ˜ 4 km, albeit in a 2D sense only, so far. The realism of the model-produced variability needs to be validated with observations in order to further improve cloud physical parameterizations and the radiation budgets that strongly depend on them. The MODIS instrument aboard the Terra and Aqua satellites provides such observations. In our presentation we will show how the monthly climatology of cloud inhomogeneity can be expressed in terms of a few standard parameters, initially calculated for each day of the month at spatial scales of 1°x1°, and subsequently averaged at monthly, zonal, and global scales. Geographical, diurnal, and seasonal changes of inhomogeneity parameters are examined separately for liquid and ice phases, and separately over land and ocean from two full months (July 2003 and January 2004) of MODIS cloud optical thickness and water path retrievals. Cloud inhomogeneity is overall weaker in summer than in winter. For liquid clouds, it is also consistently weaker for local morning than local afternoon and over land than ocean. Cloud inhomogeneity is comparable for liquid and ice clouds on a global scale, but with stronger spatial and temporal variations for the ice phase, and exhibits an average tendency to be weaker for near overcast or overcast gridpoints of both phases. Global simulations of the Earth's cloud fields, appropriately sampled to mimic the viewpoint of passive observations from space, will be considered more credible if they can reproduce some of these features.