Geophysical Research Abstracts,
Vol. 11, EGU2009-8745, 2009
EGU General Assembly 2009

Vertical velocity probability distributions simulated in the CAM-Oslo GCM

C. Hoose (1), J. E. Kristjánsson (1), G. Svensson (2), S. Arabas (3), H. Pawlowska (3), and J.-L. Brenguier (4)

(1) University of Oslo, Department of Geosciences, Oslo, Norway (corinna.hoose@geo.uio.no, +47 228 55269), (2) Stockholm University, Department of Meteorology, Stockholm, Sweden, (3) University of Warsaw, Institute of Geophysics, Warsaw, Poland, (4) CNRM-GAME, Météo-France

Cloud droplet activation is calculated as a function of aerosol number, size and composition and of the vertical velocity w in the global climate model CAM-Oslo (Abdul-Razzak and Ghan, 2000: JGR; Storelvmo et al, 2006: JGR). In-cloud turbulence is not resolved in GCMs, and has to be parameterized. For this, a gaussian distribution of the vertical velocity around its grid-mean value is assumed. We test different formulations for the width σ_w of the distribution, based on the turbulent diffusion coefficient or a turbulent velocity scale. The simulated values are compared with observations from field campaigns and LES simulations, amongst others from the EUCAARI-IMPACT campaign. It is found that the spread in simulated values from different formulations is large. One parameterization produces very large values of σ_w (>2 m/s) over land, which can be ruled out as unrealistic under non-convective conditions. Another parameterization gives very small values over ocean (<10 cm/s) and therefore requires setting a lower bound. The simulated cloud droplet number concentration is sensitive to the assumptions on σ_w.

In some situations a gaussian pdf is not a good approximation. E.g. marine stratocumulus clouds, in which turbulence is driven by cloud-top cooling, can exhibit positively skewed pdfs. Sensitivity studies with CAM-Oslo have shown that skewed distributions can reduce (positive skewness) or enhance (negative skewness) activation by 20%. The relationship between skewness and quantities which can be diagnosed from the GCM will be analysed.