Geophysical Research Abstracts, Vol. 9, 01301, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01301

Evaluation of a component of the cloud response to climate change in an intercomparison of climate models

K. D. Williams for CFMIP
Hadley Centre, Met Office

Most of the uncertainty in the climate sensitivity of contemporary general circulation models (GCMs) is believed to be connected with differences in the simulated radiative feedback from clouds. Traditional methods of evaluating clouds in GCMs compare time-mean geographical cloud fields or aspects of present-day cloud variability, with observational data. In both cases a hypothetical assumption is made that the quantity evaluated is relevant for the mean climate change response. Nine GCMs (atmosphere models coupled to mixed-layer ocean models) from the CFMIP and CMIP model comparison projects are used in this study to demonstrate a common relationship between the mean cloud response to climate change and present-day variability. Although atmosphere - mixed-layer ocean models are used here, the results are found to be equally applicable to transient coupled model simulations. When changes in cloud radiative forcing (CRF) are composited by changes in vertical velocity and saturated lower tropospheric stability, a component of the local mean climate change response can be related to present-day variability in all of the GCMs. This suggests that the relationship is not model specific and might be relevant in the real world. In this case, evaluation within the proposed compositing framework is a direct evaluation of a component of the cloud response to climate change. None of the models studied are found to be clearly superior or deficient when evaluated, but a couple appear to perform well on several relevant metrics. Whilst some broad similarities can be identified between the 60N-60S mean change in CRF to increased CO2 and that predicted from present-day variability, the two can not be quantitatively constrained based on changes in vertical velocity and stability alone. Hence other processes also contribute to the global mean cloud response to climate change.