Geophysical Research Abstracts, Vol. 9, 08204, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08204

Non-linearity of the first indirect effect: an improvement of its determination.

C. Deandreis (1), Y. Balkanski (1), JL. Dufresne (2)

(1) LSCE/IPSL, Laboratoire des Sciences du Climat et de l'Environnement, CEA-CNRS-UVSQ, Saclay, France, (2) LMD/IPSL, Laboratoire de Météorologie Dynamique, CNRS, Paris, France (celine.deandreis@cea.fr / Fax: +33 (01) 69 08 30 73 / Phone: +33 (01) 69 08 12 78)

The magnitude of the radiative forcing caused by the first indirect effect of anthropogenic aerosols is still uncertain. In this study, we examine the impact of the aerosols temporal variability in the assessment of this effect. Until now, the impact of aerosol on climate, direct and indirect effects, has been evaluated in using monthly values for aerosol concentrations. Given the atmospheric lifetime of aerosol (from a few days to a week), monthly mean concentrations don't allow to represent correctly the process in which aerosols take part (diurnal cycle, scavenging events ...); an important part of their spatial and temporal variability is lost. Such resolution doesn't affect the quantification of the direct effect which is a linear effect. However, this does not hold for the indirect effect which is non-linear. Its non-linearity comes from the relationship between the cloud droplet number concentrations to the aerosol concentration. We performed two snap-shot simulations (10 years) with the General Circulation Model of the Laboratoire de Météorologie Dynamique (LMDZ). In the first simulation we used monthly mean concentrations as external forcing to do the radiative calculation. In the second simulation, we have coupled LMDZ to the atmospheric chemistry-aerosol module, INCA. The aerosol concentrations are calculated on-line and used in the radiative code with a temporal resolution of 30 minutes. We analyse the indirect effect of sulphate aerosol for the actual period, relative to 1750. In the two simulations, the meteorological fields are the same in order that the observed effect is only due to the impact of variability on the non-linearity. Results suggest a doubled radiative forcing when we take into account the variability of aerosol concentrations (-0.47 W/m^2 vs. -0.23 W/m^2).