Geophysical Research Abstracts, Vol. 8, 01020, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01020

The effect of horizontal photon transport on the radiative effect of contrails

R. J. Hogan (1) and A. Gounou (1)
(1) University of Reading (email: r.j.hogan@reading.ac.uk)

With the rapid growth in air travel there is concern over the radiative impact of contrails and aircraft-induced cirrus on climate. Previous radiation calculations on contrails have almost all used the independent column approximation, which neglects the transport of photons through the sides of the contrail, but in this study the 3D effects are quantified using the 3D SHDOM radiation code. We have investigated the dependence of shortwave and longwave radiative forcing on contrail aspect ratio, optical depth, solar zenith angle, solar azimuth angle relative to contrail orientation, particle size and particle habit. It is found that inclusion of the 3D effects results in a reduction of the shortwave cooling effect of the contrail on climate, but an increase in the longwave warming effect. Although these two effects are individually quite modest (of order 10%), the fact that the total shortwave and longwave forcings largely cancel during the day means that the relative change in the net radiative forcing due to the 3D effect is substantial, in some cases resulting in a doubling of the net warming effect of the contrail. On a more general note, the relatively simple geometry of contrail cirrus provides an ideal test case for explaining the various mechanisms by which 3D photon transport can change the radiative effect of clouds, which can be rather difficult to visualize for more complex cloud scenarios.