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The shortwave to longwave ratio in contrail radiative forcing as evident in two radiation schemes used for global GCMs

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Contrail radiative forcing is difficult to obtain, even if contrail parameters like coverage, ice water content, crystal size etc. are known. Respective results as documented in literature hint to a substantial uncertainty. One key problem is the considerable degree of cancellation between the positive (warming) component from the contrails' greenhouse effect and the negative (cooling) component from backscattering of solar irradiance. The longwave/shortwave cancellation depends on ambient parameters like contrail temperature, co-existing natural clouds, and surface albedo. High demands are set for any radiative transfer model aiming at reliable results of the net radiative forcing.
Climate models are optimally suited to provide a representation of the required variety of ambient parameters for a climatological estimate of contrail radiative forcing. However, comprehensive global climate models use simplified radiative transfer schemes for reasons of computational economy. Hence, a dedicated test of these schemes is required. We present a comparison of contrail radiative forcing estimates from two global climate models with different radiation schemes. The first estimate results from the ECHAM4 model that has been frequently used over the last ten years for contrail climate impact calculations. The second estimate originates from the more recent ECHAM5 model (also being part of the EMAC/MESSy model system) that is used in current and future studies. Use is made of the so-called "Myhre benchmark test" with specified contrail parameters. Beyond global annual means, emphasis is also given to longwave/shortwave forcing ratios for different seasons and to daytime/nighttime differences.