Global aerosol modelling for transport and aviation research

Aerosol particles are one of the most important (and also most uncertain) constituents of the Earth system. They impact the climate via their interaction with radiation and by modifying cloud microphysical properties and lifetimes, both in the liquid and in the ice phase. Aerosol particles also have a detrimental impact on air quality.

The representation of aerosol in global climate models is still affected by considerable uncertainties, which makes the quantification of the global aerosol properties and their climate impacts very challenging. This is related to the complexity of the involved processes, especially those determining the aerosol-induced formation of cloud droplets and ice crystals, the uncertainties in the emission inventories used to drive the model simulations, and the intrinsic limitations of global models to simulate subscale processes due to their coarse spatial and temporal resolution.

The goal of this project is to improve the simulation of aerosol and aerosol-cloud interactions in a global climate model in order to better understand: i) how aerosols impact cloud properties, radiation and climate; ii) how to reduce the uncertainties in the representation of aerosol particles and processes, including both anthropogenic and natural aerosol sources; iii) how to improve the representation of sub-grid scale aerosol processes with the help of observations and higher resolution models; and iv) how aerosol properties and processes may evolve in a changing climate under different scenarios.

The model development activities and the simulations performed in this project also serve as a basis to support further modelling studies in the context of the transport and aviation research of DLR, both at the global and regional scale, and to provide input to partners in the aviation industry.