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Global atmospheric effects and climate change from aviation and surface transport

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Transport contributes about 20 to 30% to anthropogenic climate change in terms of radiative forcing (RF). The transport sector, in particular aviation, is one of the fastest growing industrial sectors. Therefore, the transport sector deserves particular attention when studying climate change.

Transport emissions can impact on climate in several ways: (1) by direct emissions of greenhouse gases, mainly CO2, but also N2O and others; (2) by emissions of indirect greenhouse gases, i.e., precursors of ozone, such as NOx, CO or volatile organic compounds (VOCs); (3) by emissions of aerosols or their precursors, in particular black carbon and SO2, which are directly and indirectly (via cloud formation and cloud modification) radiatively and chemically active; (4) by directly triggering additional clouds due to water vapour emissions (e.g., contrails, contrail cirrus). These emissions are not only responsible for a significant part of the radiative forcing and, hence, for climate change. Model calculations also indicate that the sensitivity of the climate system to some transport related perturbations may be significantly different to that of an equivalent (in terms of RF) CO2 perturbation, i.e., metrics as currently used for comparing different emissions of climate change agents might not be appropriate for transport.