Efficacies of various forcing components contributing to aircraft climate impact

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Linearity and Additivity of Forcing and Response

Traditionally, the global climate impact of individual emission sectors, as well as specific components contributing to the total effect of some sector, have been inter-compared in terms of radiative forcing (example from Sausen et al., 2005, in the column diagram below). In doing so it is implicitly assumed that the radiative forcings of the perturbations add linearly, that the climate response scales linearly with the radiative forcing, and that all radiative forcing have the same efficacy. All assumptions need to be checked, particularly if

- perturbations are heavily scaled to yield a significant statistical signal in climate change simulations with 3-d GCMs or to apply the regression-based radiative forcing definition of Gregory et al. (2004)
- some perturbations display a distinctly non-homogeneous distribution, in which case it is difficult if forcing and response parameter are linked by the same component contributing to the total effect

for conventional forcings the notion of a universal climate sensitivity parameter within a certain model framework is confirmed to a large extent by the common IPCC RF calculation method.

Conclusions

• Indications of anomalous efficacies for aviation forcings do exist, but confirming support from other model frameworks is urgently required.
• Radiative forcing scales linearly through a wide range of values and adds almost perfectly even after moderate scaling.

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References


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