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Editorial

Aviation, Atmosphere and Climate (AAC)

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Aviation can impact climate in several ways: (1) Aircraft emit greenhouse gases, in particular CO_2 and water vapour. (2) They emit precursors of greenhouse gases, like NO_x, which impacts the atmospheric abundances of ozone and methane. (3) Aircraft engines emit particles and their precursors; the corresponding aerosols are radiatively active and modify the optical and micro-physical properties of clouds. (4) Aviation triggers additional clouds (contrails and contrail cirrus) from its water vapour emissions. In all cases the result is a radiative forcing that eventually leads to climate change.

Due to the particular location of aircraft emissions, i.e., in the upper troposphere / lower stratosphere, aviation's contribution to anthropogenic climate change is significantly larger than would be expected from its CO_2 emissions alone. Furthermore, aviation is one of the fastest growing industrial sectors, e.g., in the first half of 2005 the number of revenue passengers travelling from German airports increased by 6.9 % relative to the same period of the previous year, according to a recent press release[3] of the Arbeitsgemeinschaft Deutscher Verkehrsflughäfen (ADV). Therefore, the impact of aviation on the composition of the global atmosphere and on climate has attracted a particular scientific interest, which resulted in a Special Report of the Intergovernmental Panel on Climate Change: "Aviation and the Global Atmosphere" (IPCC, 1999).

Research has continued since the publication of this Special Report and the scientific community has continued in its endeavours to increase our knowledge and to reduce uncertainties. The topic has been further explored with laboratory measurements, large field campaigns, theoretical studies, analyses of satellite data and numerical simulations. During recent years many European projects (e.g. AEROCHEM-2, TRADEOFF, PARTEMIS, MOZAIC, AERO2K, SCENIC, INCA) and many national projects have been devoted to the topic of "Aviation, Atmosphere and Climate". Significant scientific progress has been achieved: the aviation impact on the atmospheric concentrations of ozone and methane and their uncertainties have been better quantified; a consistent quantification of the radiative forcing from linear contrails has been provided; the interaction between aerosols emitted by aircraft and clouds is now better understood; first quantitative estimates of the radiative forcing from contrail cirrus are now available; and we have learned more about the potential mitigation of aircraft effects on climate.

The European Conference on Aviation, Atmosphere and Climate (AAC)[4] in Friedrichshafen (Lake Constance, Germany), 30 June to 3 July 2003, was initiated by the European Commission to update our knowledge on the atmospheric impacts of aviation. This Special Issue of METEOROLOGISCHE ZEITSCHRIFT comprises 15 papers from this conference. It covers a wide range of topics: aviation inventories (GARBER et al.; BUKOVNIK and KALIVODA), chemical reaction rates (SOMNITZ et al.), particles from aviation (PETZOLD et al.), ice nucleation (MÖHLER et al.; MANGOLD et al.; LIU and PENNER), contrails (MINNIS et al.; PALIKONDA et al.; DUDA et al.), contrail cirrus (MANNSTEIN and SCHUMANN), radiative forcing from aviation (SAUSEN et al.), and mitigation of aircraft environment effects (FICHTER et al.; MARQUART et al.; GREEN).

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[3]Pressemitteilung NR. 6 / 2005, www.adv-net.org/de/gfx/presse/pm_06_2005.php
[4]www.pa.op.dlr.de/aac/

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References

IPCC, 1999: Aviation and the global atmosphere – A special report of IPCC working groups I and III. Intergovernmental Panel on Climate Change. – Cambridge University Press, Cambridge, UK and New York, NY, USA, 365 pp.