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Climate-optimal flight planning developed within REACT4C taking into account specific weather conditions

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Aviation contributes to climate change by CO_2 and non-CO_2 effects. Mitigation of aviation climate impact is a strategic goal for sustainable development of air traffic. One mitigation strategy is operational measures for route optimisation by air traffic management (ATM). We present a comprehensive approach developed within the collaborative project REACT4C (Reducing Emissions from Aviation by Changing Trajectories for the benefit of Climate, 2010-2013) funded under the European FP7 programme. Main objective in this transdisciplinary research project, coordinated by DLR, was to identify climate-optimized trajectories, to explore the feasibility of adopting flight altitudes and flight routes that lessen the climate impact and establishing a modelling chain therefore. Second objective was to estimate the global effect of such ATM measures in terms of climate change, exploring also the implementation of a green aircraft.

Climate impact of non-CO_2 emissions depends on time and position of aircraft, as they are related to atmospheric processes, which vary with background conditions and transport pathways within the atmosphere. Hence, flying climate-optimal requires detailed knowledge on spatial dependence of climate impact. However, such information is usually not available during flight optimisation. REACT4C has expanded an air traffic planning tool in order to be able to identify climate-optimized flight trajectories.

We present the overall modelling chain for climate-optimized flight planning, stretching from aviation meteorology over climate impact and leading to climate-optimized flight trajectories. Meteorological situations are characterised with respect to the atmospheric response and climate impact of aviation emissions. Interface between climate impact and flight planning is established via climate cost functions, quantifying atmospheric climate response to aviation emissions depending on emission location and time. Additional studies explored the uncertainty of the modelling chain and aviation impacts in general. Among aviation climate impact we consider in detail CO_2, O_3, CH4, soot, contrail and contrail-cirrus.