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Quantifying the spatial and temporal non-CO_2 effect of aviation by using algorithmic climate change functions

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Aviation aims to reduce its climate impact by adopting climate-optimized aircraft trajectories, avoiding those regions of the atmosphere where aviation emission have a large climate impact. For this purpose, dedicated MET services have to be made available to the flight planning procedures, which need to be predicted with current numerical weather prediction models.

In order to represent spatially and temporally resolved information on the climate impact in terms of future temperature changes due to aviation emissions at a given time and location in such an advanced MET service, we propose to use algorithmic climate change functions (aCCFs) developed in earlier research projects. They include CO_2 and non-CO_2 effects, comprising nitrogen oxide (NO_x), water vapour and contrail-cirrus. These aCCFs allow to derive such climate impact information for flight planning directly from operational meteorological weather forecast data. By combining the individual aCCFs of water vapour, NO_x and contrail-cirrus, also merged non-CO_2 aCCFs can be generated.

With this study we aim to identify specific weather situations which have the potential to provide a robust climate impact reduction despite uncertainties. This work is part of the SESAR project FlyATM4E. For this purpose, a systematic analysis of the meteorological conditions and situations is required. We will present the characteristic water vapour, NO_x induced and contrail-cirrus aCCFs for a set of specific weather patterns based on 2018 reanalysis data. A detailed analysis of the variation in aCCFs will be presented, including the dependency of individual and merged aCCFs to seasonal cycle, different synoptical weather situations and cruise altitude.

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