SIMULATION OF AIR TRAFFIC USING WEATHER-BASED CLIMATE COST FUNCTIONS – FEASIBILITY ANALYSIS

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Abstract. The aviation-related climate impact share today is estimated at about 5%. Lately, very often this has provoked discussions on how to reduce the climate impact of the aviation industry especially in the area of non-CO2 components like ozone, methane and cirrus contrails. DLR has joined the global effort for environmentally sustainable aviation by exploiting an eco-efficient flying in the internal project WeCare (Utilizing **We**ather information for **C**lim**a**te efficient and eco efficient futu**re** aviation). The project focuses on three different areas: climate optimal routings, cost benefit analysis of mitigation options and demonstrable effects of air traffic. The operational and technical measures are considered to be the two classes of measures that can make the air traffic more climate friendly. In this paper, we aim to assess the operational measures by exploiting the effect that the climate optimized trajectories has on the existing air traffic management (ATM) by means of fast-time simulation.

The main data source for the traffic samples is Eurocontrol's S06 flight information data. In addition, the compatible airspace structure for each simulated day is used. Airspace data is gathered and consolidated from EUROCONTROL's Demand Data Repository (DDR2). There are several fast-time simulations performed, which will analyse the feasibility of the climate optimized trajectories as well as the impact they have on the ATM system.

Scenario one, or the reference scenario, is based on the air traffic scenario for the chosen day representing the current ATM system. Scenario two and three include air traffic scenario with an optimized flights for the prototype data and all weather data climate cost functions.

The methodology for this feasibility study is as follows: In the first step evaluation methodology for the final assessment is defined. The evaluation methodology focuses on parameters such as number of flights, sector capacities, controller workload and number of affected flights with both horizontal or vertical change, and flight duration. In the second step the simulations of all the three scenarios are performed and evaluated based on the predefined assessment methodology. In order to evaluate the influence of the optimized trajectories on the system's overall performance, the results of each scenario are compared.

The assumption is that the expected results will both cover qualitative and quantitative aspects. First ones can be obtained by an increased understanding of the (complex) aviation system's behaviour due to changes such as trajectory optimization. This understanding will deepen by offering quantitative results on the change on the above mentioned parameters. The quantitative values will depend on the number of optimized flights as well as on the airspace size. The more aircraft are affected, the more the number of flights in the neighbouring sectors will be increased. As a consequence, capacity will drop and controller workload will be increased.

The preliminary results however slightly differ from the original assumption. Though the traffic demand in the analysed airspaces does not increase dramatically, meaning that the sector capacity does not change, the controller workload drastically increases and the main reason is the increased number of vertical movements by the optimized flights.