A STUDY ON THE EMISSIONS OF ALTERNATIVE AVIATION FUELS

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Abstract. Since the last decade, the aviation sector is seeking for alternatives to kerosene from crude oil, as part of the efforts combating climate change by reduction of greenhouse gas (GHG) emissions, in particular carbon dioxide (CO_2) and ensuring security of supply at affordable prices. These efforts were also triggered by commitments and policy packages, e.g. the 'Flightpath 2050' initiative released by the European Commission.

The technical feasibility as well as the compatibility of alternative jet fuels with today's planes has been proven, with advanced biofuels as the only low-CO_2 option for substituting kerosene, for blends at up to 50%. Within the European Advanced Biofuels Flight Path launched 2011 by the EU, a roadmap was defined with clear milestones to speed up the commercialization of aviation biofuel deployment in Europe.

The use of sustainable kerosene offers several advantages, going beyond reduced CO_2 emissions. When burning a jet fuel, the exhaust gases are a mixture of many species, with unburned hydrocarbons, aromates and further precursors of particles and soot among them. These gases are released in the atmosphere, and may affect the growth and lifetime of contrails, depending on several parameters, e.g. pressure, temperature, turbulence, and relative humidity. Especially contrails are known to be of influence on the climate due to their radiative forcing.

These issues will be addressed by focusing on the emissions of alternative fuels taken into account their individual composition, including two types of crude-oil based kerosenes for reference. Plug flow calculations will be performed by using a detailed chemical-kinetic model for relevant temperatures, pressures, residence times, and fuel-air ratios. Results will be shown for emissions of NOx, CO, benzene and acetylene as major soot precursors. In addition, an overview of what is known on the emission pattern from measurements will be given.