AIRCRAFT LEVEL ASSESSMENT OF CONTRAIL MITIGATION

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Abstract. Contrails may contribute to a large-share of the radiative forcing due to aviation. In this context, understanding of contrails formation mechanisms in the near field of an aircraft may be helpful to provide strategies aiming at reducing their impact.

Three-dimensional RANS simulations of contrails formation produced by a commercial aircraft in cruise conditions are performed. A realistic geometry (here a Boeing 737) is taken into account including engine core and bypass flows which allows several possible parametrical studies and avoids using parameterizations for the description of the plume's dilution. The near field's plume thermodynamic properties are obtained by spatial simulation of the dynamical flow around the aircraft. A coupling is carried out with a microphysics model implemented in the CFD code CEDRE to simulate particle growth using an Eulerian approach. The implemented microphysics model is capable of simulating water condensation onto soot particles, taking into account their activation by adsorption of sulfuric species. The concentrations of which are obtained by forecasting the species chemical evolution within the bulk plume, with the addition of a detailed kinetic model to the simulation.

In this study, we investigate the potential role of soot particles concentration onto contrails properties by comparing results obtained with two different soot emission indices. Results suggest that a sensitive drop of emitted soot particles at the engine core exit would induce lower ice particle concentration, leading to both less visible and less spread contrails.