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THE CLIMATE IMPACT OF HYPERSONIC TRANSPORT

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Abstract. Supersonic transport was the subject of intense debate in the 1970s and commercial operation was eventually abandoned until recently due to economic and environmental concerns. Flight emissions at stratospheric altitude differ from tropospheric emissions mainly in terms of longevity. Long lifetimes of chemically reactive emissions, especially in the presence of the stratospheric ozone layer, require a detailed investigation of the long-term impact of emissions at this altitude.
Recent studies show a faster degradation of stratospheric water vapor with increasing altitude, driven by photolysis and chemical reaction with O^1D. This is seen as an opportunity for civil hypersonic transport. However, the climate impact of hypersonic flight has not yet been investigated.
This is why our study focuses on the emissions of hydrogen-powered hypersonic aircraft fleets (H_2O, NO_x, H_2) in the middle and upper stratosphere (27 and 36 km). Three different scenarios based on the HIKARI emission data allow an altitude dependent comparison of hypersonic emissions. The scenarios were simulated with ECHAM5/MESSy (v2.54.0), including a newly developed submodel H2OEMIS to integrate external water vapor emissions into the cycle of specific humidity.
Additional simulations using different models for comparison are planned with Didier Hauglustaine (LSCE) in the context of project 'Stratofly' funded by EU-Horizon 2020.

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