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Publication date
2020

Document Version
Final published version

Citation (APA)
Domingos de Azevedo Quadros, F., & Dedoussi, I. C. (2020). *Regional sensitivities of air quality to aviation emissions*. 17-17. Abstract from 3rd ECATS conference.

REGIONAL SENSITIVITIES OF AIR QUALITY TO AVIATION EMISSIONS

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Abstract. Emissions from civil aviation traffic degrade air quality, causing human health problems that have been estimated to result in ~16 000 premature deaths per year globally, potentially making the cost to society of the air quality impacts even greater than the cost of the climate impact of these emissions. Previous studies have indicated that aviation emissions in specific areas can have impacts of significantly different intensities due to variations in population density and background atmospheric composition. We use the GEOS-Chem global atmospheric chemistry-transport model to investigate the air quality sensitivity to aviation emissions in different regions of the world by performing simulations with increased emissions on different locations at a time and comparing the resulting changes in human exposure to air pollutants (fine particulate matter and ozone). We evaluate the impacts of both landing and take-off (LTO) and cruise level emissions. The simulations are used to investigate the drivers of the differences in air quality sensitivity to emission location, shedding light to the previously observed indications that European air traffic leads to more premature deaths per mass of emissions than North American air traffic. These regionally varying air quality effects imply that regionally non-uniform regulations, if feasible, might provide efficient strategies of mitigating costs associated with air quality impacts.

Keywords: aviation, air quality, intercontinental pollution, public health