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INTRODUCTION

The characteristics of contrails are strongly dependent on the atmospheric conditions at cruise altitude. Therefore, atmospheric data and aircraft activity data needs to be of high quality and resolution in order to accurately estimate the climate forcing effects of contrails.

Our work [1], we look at the properties of the contrails produced by a sample of flights from domestic flights in Norway in 2019.



AviTeam [2] estimates the flight trajectory and the fuel consumption with high spatial and temporal resolution, using data from ADS-B transponders, flight records and airport data. In this work,

CoCiP [3] combines the output from the AviTeam with high resolution meteorology data to estimate the formation and evolution of contrails produced by the flights. The metheorology data is the 5th generation atmospheric reanalysis of global climate (ERA5) by ECMWF.

References [1] Indo, K.: Modelling of contrail climate effects with the AviTeam and the CoCiP model [Master's thesis], 2024.

[3] Schumann, U.: A contrail cirrus prediction model, Geoscientific Model Development, 5, 543–580, 2012.

Modelling of contrail climate effects with the AviTeam and the CoCiP model



Figure 1: Mean longwave RF' per hour per season for the domestic flights in Norway 2019







domestic flights in Norway 2019.

2] Klenner, J., H. Muri and A. H. Strømman, Transportation Research Part D: Transport and Environment, 109, 103379, 2022.

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KEY STATISTICS

What makes the strongest warming contrails?

 2% of the flights (98.5% of them flying above 8000 m) were responsible for 80% of the annual warming

Autumn and Winter months were responsible for 81% of the annual warming

• The hours between 18:00 – 06:00 were responsible for 91% of the daily warming

> How are the domestic flights in Norway, compared to the average of all flights globally?

• 73% more likely to form persistent contrails

5% longer contrail lifetimes

• 90% less contrail energy forcing per flight distance

CONCLUSIONS

• We find that the domestic flights in Norway produce the strongest warming contrails:

- At higher altitudes
- [•] During the autumn & winter months,
- During evening & night hours.

• The above characteristics indicate that **Overflying and international flights likely have much** larger contrail climate forcings than the domestic flights.

 These patterns also suggest that Flight scheduling could be a tool to mitigate contrail climate forcings.