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The impact of diurnal variations of air traffic on contrail radiative forcing

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Abstract. We combined high resolution aircraft flight data from the EU Fifth Framework Programme project AERO2k with analysis data from the ECMWF's integrated forecast system to calculate diurnally resolved 3-D contrail cover. We scaled the contrail cover in order to match observational data for the Bakan area (eastern-Atlantic/western-Europe).

We found that less than 40% of the global distance travelled by aircraft is due to flights during local night time. Yet, due to the cancellation of shortwave and longwave effects during daytime, night time flights contribute a disproportional 60% to the global annual mean forcing. Under clear sky conditions the night flights contribute even more disproportionally at 76%. There are pronounced regional variations in night flying and the associated radiative forcing. Over parts of the North Atlantic flight corridor 75% of air traffic and 84% of the forcing occurs during local night, whereas only 35% of flights are during local night in South-East Asia, yet these contribute 68% of the radiative forcing. In general, regions with a significant local contrail radiative forcing are also regions for which night time flights amount to less than half of the daily total of flights. Therefore, neglecting diurnal variations in air traffic/contrail cover by assuming a diurnal mean contrail cover can over-estimate the global mean radiative forcing by up to 30%.

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