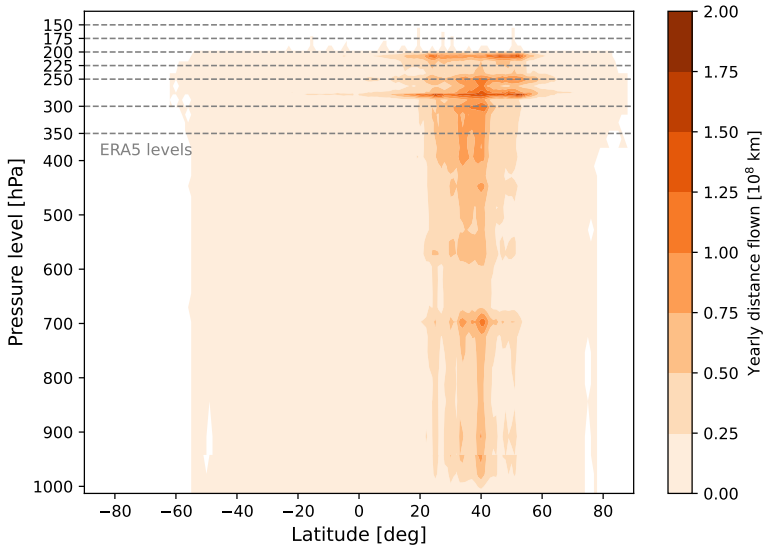
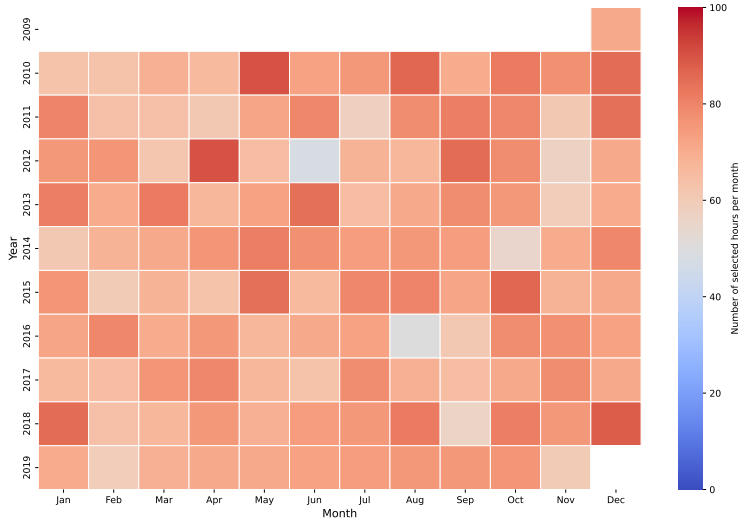


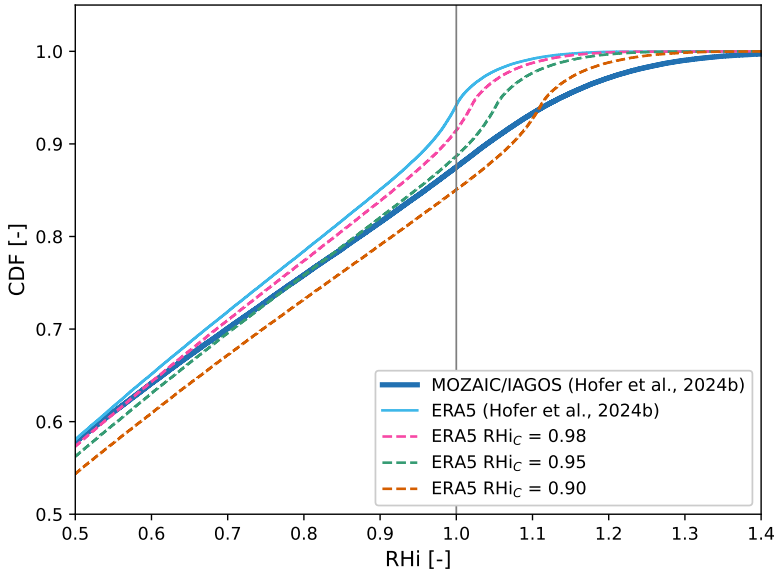

**Supplementary Figure 1.** DEPA 2050 progressive scenario for the year 2050 used to weight the potential persistent contrail formation. Also shown are the ERA5 pressure levels considered in the study.

**Supplementary Table 1.** Percentage changes in potential persistent contrail formation $p_{pcf}$ and DEPA 2050 distance-weighted $p_{pcf}$ for the pressure levels 300 and 250 hPa and all considered pressure levels, averaged over four latitude bands: the southern extratropics (xtropS), tropics (trop), nothern extratropics (xtropN) and all latitudes. The full data is available within the linked dataset.

| | Pressure level | Unweighted | | | | Weighted | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | xtropS | trop | xtropN | Global | xtropS | trop | xtropN | Global |
| WET-75 | 300 hPa | 47.9 % | 0 % | 28.1 % | 38.9 % | 2.3 % | 0 % | 11.6 % | 11.5 % |
| | 250 hPa | 59.2 % | 0 % | 35.3 % | 47.2 % | 4.7 % | 0 % | 18.3 % | 17.4 % |
| | All | 58.1 % | 34.5 % | 34.7 % | 44.9 % | 9.3 % | 1.1 % | 19.0 % | 16.3 % |
| WET-50 | 300 hPa | 80.2 % | 0.3 % | 64.4 % | 73.0 % | 22.6 % | 0.5 % | 46.5 % | 46.2 % |
| | 250 hPa | 83.2 % | 5.0 % | 74.5 % | 77.5 % | 34.3 % | 6.9 % | 59.7 % | 57.3 % |
| | All | 84.5 % | 67.2 % | 73.2 % | 76.6 % | 48.4 % | 23.9 % | 57.8 % | 52.8 % |
| HYB-80 | 300 hPa | 87.1 % | 3.4 % | 76.0 % | 82.1 % | 38.4 % | 4.5 % | 61.4 % | 61.1 % |
| | 250 hPa | 89.6 % | 16.9 % | 84.7 % | 85.7 % | 52.8 % | 20.4 % | 73.9 % | 71.6 % |
| | All | 90.5 % | 76.8 % | 82.8 % | 84.6 % | 62.8 % | 46.5 % | 71.1 % | 67.4 % |
| CON-LG | 300 hPa | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % |
| | 250 hPa | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % |
| | All | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % |
| CON-NG | 300 hPa | 105.3 % | 314.8 % | 109.0 % | 107.1 % | 144.9 % | 298.5 % | 119.8 % | 120.3 % |
| | 250 hPa | 103.1 % | 179.1 % | 104.7 % | 105.5 % | 120.0 % | 169.8 % | 109.1 % | 111.6 % |
| | All | 103.3 % | 107.9 % | 106.5 % | 105.5 % | 120.0 % | 117.6 % | 113.1 % | 113.8 % |
| H2C-04 | 300 hPa | 121.9 % | 7136.0 % | 133.9 % | 129.4 % | 407.0 % | 5163.1 % | 196.0 % | 206.0 % |
| | 250 hPa | 107.2 % | 1788.8 % | 114.6 % | 149.4 % | 153.8 % | 1135.5 % | 129.9 % | 171.6 % |
| | All | 111.6 % | 153.6 % | 122.9 % | 125.7 % | 201.9 % | 252.8 % | 157.5 % | 171.4 % |



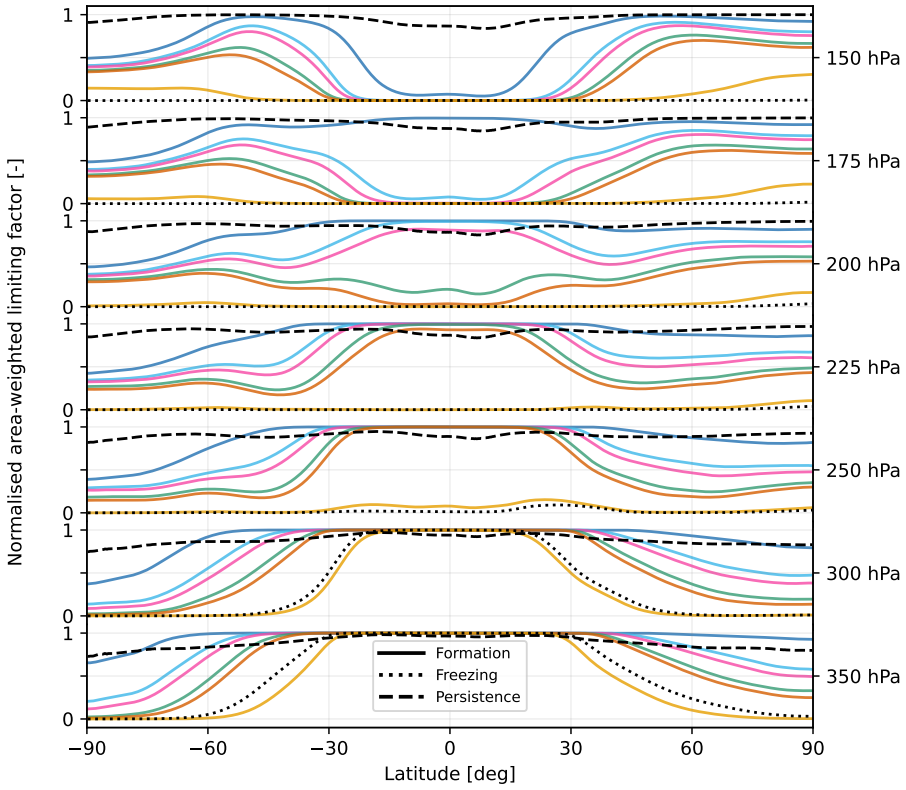

**Supplementary Figure 2.** Number of hours randomly selected in ERA5 within the 2010 decade.



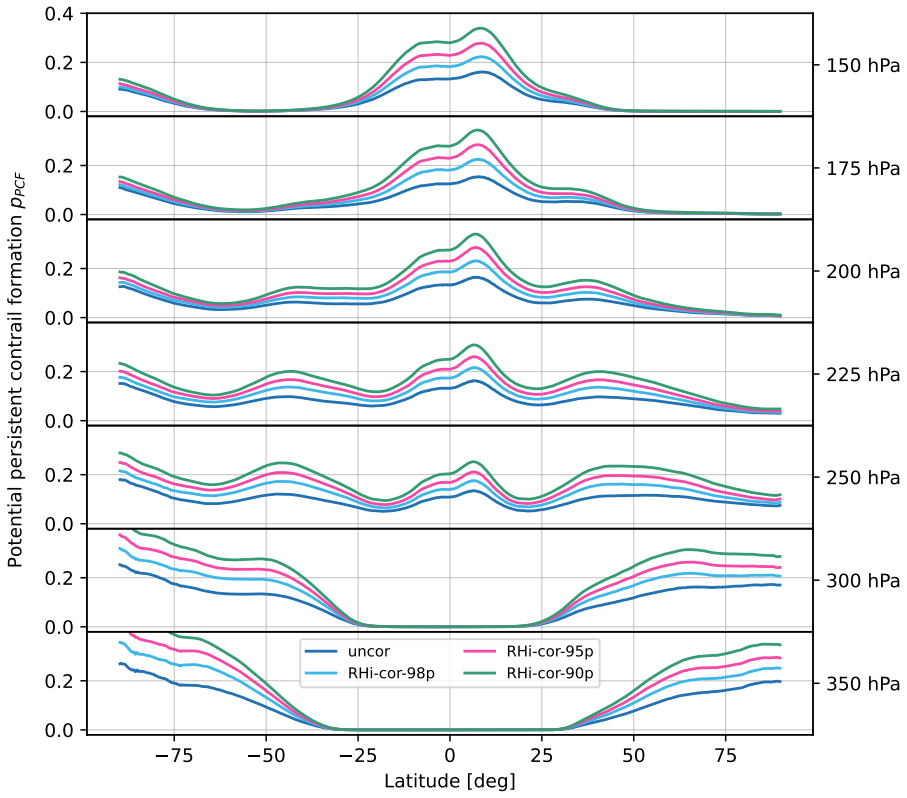

**Supplementary Figure 3.** Comparison of the cumulative distribution functions of ERA5 and MOZAIC/IAGOS from (Hofer et al., 2024). We enhance the ERA5 relative humidity by applying simple factors and find that $RHi_C = 0.95$ provides a good fit against MOZAIC/IAGOS data for RHi $\leq 1.0$.

## References

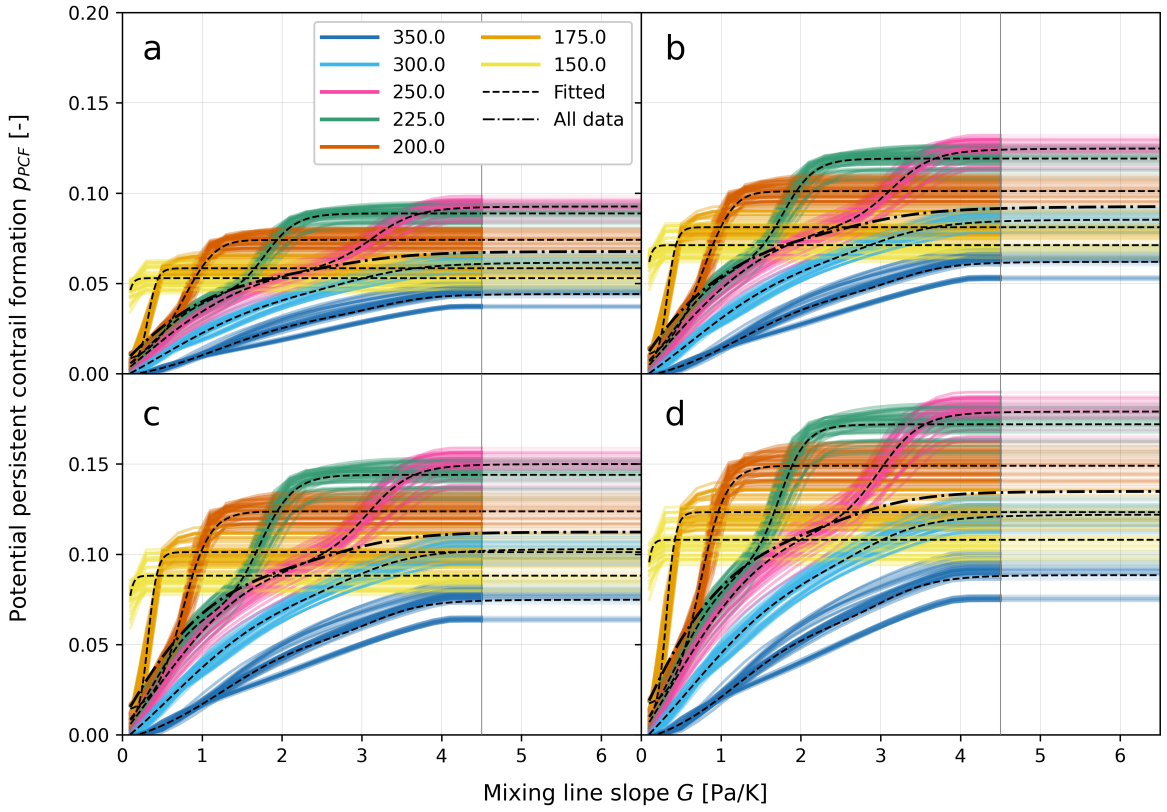
Hofer, S., Gierens, K., and Rohs, S.: How Well Can Persistent Contrails Be Predicted? An Update, Atmospheric Chemistry and Physics, 24, 7911–7925, https://doi.org/10.5194/acp-24-7911-2024, 2024.




**Supplementary Figure 4.** Normalised and area-weighted limiting factors as a function of latitude (x-axis) and altitude (secondary y-axis). A normalised frequency of 0 would mean that the factor never limits persistent contrail formation; 1 that it always does. Freezing (dotted lines) and persistence (dashed lines) are independent of aircraft design. Formation is dependent on aircraft design and shown for the different designs (colours).




**Supplementary Figure 5.** Potential persistent contrail formation as a function of latitude (x-axis) and altitude (secondary y-axis) for different relative humidity enhancements.




**Supplementary Figure 6.** Potential persistent contrail formation $p_{pcf}$ as a function of the mixing line slope $G$ on a climatological timescale for pressure levels 350 to 150 hPa. We enhance the relative humidity by applying simple factors 1/RHi$_C$: **(a)** no correction, **(b)** RHi$_C$ = 98 %, **(c)** RHi$_C$ = 95 %, **(d)** RHi$_C$ = 90 %. Each coloured line corresponds to a single season within the 2010 decade. The dashed lines are the fitted responses using a modified logistic function, for each pressure level individually ("fitted") and for all pressure levels together ("all data"). The faded part for $G > 4.33$ Pa/K represents where the data was extended to improve the accuracy of the fits. The markers show at which value of $G$ the corresponding $p_{pcf}$ reaches within 1 % of the supremum.