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Cirrus-embedded contrails: supplementary material

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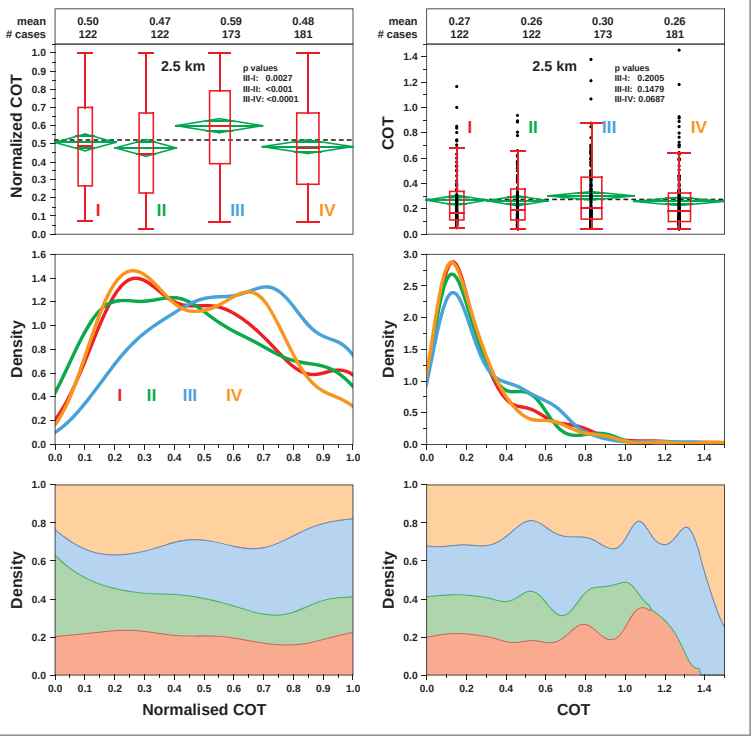
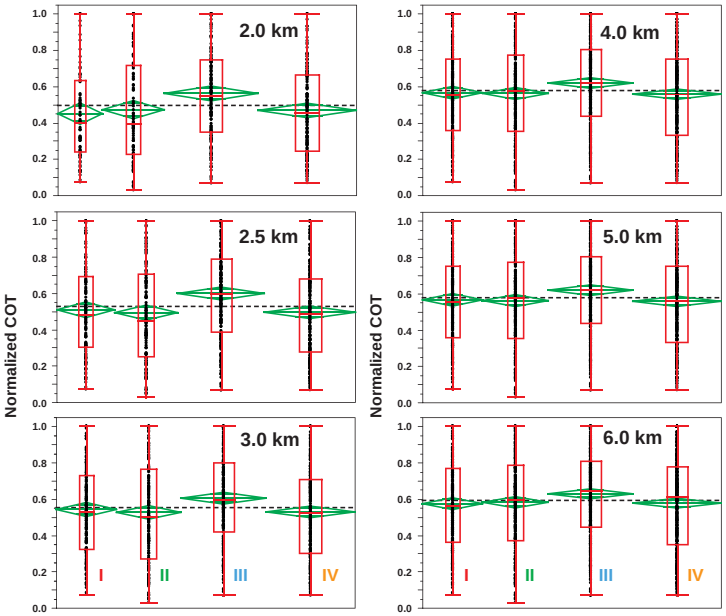
Absolute vs Normalised COT

These plots investigate the difference between absolute and normalised COT for cirrus with a geometrical depth of less than 2.5 km during cases for which extreme advection and the effect of previous aircraft following the same flight track heve been accounted for.



Effect of Cirrus Geometrical Depth

These plots refer to all cases. Screening for advection and accounting for previous aircraft do not affect the message of this plot: cirrus embedded contrails show a larger effect for geometrically thinner clouds.



Effect of Advection and other Aircraft

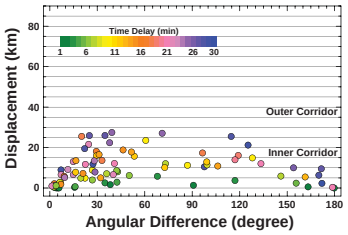
We used ECMWF wind speed and direction at the height and location of the intersection between aircraft flight track and CALIPSO path together with the actual heading of the aircraft to estimate the effect of advection perpendicular to the flight track.
Flight-track data were also used to assess the influence of other aircraft following the same track.
The figures below show the distribution of angular difference between aircraft heading and wind direction versus the displacement perpendicular to the flight track. The colour coding marks the absolute time difference between aircraft passage and CALIPSO overpass. The lower row shows box-and-whisker plots of the quantiles for the data in each category. Green diamonds indicate the 95% confidence intervals for the mean values of each of the categories. The dashed line shows the overall mean value. lots refer to clouds of all geometric depth.

Best Scenario for Data Analysis

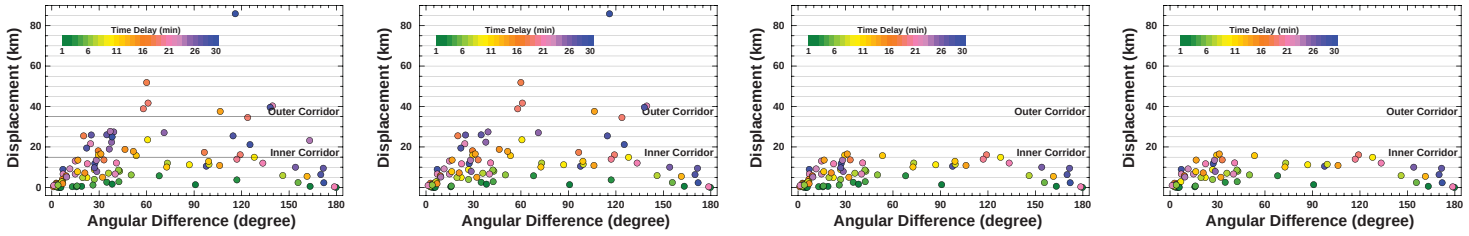
To balance between a sufficient number of data points and the requirement to account for the effects of advection and other aircraft we omit points for which:

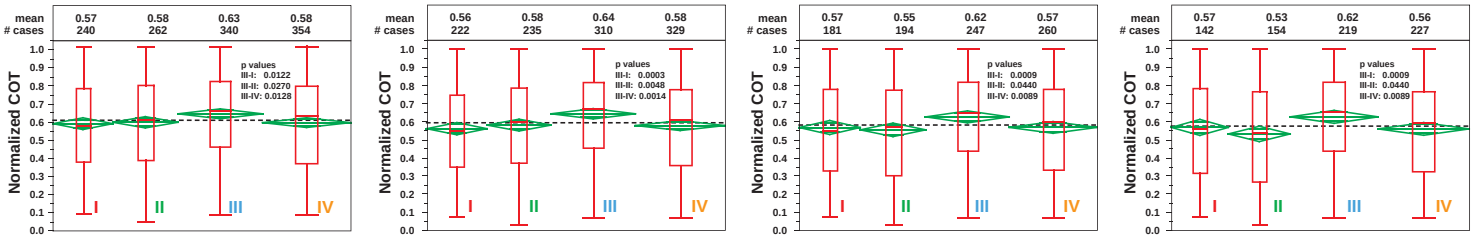
- Another aircraft flew on the same track within less then 30 minutes prior to the passage of our aircraft of interest
- We know that advection will have played a major role at the height and location of the crossing points

These criteria are less strict then the two right options (omit cases with perpendicular displacement larger then 20 km and also omit cases with another aircraft on the same track) given in the panel below



Cases with neigther previous aircraft nor extreme advection: 91 cases





All cases that fulfill the QA criteria: 109 crossings

Cases that fulfill QA criteria and don't show another aircraft on the same flight track less than 30 min prior to overpass: 99 cases

Cases for which the advection perpendicular to the flight track did not exeed 20 km: 82 cases

Cases with neigther previous aircraft nor advection of more then 20 km: 69 cases