

Aircraft Contrails – Observation and Prediction

Task for a *Project*

Background

Aviation-induced cloudiness (due to contrails, persistent contrails, and contrail cirrus) is globally responsible for about half of the warming effect of aviation (depending on the metric). Locally, contrails can be warming or cooling. Avoiding many single warming contrails can help to reduce the global warming effect of aviation. It is a two-step process; first it needs to be predicted if an aircraft leaves a contrail behind or not. This is done with the Schmidt-Appleman Diagram. Input values are altitude, temperature, and relative humidity. If it is determined that a contrail is formed, it is investigated in a second step if the contrail stays in the sky for a short or for a long time. This depends again on temperature and especially on relative humidity. Contrails are persistent at higher relative humidity. Otherwise, they dry (sublimate; the direct transformation of ice into water vapor). Only contrails that are sufficiently persistent to form cirrus clouds are relevant for the energy balance of the atmosphere. A comparison can be made between observed contrails in the sky and their calculated possibility of existence and estimated persistence. If calculations and observations show good agreement in a trial, contrail prediction with the aim to avoid warming contrails becomes feasible.

Task

Task of this project is to observe contrails in the sky and to compare their existence and persistence with calculations. These steps need to be worked on:

- Summarize contrail fundamentals (formation, duration, impact, avoidance).
- Explain prediction of contrails and estimation of their span of life.
- List elements of contrail observation and documentation.
- Observe aircraft passing by in cruise, classify their contrails, compare with results from their contrail prediction, and discuss the achievable accuracy of the prediction also in view of required expenses for necessary tools.

The report has to be written in English based on German or international standards on report writing.