Non-CO_2 effects

BASIC RESEARCH REQUIRED

According to current scientific knowledge, the overall impact of aviation on the climate is not limited to the effect of CO_2 emissions. This is due to the so-called non-CO_2 effects. Intensive research is still needed to better understand how they work and to develop measures to reduce the overall greenhouse effect.

Around three per cent of man-made CO_2 emissions are caused by global aviation. In addition, so-called non-CO_2 effects are also thought to have an impact on the climate. These include, in particular, long-lasting contrails and cirrus clouds at high altitudes. They are formed when exhaust particles and water vapour emissions from engines freeze into ice crystals in sufficiently cold and humid layers of air and fan out over a longer period of time. Depending on the geographical location and time of day, these contrails can have a cooling or warming effect, although the warming effect (greenhouse effect) probably predominates.

"100 Flights Program" tests the avoidance of contrails

In order to better understand the effect of contrails and to be able to avoid possible greenhouse effects in the future, Lufthansa is conducting the "100 Flights Program" together with TUIfly, Condor, DHL, German Air Traffic Control (DFS) and Eurocontrol. As part of this program, which has been coordinated with the Federal Ministries BMWK and BMDV, 100 scheduled flights will fly around climate-sensitive areas using newly developed forecasting tools and analysed weather data. The German Aerospace Center (DLR) and the German Meteorological Service are evaluating the test flights.


Long-lasting, climate-impacting contrails


Short-lived contrails

Optimizing routes and automating flight planning

The data and methods used are still highly uncertain. Therefore, the quality of the forecast data used to calculate the flight route optimization must be improved with the help of satellite data, among other things. It must also be investigated whether the additional CO_2 emissions for the detours contribute more or less to climate change than the contrails themselves. Automating flight planning is also a challenge – currently, both the weather data is fed in before the flight and the route is still adjusted manually. In addition, the optimised route can only be flown if the airspace in the relevant region is not too full. All of this shows that it will still take some time before CO_2 effects can be automatically and systematically avoided in scheduled flight operations.

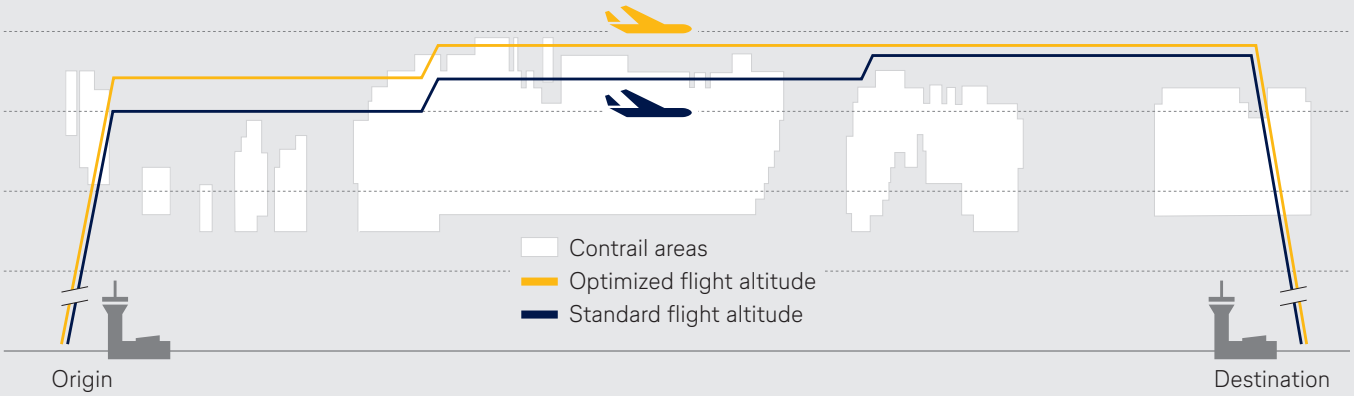
Climate reasearch since 1994

The Lufthansa Group has been involved in climate and environmental research for 30 years. For example, the company supports the European research infrastructure IAGOS (In-service Aircraft for a Global Observing System) with the two sub-projects IAGOS-CORE and IAGOS-CARIBIC (Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container).

In cooperation with research partners, Lufthansa equips selected aircraft with measuring instruments that collect information on the state of the atmosphere during regular passenger flights. The measurement data helps researchers to gain new insights into the development of the climate and the composition of the atmosphere, to make climate models more precise and to improve weather forecasts. They are freely and openly accessible via the central database of the CNRS (Centre National de la Recherche Scientifique) in Toulouse and are currently used by around 300 organizations worldwide.

Flying over climate-sensitive regions

As part of the joint project D-KULT, Lufthansa is flying over regions where long-lasting contrails can form. Optimized flight routes require precise forecasts before take-off and sufficient capacity in the airspace. On that basis, the altitude profile of a flight (shown here schematically) can be improved.



Source: Projekt D-KULT – Fa. PACE

Review of climate impacts across the EU

The EU is also focussing on non-CO_2 effects. As part of the reform of the European Emissions Trading System (ETS), a recording and reporting system (MRV) for non-CO_2 effects was adopted. From January 2025, airlines will have to monitor and report non-CO_2 effects using the MRV system. It is still unclear exactly how this will be done. What is clear is that reliable data, models and uniform, transparent standards are required.

The following points are also important:

- **Regulating effectively:** To ensure that flying around the sometimes very large air masses has an overall positive climate effect, the climate impact of the avoided contrails must be compared with the additional CO_2 emissions. A suitable calculation tool does not yet exist. Only such an instrument and the resulting findings will form a solid basis for effective regulation of non-CO_2 emissions.
- **Promoting test flights:** Flying detours increases kerosene consumption. The resulting additional costs have so far been borne solely by the airlines that carry out the test flights. It would make sense for the industry and the regulator to share the burden.
- **Accelerating the SAF ramp-up:** Flying with sustainable aviation fuels (SAF) reduces soot particles and the formation of contrail ice crystals. The use of SAF could therefore also reduce the climate-warming effect of contrails. Politicians must promote the ramp-up of SAF overall.
- **Securing research in the long term:** The ongoing basic work must be continued with further projects to research non-CO_2 effects and their avoidance. The data and measurement methods must be significantly improved. The aim must be to create a reliable database so that climate effects (non-CO_2 and CO_2) can be automatically and systematically taken into account in scheduled flight operations. To achieve this, all relevant partners from politics, research and industry must work together in the long term.

D-KULT lighthouse project

The “100 Flights Program” is part of the joint project D-KULT (Demonstrator Climate and Environmentally Friendly Air Transport), which was launched in 2022 and is funded by the Federal Ministry of Economics and Climate (BMWK) as part of the sixth civil aviation research program. D-KULT will create important scientific foundations for the avoidance of climate-sensitive areas in routine flight operations. The aim of the project is to define, develop and test all components (data, software and processes) required for climate optimization in routine flight operations. D-KULT is a Europe-wide “lighthouse project”; comparable projects in other countries were not launched until 2023.