

# Increased Flight Safety and Cost Savings for Airlines through Real Time Thunderstorm Information

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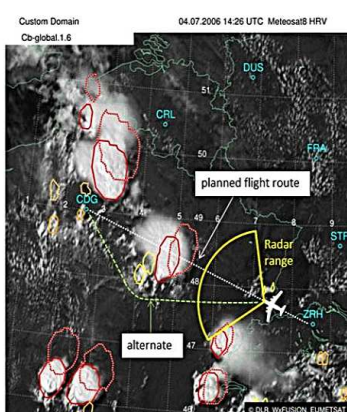
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## Aim of the Study

Satellite-based thunderstorm detections and nowcasts from the DLR tool Cb-global provide pilots an overview of the current thunderstorm situation beyond the limited view of the on-board radar. If uplinked into the cockpit of aircraft in real time this information enables a pilot to strategically plan a safe and fuel-saving flight route around the thunderstorms well ahead in time instead of flying tactical maneuvers and searching for gaps between the thunder cells. In this study, the great potential of Cb-global with respect to flight safety and fuel efficiency is systematically proven by comparing flight tracks and meteorological measurements from the IAGOS (In-service Aircraft for a Global Observing System) data base with Cb-global data.

## Cb-global

Based on geostationary satellite data the DLR tool Cb-global detects, tracks, and predicts thunderstorm hazards for aviation for up to one hour (=nowcasting). Four different spectral channels are combined in order to identify three different development stages: potential thunderstorm development (yellow), rapid vertical cloud growth (orange), and mature thunderstorm (red). Compared to the limited view of the on-board radar, Cb-global provides the pilot with the big picture of the situation.



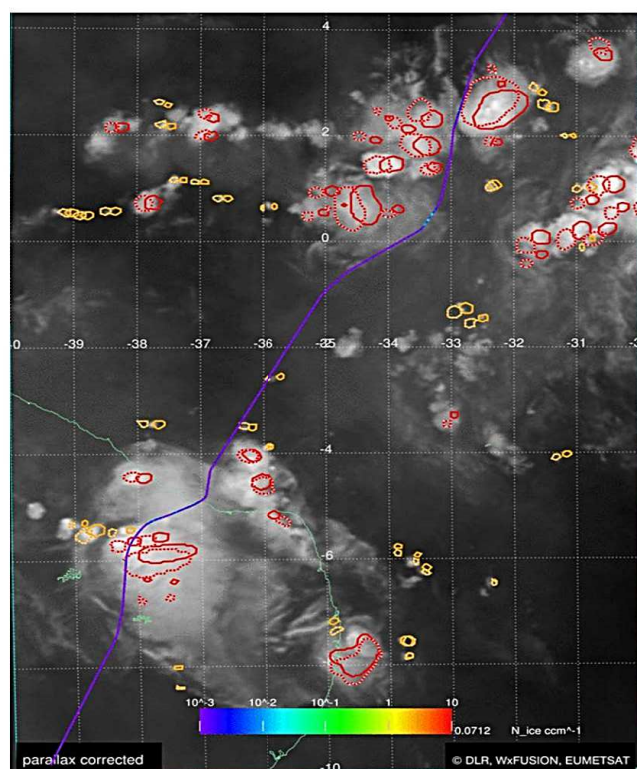
## IAGOS Database

In-service Aircraft for a Global Observing System (IAGOS) is a European Research Infrastructure for global observations of atmospheric composition from commercial aircraft ([www.iagos.org](http://www.iagos.org)). For this study, meteorological measurements along the flight routes were compared to Cb-global data for 31 IAGOS flights with avoidance manoeuvres around thunderstorms.

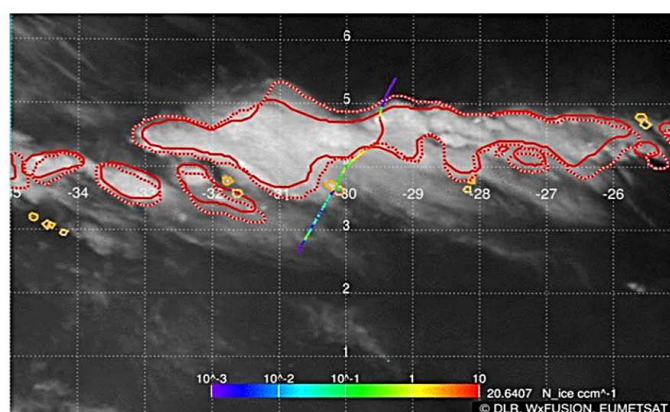


The IAGOS Backscatter Cloud Probe (BCP) instrument measures ice particle number concentrations  $N_{ice}$ . In combination with temperature  $T$  and relative humidity over ice  $RH_{ice}$  the BCP values give an indication on aircraft icing conditions.

## Systematic Comparison of Cb-global with IAGOS Data



For 29 of the 31 flights with avoidance manoeuvres the flight routes lead around the thunder cells detected by Cb-global. All these flights show  $N_{ice} < 2/cm^3$  at  $T \sim 230K$  and  $RH_{ice} > 100\%$ , i.e. no icing conditions



Two of the 31 flights lead through the thunder cells detected by Cb-global with  $N_{ice} > 20/cm^3$  at  $T \sim 248K$ , i.e. conditions favorable for icing

## Conclusions

- IAGOS is a unique data base to provide proof of the quality of Cb-global
- Obviously, the on-board radar picture is in accord with Cb-global
- The combination of  $N_{ice}$  with  $RH_{ice}$  and  $T$  indicates that the flown routes that avoid the Cb-global areas were safe with respect to thunderstorm hazards
- The few cases where the flight route leads through Cb-global areas show conditions favorable for icing within these regions
- The Cb-global detections and nowcasts are reliable
- Cb-global can be used by pilots to plan safe flight routes thereby saving fuel costs