



## **Advanced MET Services for enhanced safety and climate optimisation of aircraft trajectories within 5DMET-Advisory**

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The potential of on-board use of advanced MET information services in order to improve the efficiency of flight operations is extremely high. Enhanced situation awareness, taking advantage of up-to-date, high-resolution graphical or structured MET, will provide more appropriate description of the dynamic flight environment to the crew by also providing additional information relevant for key performance areas safety and environment. Better familiarity with the environment, in which the flight is executed, leads to better strategic decisions, more balanced pilot workload, and consequently also to reduced workload for dispatchers and controllers. It is assumed that such improvements will have quantifiable benefits on fuel consumption, safety enhancement, overall flight efficiency and consequently on environmental sustainability. Within this study we focus on safety enhancement and environmental sustainability in terms of climate impact.

With regards to safety, forecasts from numerical weather prediction models can only give a rough estimate on the future location and time of the occurrence of thunderstorms. They are useful for strategic planning phase, i.e. days before the execution of a flight. However, for the tactical phase, i.e. shortly before take-off and during the flight, observations and nowcasts of currently occurring thunderstorms are necessary in order to adjust and replan flight routes. We present an advanced MET Service which provides such observations and nowcasts are provided by the Cb-global, where Cb stands for cumulonimbus. The system uses data from geostationary satellites in order to identify, track and nowcast thunderstorm cells up to one hour. We will present case studies and trials with real time data link of Cb-global data into the cockpit of aircraft, where it was shown that the use of Cb-global data for the flight planning can considerably increase flight safety and reduce fuel consumption and delays.

With regards to environmental sustainability, an option to reduce aviation impact on climate, are operational measures which optimize individual aircraft movements by minimizing their climate impact, hence improving environmental performance. Thus improved flight guidance and routing avoid in particular climate-sensitive regions of the atmosphere, e.g. contrail forming areas or areas with strong ozone production. For the use case climate-optimized aircraft trajectories and assessment of the environmental performance of flight trajectories require a dedicated MET Information Service and a measure or metric to allow for the valuation and the assessment of the environmental impact of flight trajectories. We present how to establish this interface by so-called environmental change functions (ECFs), which provide environmental impact of a local emission and which can be directly integrated in aircraft trajectory optimisation tools. Such ECFs are calculated from comprehensive chemistry-climate-models, which present a novel advanced MET service for climate-optimisation.

The presented work on advanced MET services for safety and environment represents a progression of work undertaken in SESAR1 in support of trajectory planning & management in general. It is part of the projects PJ18 4DTM and ATM4E having received funding from the SESAR Joint Undertaking under grant agreement No 734161 and No 699395 under European Union's Horizon 2020 research and innovation programme.