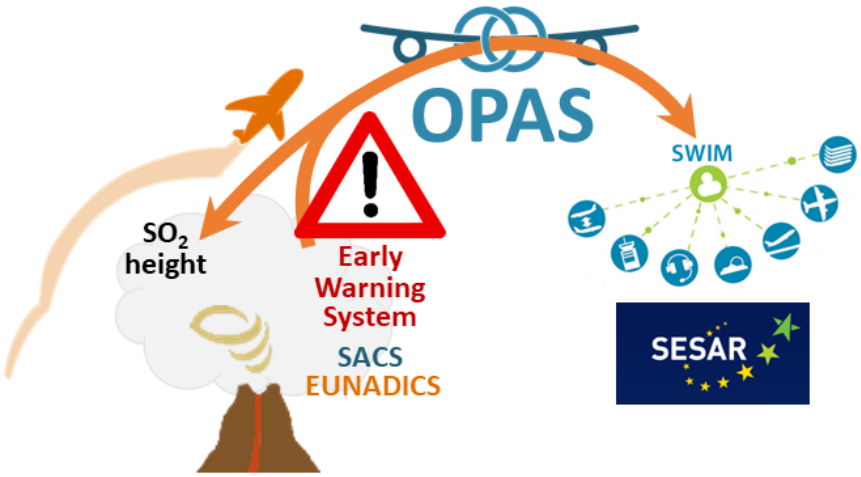
Operational alert Products for ATM via SWIM ('OPAS')

Executive summary

Natural airborne hazard can affect the good proceedings of long-haul flights, being a possible threat to the health of the passengers, affecting Air Traffic Management (ATM) and causing potential damage to aircraft engines. For this reason, it is essential to give stakeholders access to global Earth observations from satellite, with the objective to generate prompt alerts, e.g. of the emission of gas and aerosols from a volcanic eruption. The availability of relevant information is critical for enhancing situational awareness and providing resilience in crisis.



The OPAS Engage-KTN project aims to develop a new type of early warning and the delivery of tailored information to avoid the contamination of sulphur dioxide (SO_2) during long-haul flights.

The type of alert developed by the OPAS project is the plume height of SO_2 emitted by a volcanic eruption. The knowledge of the height of the volcanic plume is essential for the good proceedings of a flight. The SO_2 height is often a good proxy of the height of volcanic ash, which is known for being a potential source of damage on aircraft. The ash (and its height) is notoriously difficult to measure. A recent study achieved by Rolls-Royce, shows the impact of the SO_2 exposure and the sulphur damage to engines has been diagnosed for several hundred flights. This highlights the critical interest for stakeholders to get information on the SO_2 plume height to avoid contamination.

The OPAS ('Operational alert Products for ATM via SWIM') project uses data from three satellite sensors:

- TROPOMI on board Sentinel-5 Precursor platform (S5P)
- IASI-A & IASI-B, respectively on board MetOp-A & MetOp-B

These three hyperspectral instruments, operating respectively in the ultraviolet and infrared ranges, contribute significantly to the state of the art of SO_2 measurements from satellite.

The outcome of the OPAS project is the new algorithmic development (iterative SO_2 optical depth fitting) of TROPOMI SO_2 layer height retrievals (SO_2 LH). This algorithm is operationally running at BIRA by using the spectral radiance provided by the ESA hub. In addition, the OPAS project developed a new type of warning, the SO_2 LH from TROPOMI, used by an existing Early Warning System (EWS), i.e. the Support to Aviation Control System (SACS; http://sacs.aeronomie.be). This system is dedicated to aviation and ATM. SACS was initially developed by ESA (2002-2014) and recently upgraded in the frame of EUNADICS–AV project (European Natural Airborne Disaster Information and Coordination System for Aviation; http://www.eunadics.eu). The IASI sensors already provide well recognised estimations of SO_2 LH and alerts, which are used by the SACS EWS.

The outcome of the OPAS project is the improvements of the SO_2 LH alerts (TROPOMI and IASI) by providing tailored information, i.e. SO_2 contamination of flight level (FL) and improved SO_2 mass loading.

The OPAS Engage-KTN project has developed a SWIM Technical Infrastructure Yellow Profile service. The OPAS SO_2 LH notification SWIM service allows subscribers to receive warnings with information on the height of volcanic plume (emission of SO_2 from an erupting volcano) and the associated SO_2 contamination of FL. The subscriber receives an email notification that provides access to datasets of SO_2 LH from three satellite instruments (via https connection). These datasets are characterised based on metadata and provided in NetCDF format.

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