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Satellite Monitoring of Ash and Sulphur Dioxide for the mitigation of Aviation Hazards: Part I. Validation of satellite-derived Volcanic Ash Levels.

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The 2010 eruption of the Icelandic volcano Eyjafjallajökull attracted the attention of the public and the scientific community to the vulnerability of the European airspace to volcanic eruptions. Major disruptions in European air traffic were observed for several weeks surrounding the two eruptive episodes, which had a strong impact on the everyday life of many Europeans as well as a noticable economic loss of around 2-3 billion Euros in total. The eruptions made obvious that the decision-making bodies were not informed properly and timely about the commercial aircraft capabilities to ash-leaden air, and that the ash monitoring and prediction potential is rather limited. After the Eyjafjallajökull eruptions new guidelines for aviation, changing from zero tolerance to newly established ash threshold values, were introduced.

Within this spirit, the European Space Agency project *Satellite Monitoring of Ash and Sulphur Dioxide for the mitigation of Aviation Hazards*, called for the creation of an *optimal End-to-End System for Volcanic Ash Plume Monitoring and Prediction* . This system is based on improved and dedicated satellite-derived ash plume and sulphur dioxide level assessments, as well as an extensive validation using auxiliary satellite, aircraft and ground-based measurements. The validation of volcanic ash levels extracted from the sensors GOME-2/MetopA, IASI/MetopA and MODIS/Terra and MODIS/Aqua is presented in this work with emphasis on the ash plume height and ash optical depth levels. Co-located aircraft flights, Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation [CALIPSO] soundings and well as European Aerosol Research Lidar Network [EARLINET] measurements were compared to the different satellite estimates for the those two eruptive episodes. The validation results are extremely promising with most satellite sensors performing quite well and within the estimated uncertainties compared to the comparative datasets. The findings are extensively presented here and future directions discussed in length.