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En route to sustainable aviation: from climate science to mitigation policies

Abstract

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Towards a European network of observation supersites for contrail tracking, attribution to flights and assessment of contrail prediction models

Contrail observations are essential for evaluating physical models, assessing forecasts and mitigation strategies, and reducing uncertainty in aviation's climate impact. Yet no single observing system can capture both the evolution of individual contrails and the physical properties needed to evaluate their effects. Observational continuity may be lost as contrails thin, overlap or merge with surrounding cirrus, even while their physical influence persists.

This presentation explores the role of coordinated observation super-sites in addressing these challenges. Combining ground-based cameras and lidars, geostationary and polar-orbiting satellites, and flight trajectories offers complementary information on flight attribution, plume evolution, altitude, optical properties and radiative effects. Emerging satellite capabilities also provide valuable context on atmospheric temperature, humidity and surrounding ice clouds. Examples from ongoing European research illustrate the benefits and practical challenges of these combinations. Particular attention is given to artificial intelligence for detection, tracking, collocation and the transfer of information between sensors, supported by shared, labelled datasets.

Finally, the presentation outlines a pathway towards a European network of contrail observation super-sites, building on existing infrastructure. Particular attention is given to ground-based camera networks, assessing their current coverage, extension costs and prospects for deployment in conjunction with satellite observations. ContrailNet and EUMETSAT cloud infrastructure are discussed as potential foundations for shared datasets and scalable processing, enabling coordinated observations to support flight attribution and systematic evaluation of contrail prediction models.