



# ICAO Symposium on Non-CO<sub>2</sub> Aviation Emissions

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Montréal, Canada



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# SATAVIA



## Aviation non-CO<sub>2</sub> climate impact

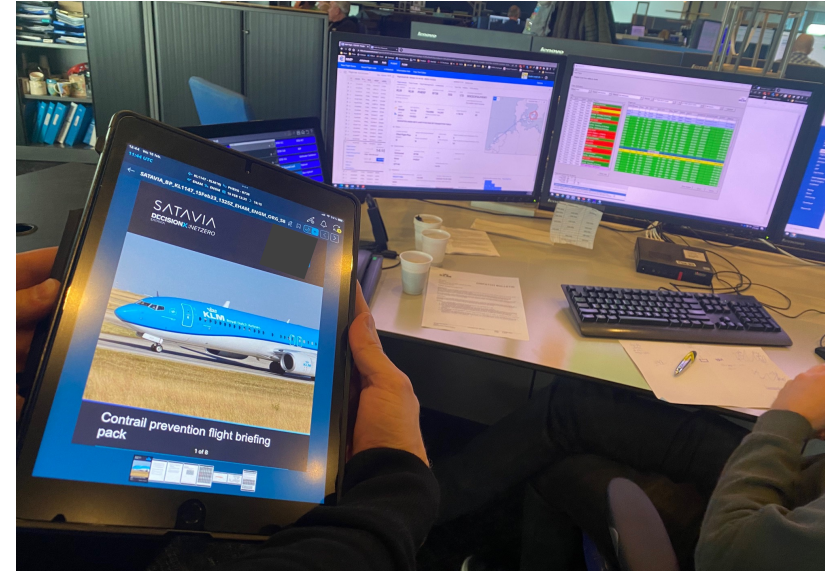
- Non-CO<sub>2</sub> climate impact consists of contrails, NO<sub>x</sub> and soot; aircraft contrails trap heat in the atmosphere
- Only ~2% of flights create ~80% of the annual contrail energy forcing\*
- EU regulation is coming on 1 January 2025 to monitor, report and verify (MRV) non-CO<sub>2</sub> impact

\* Teoh et al. (2024), Atmos. Chem. Phys., 24, 6071–6093;  
<https://doi.org/10.5194/acp-24-6071-2024>



## Flight operations optimisation

- SATAVIA's industry-leading tech platform, DECISIONX, integrates numerical weather prediction modelling, Earth Observation data, and global asset-tracking to provide high-resolution and easily accessible atmospheric data.
- SATAVIA's unique capability lies in forecasting inputs, such as humidity at altitude, to the existing models, including free models.
- Pre-tactical solution to optimise existing flight plans to minimise contrail climate impact



## Quantifying mitigated impact with carbon accreditation

- SATAVIA is pursuing rigorous external accreditation in partnership with Gold Standard, a leading carbon accreditation platform to enhance the governance and accountability of its solution.
- The purpose of the methodology is to quantify or estimate avoided climate impact in standard CO<sub>2</sub> equivalent units similar to those used by emissions trading schemes.
- The verification methodology will provide a robust transparent process around the climate benefit.

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## Advancing the underlying science

- The science team at SATAVIA have been driving forward the fundamental science around numerical weather prediction.
- The team recently published a paper quantifying the uncertainty associated with numerical weather prediction model forecasts.
- Statistical analysis of upper-tropospheric, lower-stratospheric moisture predictions focusing on ice supersaturated regions (ISSR).

*Atmospheric Research, Volume 311, 1 December 2024, 107663*



Atmospheric Research  
Volume 311, 1 December 2024, 107663



### On the fidelity of high-resolution numerical weather forecasts of contrail-favorable conditions

Gregory Thompson  , Chloé Scholzen, Scott O'Donoghue, Max Haughton, Roderic L. Jones, Adam Durant <sup>1</sup> , Conor Farrington

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<https://doi.org/10.1016/j.atmosres.2024.107663>

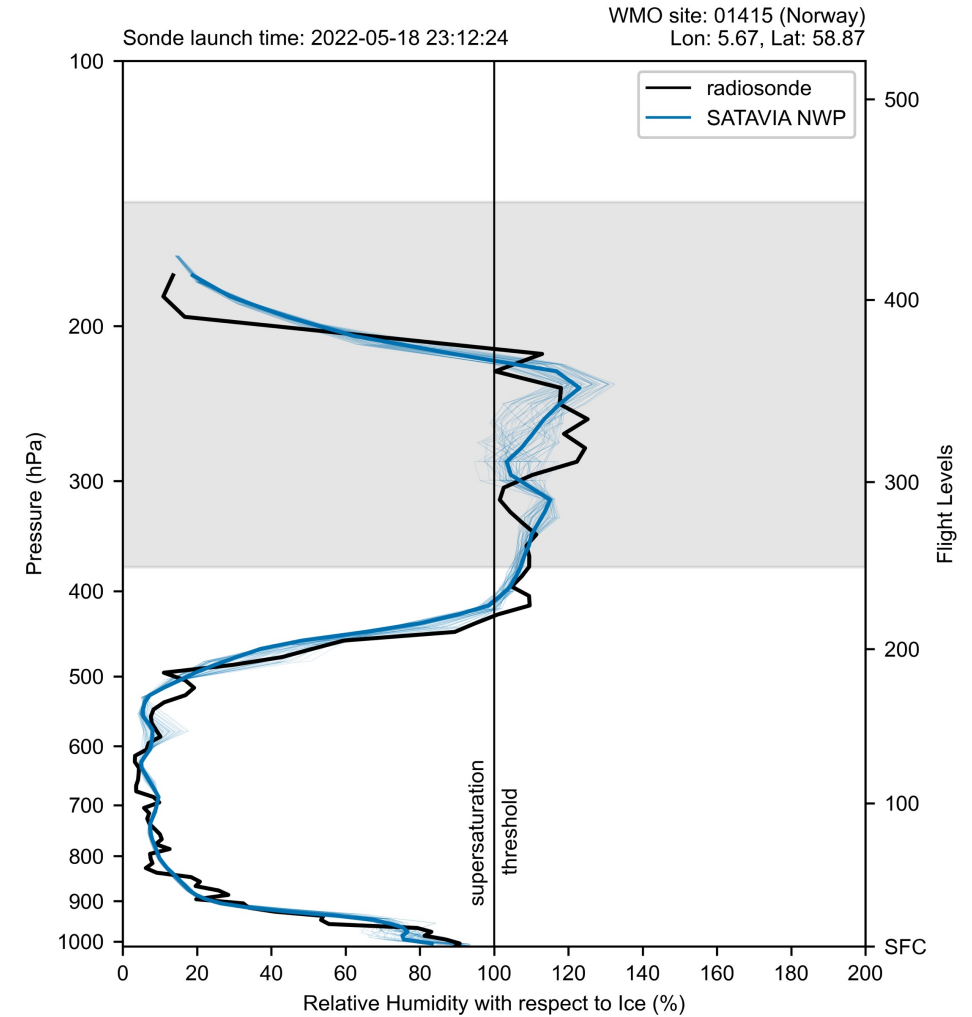
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#### Highlights

- Statistical analysis of upper-tropospheric, lower-stratospheric moisture predictions.
- Skill of forecasts of relative humidity with respect to ice.
- Numerical weather prediction of ice supersaturation and contrail formation regions.
- Applicability of numerical weather prediction of contrails to re-route aircraft in order to prevent contrails.
- Reducing non carbon dioxide impacts of aviation by contrail management.

## Advancing the underlying science

- The forecasts were compared against in situ measurement data from radiosondes and aircraft measurements
- The results are encouraging and demonstrate that NWP forecast skill is adequate when the model is configured for the use case of aircraft navigation
- Further improvement could be made around eliminating false positives, where the forecast incorrectly predicted an ISSR, and false negatives, where the forecast missed an ISSR



# Measuring mitigation success in aircraft operator trials 2022-2024

- Operational mitigation requires thoughtful trade-off between fuel burn and CO<sub>2</sub>, climate impact of non- CO<sub>2</sub> climate forcers (contrails, NOx and soot) and other operational cost factors.
- CO<sub>2</sub> penalty emissions are a major concern when performing deviations around ISSRs.
- Trials with 14 operators have shown that potential cost can be minimised while still delivering significant climate benefit.



Stats (2023/2024)	Value
Number of flights modified	77
Airlines	14
Average CO <sub>2</sub> e reduction per flight (T) (GWP100)	-35.9
Average fuel burn penalty per flight (T)	+0.094
Average CO <sub>2</sub> penalty per flight (T)	0.29
Average flight time delta (seconds)	-17
Largest CO <sub>2</sub> e reduction on a single flight (T)	251

**100X  
benefit**

## Summary and priorities

- Enhancing the scientific understanding of aviation's non-CO<sub>2</sub> effects, including contrails, is the top priority
- SATAVIA has shown that it is possible to generate reliable water vapour forecasts using a NWP model.
- The next step is to focus on linking forecasts to observations in near-real-time to achieve a step-change in capability to manage contrails.

