non-CO_2 emissions characterisation: ECLIF3 and VOLCAN in-flight measurement campaigns overview

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Airbus & partners actively contribute to contrail research

ECLIF3

- A350-900 / Rolls-Royce Trent XWB-84
- 9 flights, incl. 6 in contrail forming conditions
- 3 fuels: JET A-1, 38% HEFA blend, 100% HEFA
- Q2-2021 and Q4-2021

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VOLCAN

- A319neo and A321neo / CFM LEAP-1A
- 21 flights, incl. 13 in contrail forming conditions
- 4 fuels (JET A-1, HEFA+0%/8%/17% aromatics)
- Lean Burn and (forced) Rich Burn combustion modes
- Q4-2021 and Q1-2023

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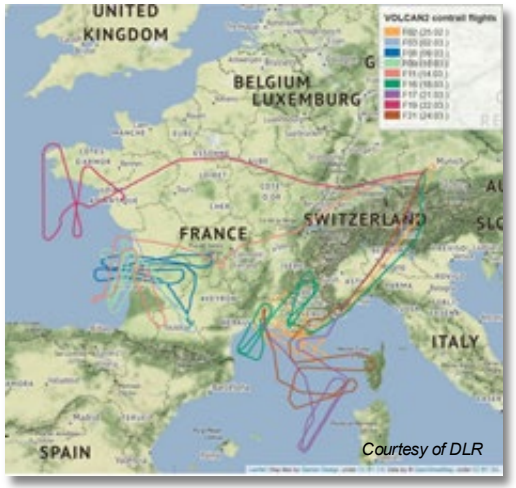

⇒ 2 intensive ground & in-flight emission measurement campaigns with different combustor technologies and fuels to improve understanding of their impact on aircraft emissions and contrails properties.

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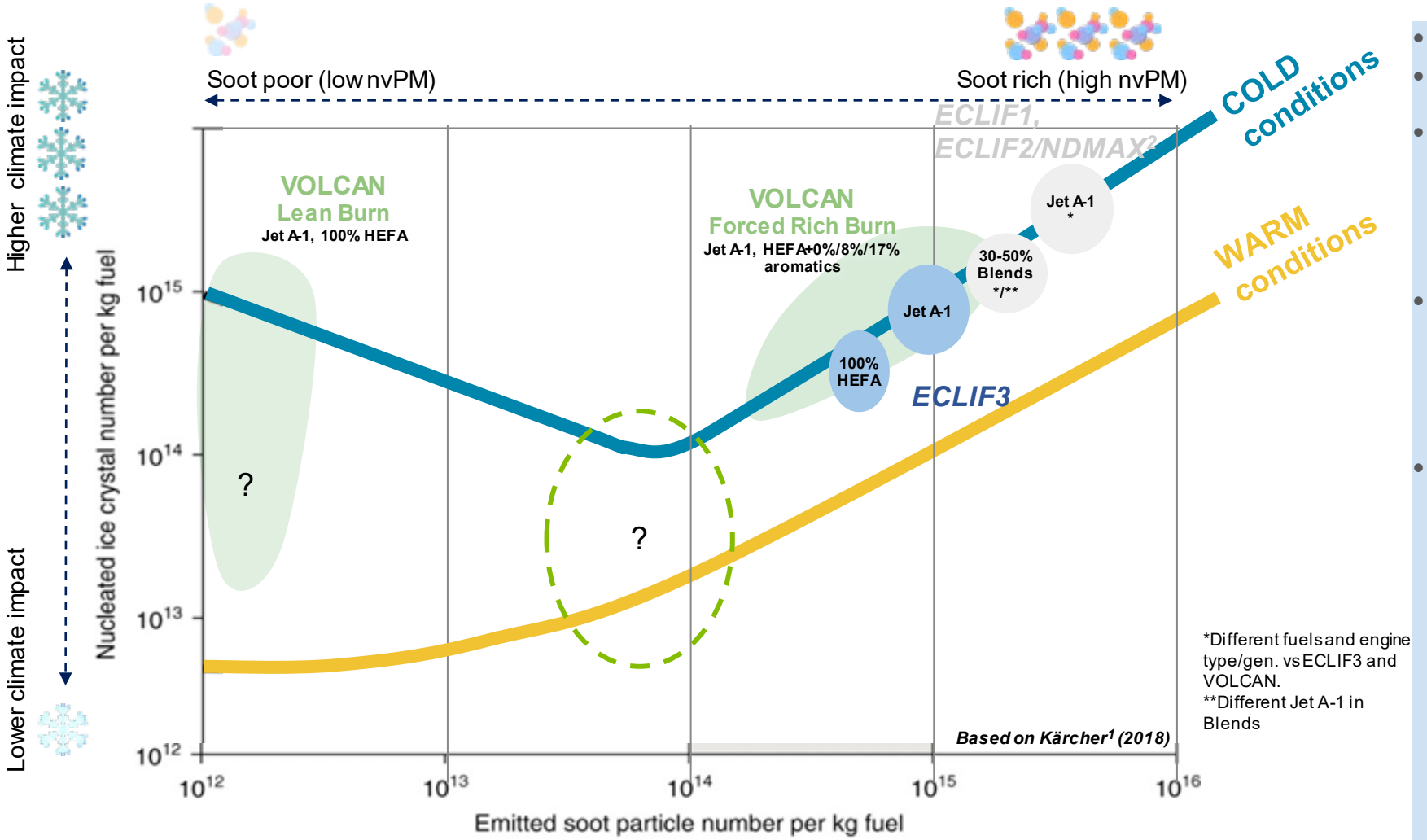
Key learnings so far and next steps…



- First ECLIF3 results publication early 2024
- VOLCAN data analysis still in progress
- Measurements in soot-rich regime confirm expected trend in nvPM reduction when using SAF. Ice crystals number reduction in contrails to be understood (role of sulfur?)
- In soot-poor regime, results so far not contradictory to theory, but ice nucleation (and temperature dependency) need to be better understood (role of vPM?)
- Future campaigns needed to:
  - expand the range of tested fuel composition (other SAF pathways) and combustor technologies
  - understand effect of other species: vPM (incl. from engine oil?), ions, sulfur…
  - understand engine-engine variability / engine aging effects
  - understand evolution of contrails properties with time.

⇒ More tests and research needed to better understand contrails and mature climate impact benefits of fuels & engine/combustor technologies. New campaigns to be planned.

[1] B. Kärcher (2018). Formation and radiative forcing of contrail cirrus. Nature Communications OPEN. DOI: 10.1038/s41467-018-04068-0
[2] Moore et al. (2017) ; Voigt et al. (2021)

Thank you

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