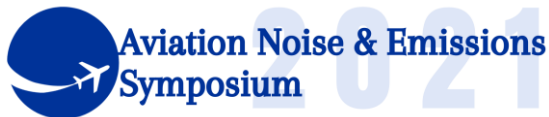




**Christiane Voigt**

DLR German Aerospace Center

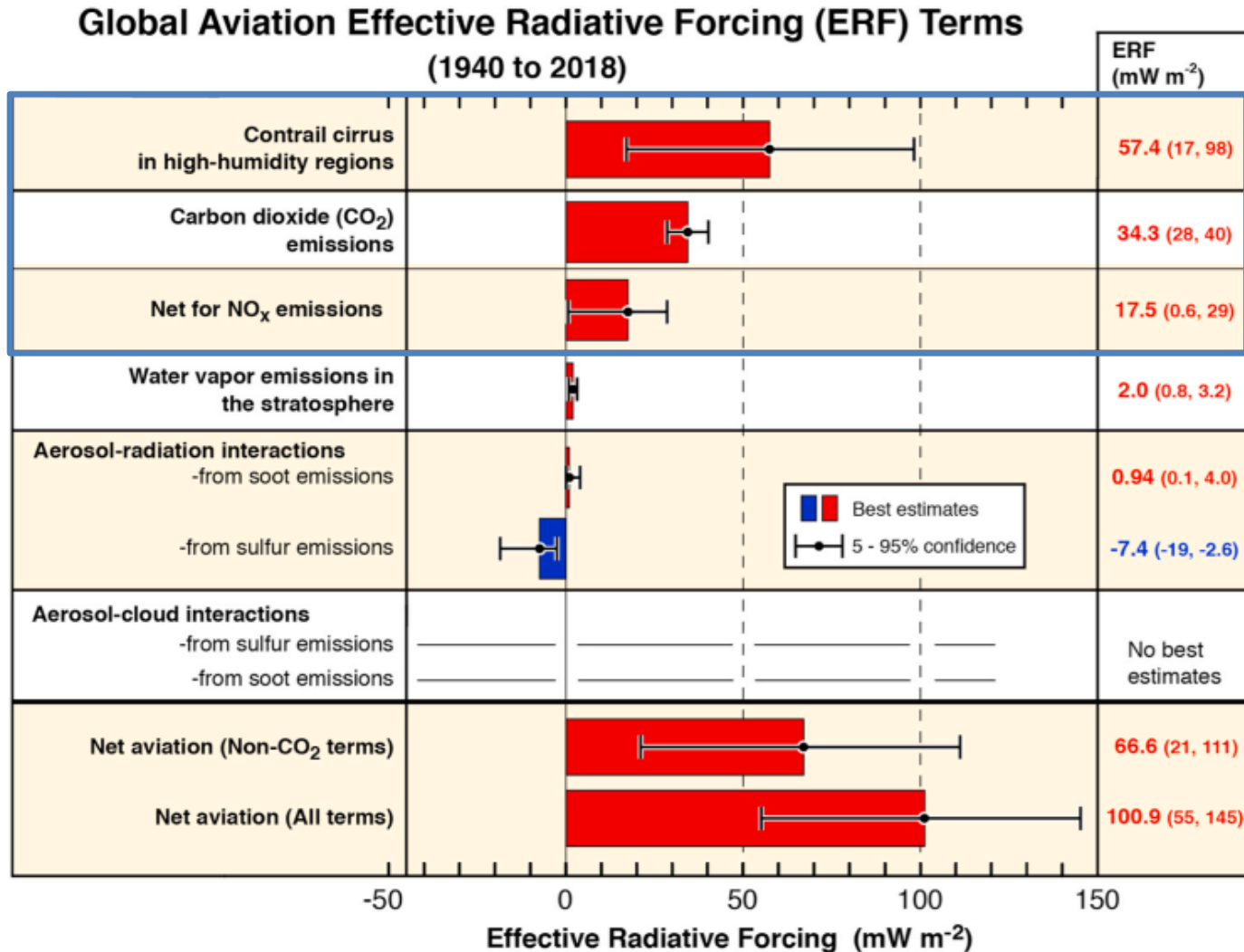
**Reducing emissions, contrails and climate impact from aviation –  
Highlights from recent aircraft campaigns**



Wissen für Morgen



# Global Effective Radiative Forcing from Aviation



NO<sub>x</sub>  
17.5 mW m<sup>-2</sup>

CO<sub>2</sub>  
34.3 mW m<sup>-2</sup>

Contrail cirrus  
57.4 mW m<sup>-2</sup>

Lee et al., Atmos. Env., 2021

# Reducing the climate impact from aviation

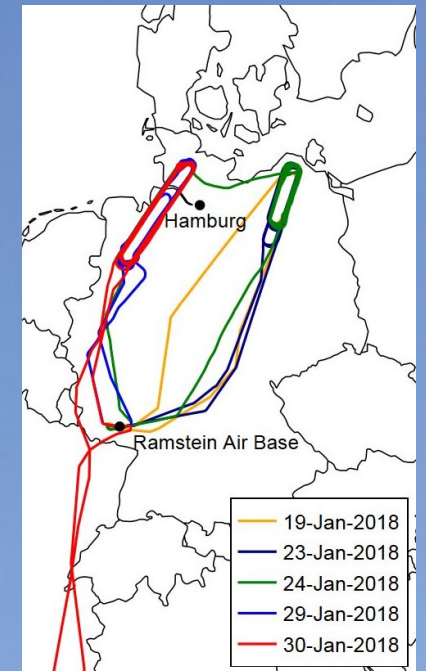
- Aviation climate impact mitigation by alternative fuels – the fast chain
- Lean combustion
- Reduced emissions during COVID lockdown 2020, Contrail avoidance



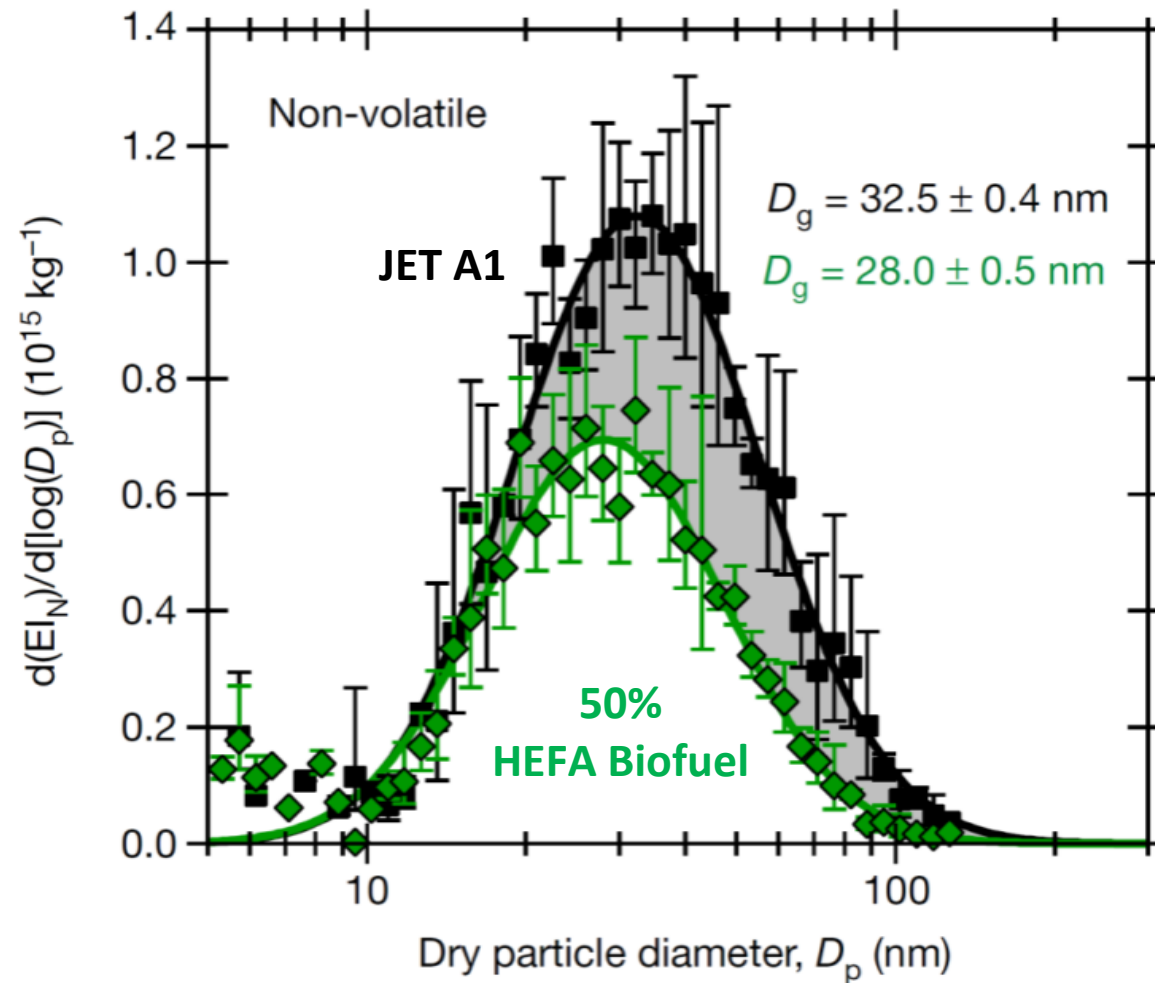
# ECLIF2/NDMAX 2018

Lead: Bruce Anderson, NASA

P. LeClercq, H. Schlager, C. Voigt DLR



# Reduced soot emissions by biofuel blends



Moore et al., Nature, 2017

# Climate impact and way forward

## Efficient mitigation by alternative fuels

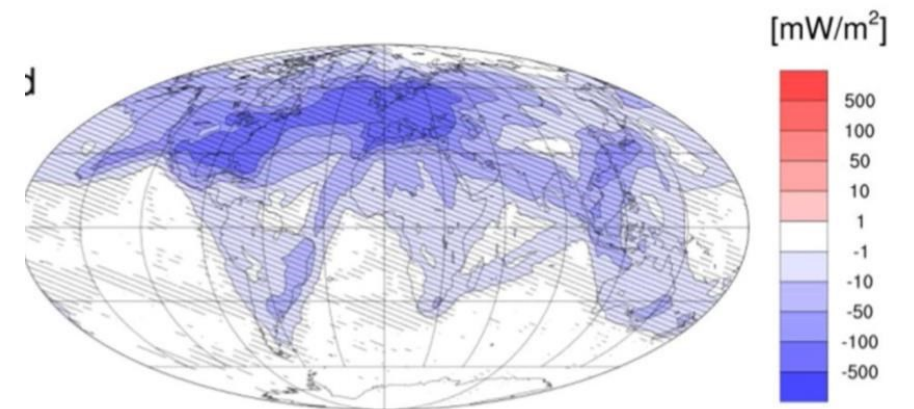
- 80% reduction in ice particle concentrations leads to 50 % reduction in radiative forcing
- more pronounced in air traffic corridors
- **Fast implementation in fueling system possible**

## Previous campaigns

- no 100% alternative fuel
- No aromatic composition < 8.5%
- No large engines
- **Novel observations needed**



Reduction in contrail cirrus RF by 80% reduction in Elice



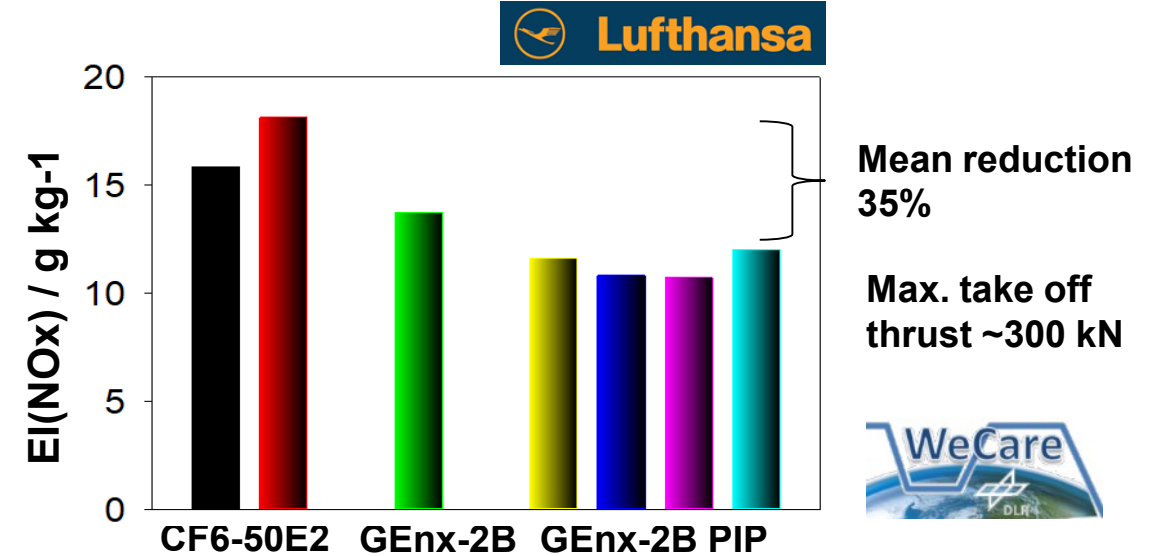
Burkhardt et al., 2018

# Lean Combustion

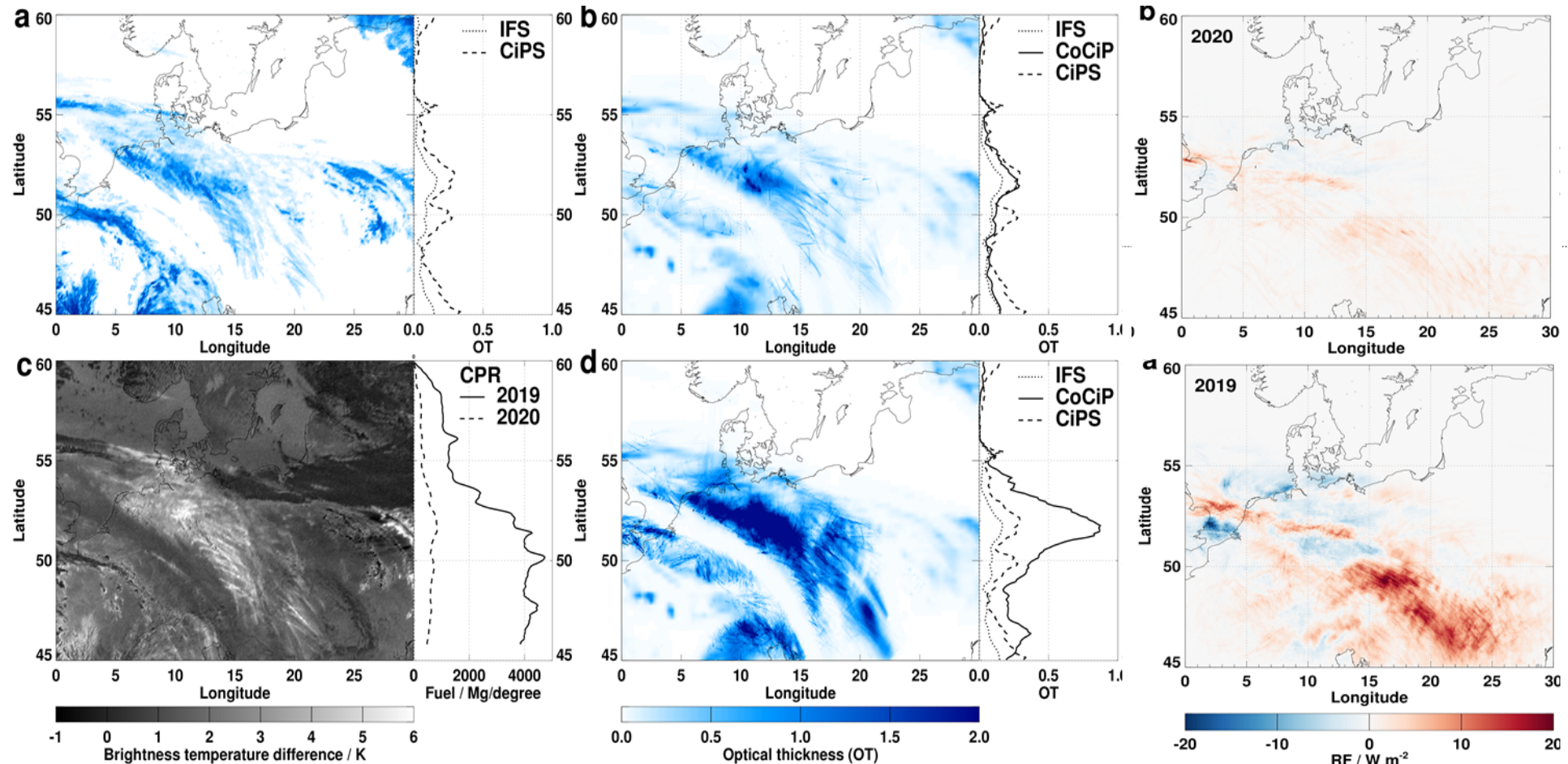
- **Reduced NO<sub>x</sub> and soot emissions** of staged lean combustors during LTO cycle
- Flight tests show **35% reduction in EI NO<sub>x</sub>** of new GEnx-2B PIP at cruise altitudes wrt CF6-50E.

## What about soot and contrails at cruise?

- Soot and contrail characteristics to be confirmed
- **Novel observations needed**



# CoViD Impact on airtraffic, contrail cover and climate



Schumann et al., 2020

→ 80 % reduction in airtraffic in May 2020 in Europe  
 → Strong reduction on contrail cirrus cover, optical thickness and radiative forcing

→ Contrail avoidance demonstrator projects  
 → DLR, ATC Maastricht 2021  
 → Greener by Design/DLR project



# Thank you!



[Christiane.Voigt@dlr.de](mailto:Christiane.Voigt@dlr.de)

