The EU Project ACACIA (Advancing the science for aviation and climate)

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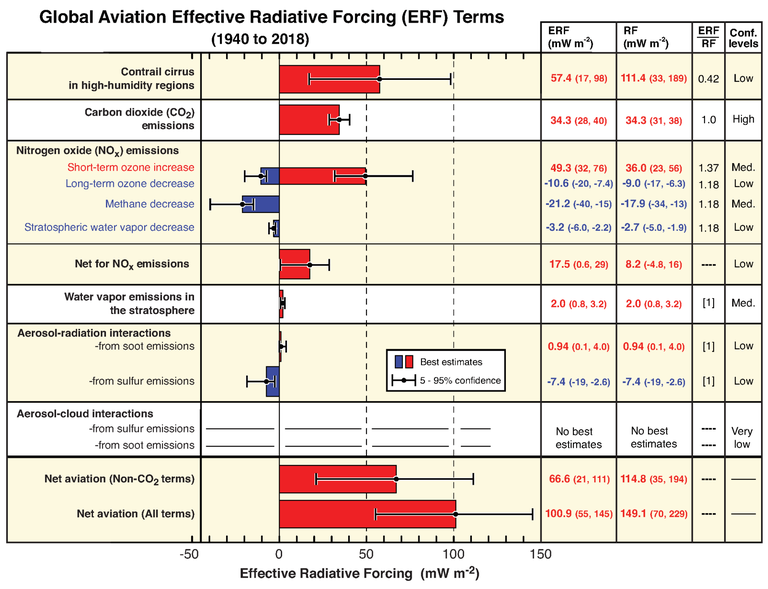
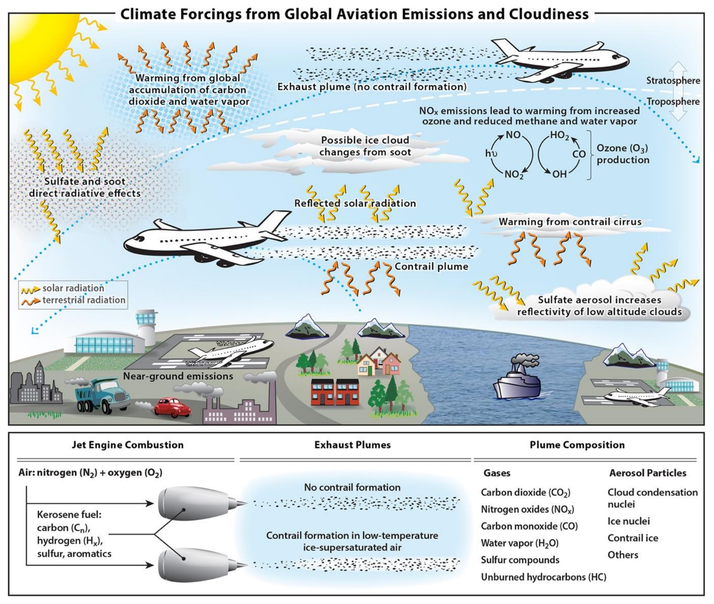
The Climate Impact of Aviation

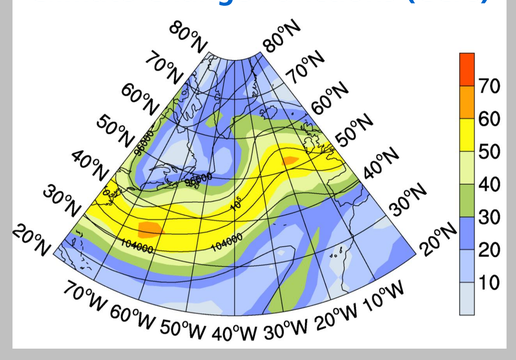


- Aviation contributes to climate change about 3.5% to the net anthropogenic **Effective Radiative Forcing (ERF)** with increasing trend.
- **Non-CO_2 impacts** comprising, e.g. ozone and methane from NO_x emissions, contrails, indirect aerosol effects contribute about two thirds to aviation's net ERF.
- The impact the non-CO_2 effects is associated with much **larger uncertainties** than that of CO_2.
- Some of these effects might result in a relatively large cooling.

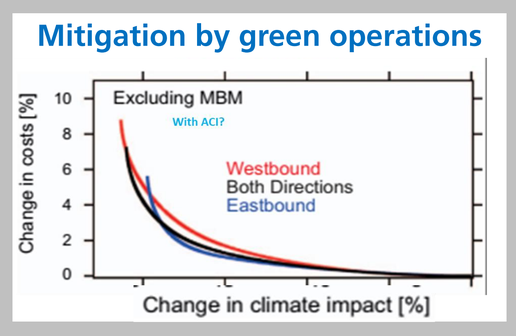
Figures from Lee et al., 2020, doi: 10.1016/j.atmosenv.2020.117834



Climate Change Functions (CCFs)



Mitigation by green operations



Aims

ACACIA aims for **scientifically based and internationally harmonised** policies and regulations for a more **climate-friendly aviation system**.

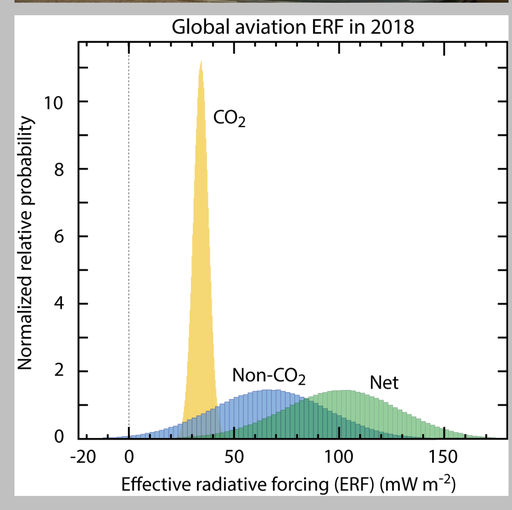
(1) **Improve scientific understanding** of those impacts that have the largest uncertainty, in particular, the indirect effect of aviation soot and aerosol on clouds.

(2) **Identify needs for international measurement campaigns** to constrain our numerical models and theories with data and we will formulate several design options for such campaigns.

(3) Putting all **aviation effects on a common scale** will allow providing an updated climate impact assessment. Uncertainties will be treated in a transparent way, such that trade-offs between different mitigation strategies can be evaluated explicitly.

(4) Provide the **knowledge basis and strategic guidance** for future implementation of mitigation options, giving robust recommendations for no-regret strategies for achieving reduced climate impact of aviation.

Figures from Lee et al. 2020, Grewe et al. 2017, Frömming et al. 2020



Project structure and Role of Partners

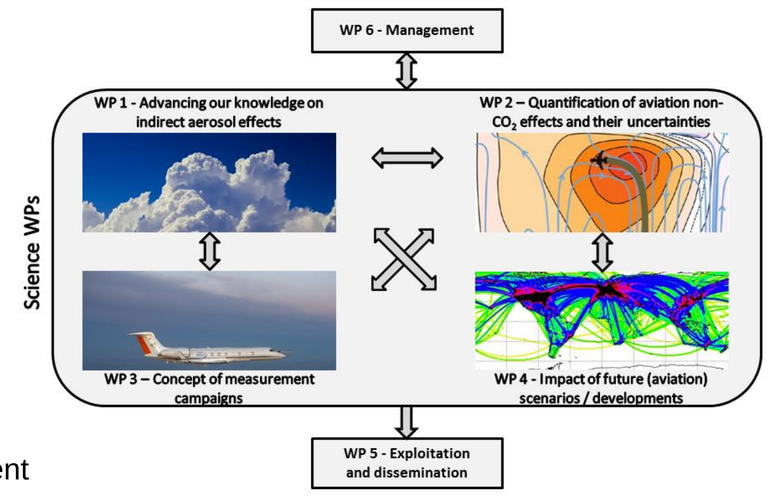
Scientific Workpackes:

WP 1: Advancing our knowledge on indirect aerosol effects → aim 1

WP 2: Quantification of aviation non-CO2 effects and associated uncertainties → aim 1

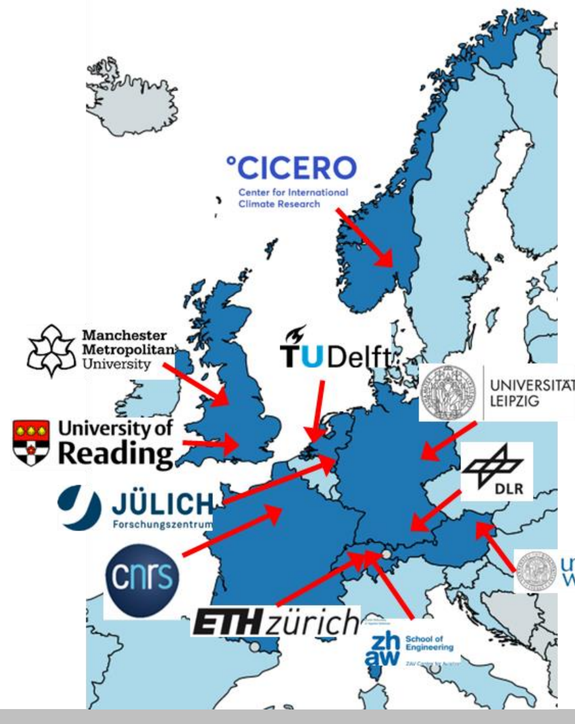
WP 3: Concept of measurement campaigns → aim 2

WP 4: Impact of future (aviation) scenarios / developments → aim 3



Collaborative work in Partner Institutions:

DLR	Chemistry, aerosol and cloud modelling in ESM, uncertainties analysis, concepts of measurement campaign, overall assessment and synthesis
CICERO	Modelling of aerosol and NOx-induced effects, assessment of non-CO2 impacts in policy, climate impacts in future scenarios, metrics
Manchester Metropolitan University	Trade-off studies, radiative transfer calculations for individual contrails, overall assessment and synthesis
University of Reading	Large-eddy simulations of aerosol-cloud interaction, analysis of satellite data, ESM simulations of impact, overall assessment and synthesis
universität wien	Gap analysis for concept development of future measurement campaigns, concepts of measurement campaign
ETH zürich	Laboratory studies of ice nucleation ability of aircraft soot, identification of meteorological conditions for large aviation-induced ice cloud perturbations
UNIVERSITÄT LEIPZIG	Analysis of newly developed ice cloud microphysical retrievals, cloud-resolving simulations
TU Delft	Transport pathways from the location of emission to the location of impacts, methods for green flight trajectories
JÜLICH Forschungszentrum	High-resolution reference datasets of water vapour, clouds, aerosol and chemical tracers, concepts for future measurement campaigns
cnrs	ESM simulations of chemical impacts, assessment of uncertainties
zhaw School of Engineering	Aircraft emission measurements on a test rig



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