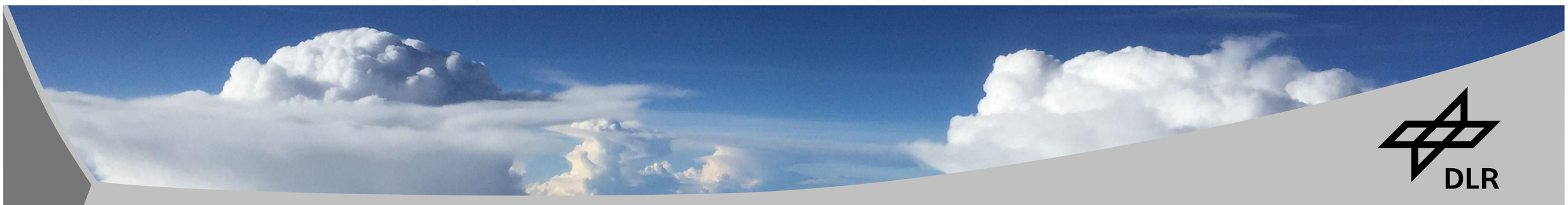

OpenAirClim - A framework for the computation of air traffic climate impact based on response modeling

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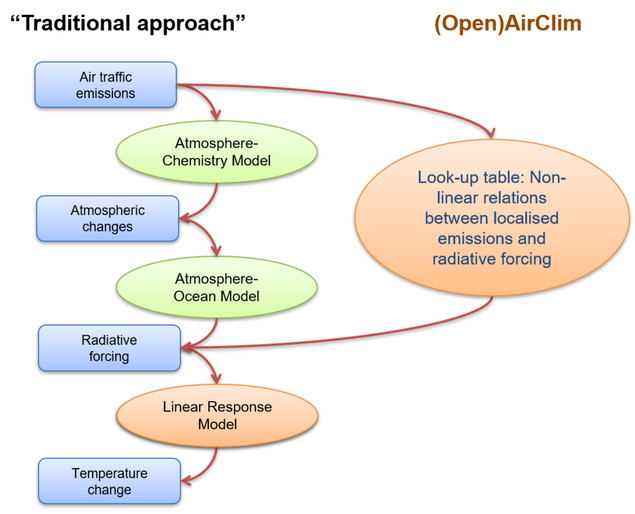
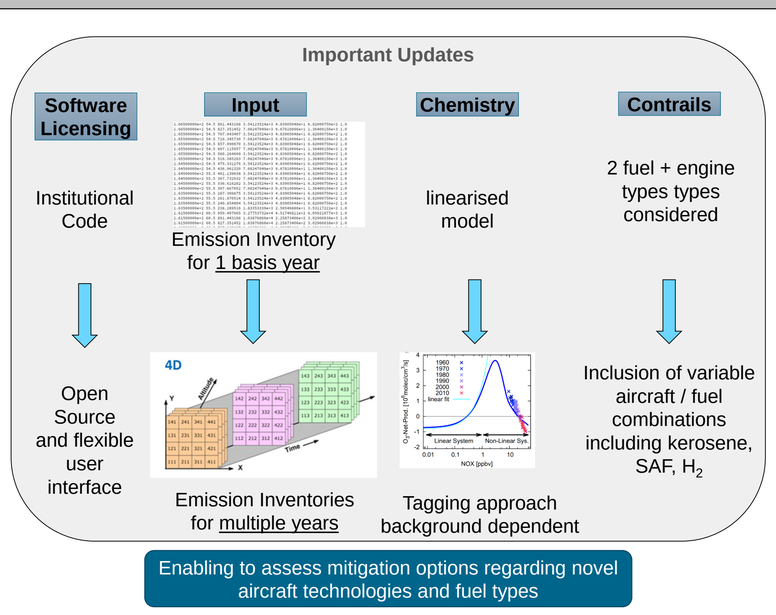
Motivation and Scope

- The contribution of aviation to the anthropogenic effective radiative forcing (ERF) was calculated to be 3.5% for the year 2011 [1].
- Global aviation is growing fast in terms of revenue passenger kilometers (RPK). The improvements made in aircraft efficiency over the last decades do not fully compensate the worldwide growth; fuel consumption is increasing steadily.
- Several measures including novel aircraft technologies, alternative fuels and operational measures have the goal to reduce the climate impact of the aviation sector caused by CO_2 and non-CO_2 effects.
- In order to be able to pick promising mitigation solutions, it becomes important to **assess reliably the climate impact** of technological options which are under discussion for the introduction of future aircraft fleets.



Evaluation of aviation climate impact

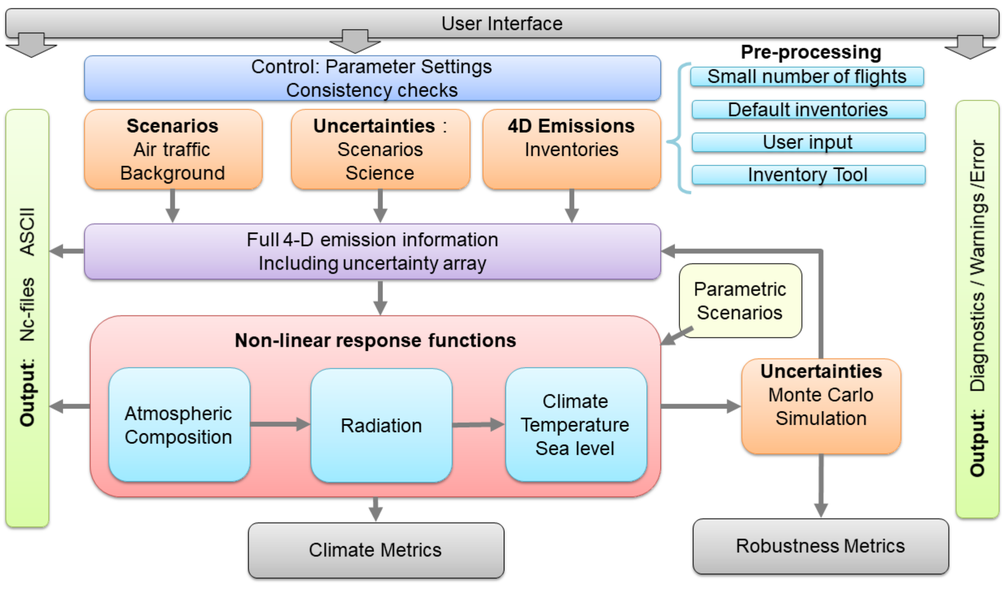
- For evaluation of multiple scenarios of future aircraft fleets, the "traditional approach" applying detailed climate-chemistry simulations is inefficient due to the computational run-times and the effort required for setting up and analyzing the output of these simulations.
- The **AirClim** software applies **response modeling** using pre-calculated look-up tables circumventing the need for detailed climate-chemistry simulations when computing the climate impact of dedicated scenarios [2,3,4].
- AirClim has successfully proven its capabilities and efficiency in various projects.
- Increasing demands on the required functionalities and user friendliness made it necessary to setup a new software development, OpenAirClim.



Planned features of OpenAirClim

- OpenAirClim has an **Open Source License** and easy-to-use user interface.
- An **International Core Development Group** (DLR, Chalmers University, TU Delft, NLR) contributes to the software development.
- **Input of aviation emission inventories** that are evaluated **is 4D**: time (multiple years), lon, lat, alt, introducing the additional dependence on time.
- Chemistry: OpenAirClim uses contribution approach / **tagging** [5]. Background concentrations and non-linear production or loss of greenhouse gases (O_3, CH_4, Stratospheric Water Vapor) are taken into account.
- Contrails: OpenAirClim provides impact of contrail climate effect for any **combination of fuel and aircraft**, including number particle emission effects.

Layout and Workflow



- User interface for settings in the run control and outputs (grey)
- Definition of background conditions, such as aviation scenarios, uncertainty ranges and aviation inventories (orange)
- Pre-processing unit for aviation inventories (light blue)
- Processor for a full 4D-emission inventory at multiple timesteps (violet)
- A framework for the application of non-linear response functions (red) to these emission inventories
- Response functions for climate / temperature and sea-level changes
- Parametric scenarios as sensitivities (yellow), e.g. at post-processing level: climate optimized routings
- Output: Warnings, errors (log files), climate indicators and diagnostics (green), values of climate and robustness metrics (grey)

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