INTERNSHIP - Modeling of the Impacts of Climate Change on Aviation and Adaptation (MICCAA): impact on demand, loss and damage

PARTENAIRES

IRT SAINT EXUPÉRY

Key words: aviation, global warming impacts, economic models, AeroMAPS

Department: DRRP/DAEP

Most prospective scenarios for aviation and air transport estimate the warming caused by the sector but rarely account for its exposure and vulnerability to the impacts of climate change (Delbecq et al, 2023). However, warming is already damaging ground infrastructures (airports), decreasing aircraft performance (temperature rise) and threatening flight safety (clear air turbulence). Global warming also reduces economic output and thus air travel demand. Climate change can therefore erode part of the traffic that these prospective scenarios project. In that context, this internship should address a key question: how much future air traffic is lost due to global warming?

JOB DESCRIPTION:

This work builds on AeroMAPS, an open-source framework for prospective air transport scenarios (Planès et al., 2023), which already models aviation emissions and an income-driven demand for revenue passenger kilometers (Costa-Alves et al., 2026). To evaluate climatic damages, several models could be considered, such as DICE, the Dynamic Integrated model of Climate and Economy (Nordhaus, 1992; Barrage and Nordhaus, 2024) or the Dietz-Stern model (2015). In the specific context of air transport, Johansson et al. (2025) used a modified version of DICE to value aviation CO_2 and contrail cirrus within the same framework. Then, Burke et al. (2026) define loss and damage as the discounted damages attributable to specific emissions.

The internship transposes this logic to aviation within AeroMAPS. Aviation emissions are combined with background global emissions from the CMIP7 Scenario Model Intercomparison Project (Van Vuuren et al., 2026), as shown in Fig. 1. The global temperature increase is computed with the FaIR simple climate model (Leach et al.,

2021) and non-CO2 effects (such as contrails) following Johansson et al. (2025). The damage function converts temperature into a loss of world Gross domestic product (GDP), from which loss and damages for air transport can be derived. The damaged GDP then drives future demand in air transport, through loss in revenue passenger kilometers (RPK), which is measured against a counterfactual scenario without climatic damages. Population and GDP projections are kept identical in all runs, so that differences between scenarios result from the climatic impact alone. The share of each impact attributable to aviation is obtained by repeating each run with and without aviation emissions. Climatic damages evaluation is heavily sensitive to the parametrization of the damage function (eg elasticity of marginal utility), as shown in Stern (2007) and Hänsel et al. (2020). This work will thus evaluate the sensitivity of results to these uncertain parameters. Finally, the internship will consider different scenarios for the global economy, such as Medium (M), High (H) and Very Low (VL) scenario pathways (Fig. 1). For each of these global scenarios, different decarbonization scenarios will be considered for aviation from AeroMAPS. For each case, the objective is to evaluate global loss and damage, aviation-attributable loss and damage, and loss in air transport demand up to 2100.

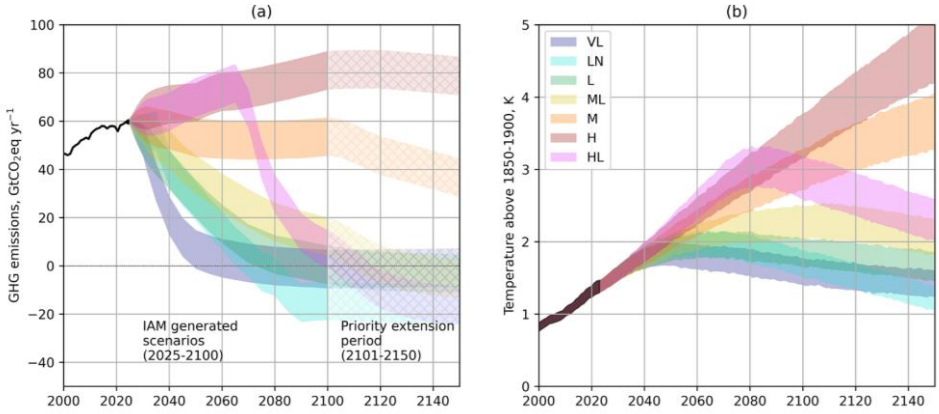


Fig. 1 Prospective scenarios of the CMIP7 database (Van Vuuren et al, 2026): (a) greenhouse gas emissions and (b) temperature rise above the pre-industrial area. In particular, high emissions scenarios (M, H and HL) are associated to important physical risks due to global warming.

MISSIONS: The expected results are the magnitude of the climate-induced loss on air transport demand, compared to projected traffic growth, the share of that loss caused by aviation's own emissions, and the extent to which aviation decarbonization pays back through protected traffic. After a literature review, the student implements the climate, damage, and economic models in AeroMAPS, runs the grid and the sensitivity analyses, and integrates them into AeroMAPS with tests and documentation. Due to the novelty of this topic, this work is expected to be proposed for publication in a peer-reviewed journal, co-authored with the internship student.

REQUIRED PROFILE:

You are in last year of an engineering school or Master2 program, with a background in air transport and/or aviation. You have good programming and optimization skills (Python) and a good knowledge in environmental issues (climate & energy). You are interested to work on complex systems, on a topic with important societal impact, in a multidisciplinary environment.

The training should start in March or April 2027, for 6 months. You will be located in Toulouse, in the premises of ISAE-SUPAERO. The internship will be jointly supervised by ISAE-SUPAERO, IRT ST-EXUPERY and TU-DELFT. Some interactions are expected with other partners of the project, including environmental agencies and aviation industry.

EXPERIENCE: Master2 or last year of engineering school

COMPENSATION: 4.35€ / h – 35h per week

DURATION: 6 MONTHES

RYTHM: Full time

LOCATION: TOULOUSE

RESPONSIBLE OF THE SUBJECT:

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APPLICATION PROCESS: Please send CV and motivation letter to the project managers

APPLICATION DEADLINE: December, 18th, 2026

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