**Monitoring Air Miles at the Faculty of Mathematics and Natural Sciences (MNF) to reduce CO2 emissions**

GEO 885, Group G1

S. Di Vincenzo1, G. Biland1

1Department of Geography, University of Zurich

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## Abstract

To counteract the effects of climate change, a radical reduction of greenhouse gas emissions is essential. Reducing emissions is necessary for all areas of society, which includes the scientific community. Sustainable policies are being introduced progressively at universities, as well as for this paper relevant, the University of Zurich. The University of Zurich has actively chosen a more sustainable path and implemented “Strategy 2030” in 2022, which calls for climate neutrality until the year 2030. To achieve this goal a flight emission reduction of 53% by 2030 is indispensable. The first steps in the right direction have already been taken by the Faculty of Science (MNF). The MNF collected relevant information about all their paid flights from 2018 to 2020 including flight numbers, IATA codes of the origin and destination airports, booked service class (economy, premium economy, business and first-class) and emission of greenhouse gas per flight. Analyzing the provided dataset we were interested in how a chosen service class impacts flight emissions. As a result, we conducted an R analysis to quantify the impact of choosing a lower service class has on future flight emissions. The goal is to provide the MNF with concrete approaches, starting with choosing lower service classes and thus reaching the reduction of the sustainability goals of the University of Zurich.

**Keywords**: academic flying, carbon emission, sustainability, environmental protection

## 1. Background

The negative implications of air travel are globally well known. The aviation sector alone is responsible for 3.8% of carbon emissions (Klöwer et al., 2020). An important part of those emissions is caused by researchers who due to conferences, guest lectures, and fieldwork fly frequently to foreign universities. In recent years, travel by airplanes done by academic staff received growing attention. Especially as Universities all over the world incorporate sustainable development strategies (Borgermann et al., 2022). Similarly, also the University of Zurich are setting an example to be carbon neutral and reducing air travelling by 53% by 2030. Although the majority in academic circles are in favour of this development, questions have arisen, in particular, as to whether this might not harm academic work as flying and face to face interactions play an important role in an academic career (Klöwer et al., 2020; Kreil, 2021). Thus researching the relationship between academic flying and academic work and finding approaches to reducing emissions via air travel became the subject of multiple studies. The study of Kreil et al. (2021) proved for example that a reduction in air travel would not affect scientific work, but also be beneficial. Possible alternatives to long-duration flights were shown in the study by Klöwer et al. who demonstrated that virtual conferences have a higher attendance rate and how such annual global conferences could be held physically, for example, only biennially.

Contrary to other papers, which thematized the problem on a more global scale, the aim of this paper is to find easy and applicable solutions to reduce air travel emissions at the university level, which are easier to implement.

## 2. Research goal

The goal of this study is to provide the Faculty of Mathematics and Natural Sciences with an analysis of all flight emissions funded by MNF. The goal is to present concrete proposals on how MNF can reduce its flight emissions by 53% by 2030 and what role the flight classes play in this reduction target.

## 3. Methods and data

The dataset used in this paper was provided by MNF and included all flight numbers of MNF-paid flights for 2018-2020. The dataset also included certain IATA- codes for the corresponding origin and destination airports. Information on flight distances and emissions emitted was not available. To create accurate and meaningful recommendations for reducing flight emissions at MNF, it is essential to complete the dataset with all IATA codes and corresponding emissions. Two different APIs were used in the data preprocessing, which retrieved the corresponding IATA codes for each flight number using a Python script and retrieved the emitted emissions for each flight segment in a second step using the obtained IATA numbers. With the data set now complete, the analysis is performed to analyze the effect of flight class on emitted emissions. For this purpose, R is used, taking only the emissions and not the flight distances. To determine the MNF reduction target, the average of all emitted emissions for the year 2018 to 2020 was taken as the measure. As only these data were available for this paper and a specific analysis of these data was pursued, no alternative remained open in terms of data selection and preprocessing of the data.

## ****4. Expected or preliminary results****

As a result of analyzing the data and the nature of this paper, no hypothesis is made other than that the goal of the paper holds reducing emissions as a goal and this can be achieved in diverse ways, only one of which is specifically analyzed here. However, as visible in Figure 1, the preliminary results show that the space and CO2 intensive flight classes cause only a very small portion of the rammed emissions. Thus, it can be hypothesized that the emission targets of MNF cannot be achieved with a mandatory economy class.

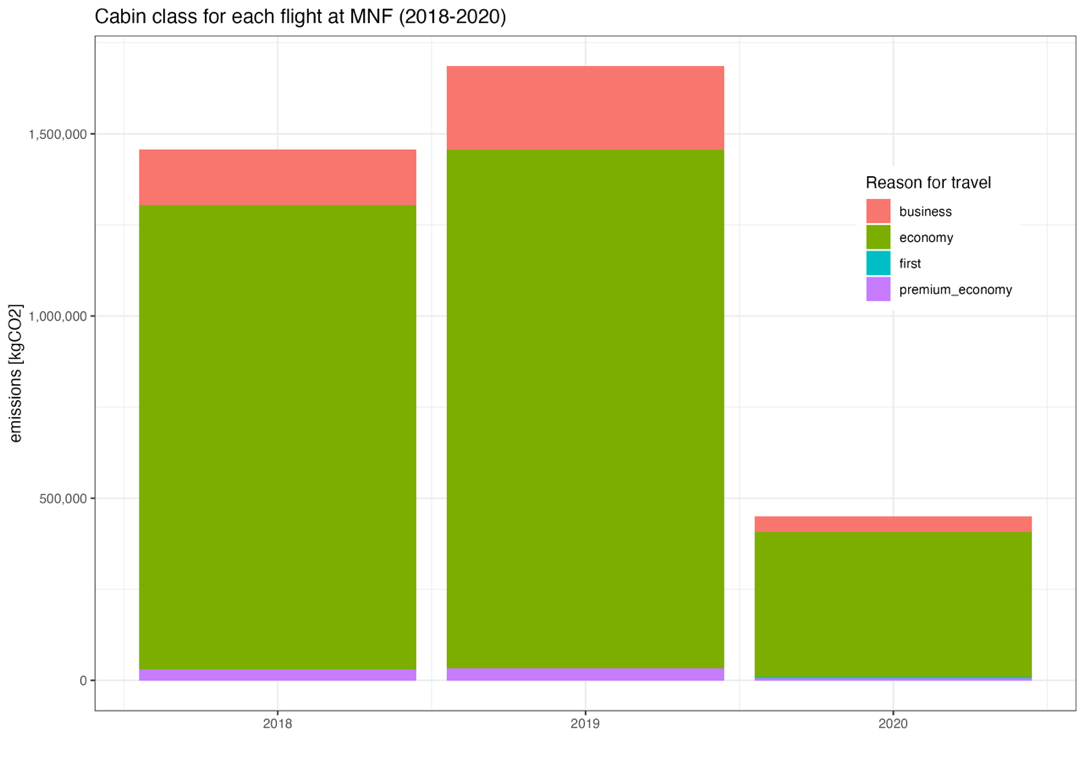


Figure 1: Distribution of emitted kgCO2 for each cabin class for every flight at the MNF in 2018-2020, distinguished by color.

## ****5. Impact****

The findings of this paper will contribute significantly to MNF's ability to meet your goal of reducing your aviation emissions by 53% by the year 2030. Likewise, this paper will demonstrate the varying implications of flight classes on the emissions emitted and illustrate how severe or not a higher flight class is on the emissions generated. Furthermore, the analysis will demonstrate for the first time the spatial distribution and focus of flights across the MNF and what spatial focus could be further explored with particular attention to groupings for flights.

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