University of Zurich[UZH]

Academic air travel at UZH's Department of Geography: Assessing the willingness and reduction potential of voluntary reduction measures

GEO 511 Master's Thesis

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Abstract

Academics consider air travel crucial for a successful career and fly frequently to attend conferences, participate in collaborative meetings, teach classes, and conduct fieldwork. However, this air travel behavior causes significant greenhouse gas (GHG) emissions, often accounting for the largest share of a university's emission total. In order to reduce its environmental impact, the Department of Geography at the University of Zurich (GIUZ) seeks to reduce emissions from air travel by 53% by 2030 compared to the baseline average between 2017 and 2019. This Master's Thesis aims to describe air travel behavior and examine opinions on academic air travel reduction at GIUZ. Furthermore, it seeks to evaluate voluntary air travel reduction measures based on the willingness to be implemented by GIUZ scientific staff and their emission reduction potential. To achieve these goals, air travel data collected at GIUZ between 2017 and 2022 was analyzed, and an online survey addressed to the scientific staff at GIUZ was conducted. The results show that scientific staff at GIUZ fly mainly to North America and Western Europe. Most air travel GHG emissions are caused by travel for conferences and fieldwork. Considering academic positions, professors and invited guests generate the most emissions from air travel, while PhD students and employees with PhD fly much less. The results of the online survey indicate that GIUZ academics consider air travel to be relevant for a successful career. Nevertheless, they also strongly approve of the air travel reduction project. Moreover, the findings show that GIUZ academics are willing to implement voluntary reduction measures and that these have substantial emission reduction potential. While all measures show a positive willingness, there is a negative relationship between reduction potential and willingness. Academics are willing to implement measures with low reduction potential. On the contrary, they are less willing to implement measures with high reduction potential. The findings of this thesis denote a widespread awareness among GIUZ academics of the environmental impact of academic air travel, as well as a willingness to take action to reduce it. Further research in the coming years is needed to examine whether the willingness to implement voluntary reduction measures will actually translate into behavioral change. The results indicate that innovative infrastructures and approaches need to be further developed to effectively reduce long-haul journeys, which are responsible for most emissions.

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Contents

1 Introduction

The aviation sector contributes around 4% to anthropogenic climate change (Klöwer et al., 2021). The number of passengers has increased yearly by 6.9% over the five years before COVID-19 (IATA, 2020). After the decline in air travel caused by the pandemic, the number of passengers is expected to grow over the next decades (Grewe et al., 2021).

Clear inequalities characterize the aviation sector. Only a small percentage of the global population is responsible for most aviation-related greenhouse gas (GHG) emissions (Klöwer et al., 2020). It was estimated that in 2018, only 2%–4% of the global population flew internationally and that only 1% of the population is responsible for half of the total aviation emissions (Gössling & Humpe, 2020). From these numbers, it can be seen that flying is one of the most carbon-emitting activities at the individual level. Therefore, avoiding air travel is one of the most impactful actions against climate change that an individual can take (Kreil, 2021; Tseng et al., 2022).

The internationalization of universities and academics is perceived as essential for an academic's career success and is therefore encouraged (Poggioli & Hoffman, 2022; Storme et al., 2013). Academics are generally highly aeromobile and fly mainly to attend conferences, participate in collaborative meetings, deliver papers, teach classes, and conduct fieldwork (Arsenault et al., 2019; Higham & Font, 2020). Numerous academics claim that a minimum travel threshold is necessary to succeed, especially for early career researchers (Storme et al., 2013; Wynes et al., 2019). It has been shown that international collaborative papers have a higher citation impact than domestic papers (Adams, 2013).

All this is embedded in an attitude towards physical travel deeply rooted in academia, which Poggioli and Hoffman (2022) define as "flyout culture". This pattern of physical travel often results in emissions from academic air travel being a substantial part of a university's carbon footprint (Eriksson et al., 2020). Therefore, pressure is coming from outside and within academia to reduce academic air travel (Poggioli & Hoffman, 2022). Academics are accused of hypocrisy, and according to normative arguments, they should act as a role model in reducing the environmental impact of air travel, especially those dealing with climate issues (Higham & Font, 2020). Likewise, a researcher's credibility is shown to be negatively affected by the size of their carbon footprint (Attari et al., 2016). Consequently, more and more universities are actively committed to reducing their air travel volume (Poggioli & Hoffman, 2022).

1.1 Research context

Air travel is considered crucial for a successful academic career (Cohen et al., 2020; Eriksson et al., 2020; Nursey-Bray et al., 2019; Wenger, 2021a). In recent years, several studies identified the discourse around academic air travel. Kreil (2021) extracted arguments for and against reducing academic air travel at ETH Zurich (ETHZ) through qualitative analysis of interviews, survey results, and other sources. The dominant assumption at ETHZ was that a reduction in academic air travel

would harm science. Academics believed this damage would be created by the decrease in an academic's internationality and by the lack of visibility and physical presence at conferences and exhibitions, making it much harder for them to become known (Kreil, 2021). This view was countered by a second opinion that was extracted in this study, namely that science would benefit from flying less, as there would be more time for research and reflection, as well as greater engagement with local scholars and an increase in the reputation of the institution due to the leadership role in reducing air travel (Kreil, 2021). These findings largely reflect recurring arguments in other studies, such as the work by Tseng et al. (2022), in which 17 academics from the University of Otago, New Zealand, were interviewed. Tseng and colleagues found that academics flew to network and collaborate in international teams, which they believed positively affects their academic career success (Tseng et al., 2022). Eriksson et al. (2020) also identified the same argument in their work.

The relationship between academic air travel and career success has also been studied empirically. Wynes et al. (2019) evaluated this possible link focusing on the case study of the University of British Columbia, Canada, without finding a statistically significant relationship. In contrast, a more recent study conducted over a large sample of French academics found that increasing air travel results in higher academic success (Berné et al., 2022). Chalvatzis and Ormosi (2021) studied the possible relationship between distances traveled and academic citations. They found that travel to conferences typically does not influence the number of citations, except for European academics, who seem to profit from cross-Atlantic trips (Chalvatzis & Ormosi, 2021).

Another study by de Leon & McQuillin (2020) examined the consequences of a short-term cancellation of a large international conference due to a natural event on the citations of the papers that would have been presented. The results suggested that conference attendance is important for both younger and more experienced academics because it influences short-term visibility and increases a paper's likelihood of being cited. According to their results, early career researchers experience a “maturation effect”, whereby the presented paper undergoes improvement and progress due to interactions at the conference. For senior academics, an “advertisement effect” is prevalent, whereby presenting a paper at a conference increases the likelihood of the paper being cited (de Leon & McQuillin, 2020).

The literature reports a "fear of not flying," whereby academics do not want to reduce air travel because they worry about career repercussions (Nursey-Bray et al., 2019). This occurs despite awareness of the significant environmental impact of academic air travel. Several studies identified an “attitude-behavior gap” according to which researchers realize the environmental burden of academic air travel but still choose to fly or experience pressure to fly (Nursey-Bray et al., 2019; Schrems & Upham, 2020; Wynes et al., 2019). It was reported that knowledge about the environmental impact of air travel was insufficient to effectively change the air travel behavior (Whitmarsh et al., 2020). This was also demonstrated among climate change researchers, who have been shown to have similar flying behavior to their non-climate change expert peers (Wynes et al.,

2019) or even to fly more (Whitmarsh et al., 2020). Of course, the flying behavior is related to the study area and climate change researchers strongly depend on fieldwork, often abroad (Whitmarsh et al., 2020).

A variety of different reduction measures are examined in the literature. One of the most discussed air travel reduction measures is virtual communication. This measure was widely adopted during the COVID-19 pandemic, highlighting both its advantages and disadvantages. Virtual communication has the potential to reduce air travel emissions significantly. For example, Klöwer et al. (2020) estimated that GHG emissions from an in-person conference could be reduced by 90% by holding it virtually. In addition, virtual communication can increase inclusion, eliminating geographical, temporal, economic, and other air travel-related barriers, such as gender, career stage, or disabilities (Poggioli & Hoffman, 2022; Skiles et al., 2022). However, virtual communication showed intrinsic limitations such as technical difficulties, time zone differences, or digital fatigue (Foramitti et al., 2021; Moss et al., 2021). The most important drawback of virtual communication is the reported ineffectiveness of informal exchange and scientific networking, which is considered crucial to building collaborations and a successful career (Foramitti et al., 2021; Wenger, 2021a, 2022).

Scientific conferences attract academics from all over the world, causing a huge environmental impact. Jäckle (2019) estimated that an average ECPR General Conference is responsible for as many CO_2 emissions as 100-150 Germans in an entire year. For this reason, the possibility of employing virtual communication in the context of scientific conferences is increasingly being addressed in the literature (e.g., Foramitti et al., 2021; Klöwer et al., 2020; Parncutt et al., 2021; van Ewijk & Hoekman, 2021; Wenger, 2023). In addition to virtual conferences, other formats have been proposed to reduce the environmental impact of scientific conferences. These include hybrid and multi-hub conferences (Klöwer et al., 2020; Parncutt et al., 2021). Hybrid conferences have a central venue, but participants from faraway locations can decide to participate online. This format can reduce GHG emissions and increase the event's inclusivity, but the virtual participants are disadvantaged compared to physically present participants, as they cannot experience face-to-face interactions (Moss et al., 2021; Parncutt et al., 2021). Multi-hub conferences are organized with multiple venues strategically located across the world that are virtually connected live. This format also reduces GHG emissions and increases inclusivity but improves equity thanks to a combination of face-to-face interactions at the hubs and digital socializing sessions across the hubs (Parncutt et al., 2021).

Other measures proposed for conference organization include moving large annual conferences to a biennial format (possibly supported by a virtual conference in alternate years), choosing an accessible venue that minimizes distances for participants, encouraging virtual attendance for participants from distant locations, and using environmentally friendly modes of transportation (Chalvatzis & Ormosi, 2021; Klöwer et al., 2020).

In addition to the organization of scientific conferences, other reduction measures are examined in the literature. Ciers et al. (2019) discussed three reduction measures intended to decrease GHG emissions from academic air travel without reducing mobility. These measures include replacing business or first-class flights with economy flights, only traveling by train for journeys under 800 kilometers, and replacing stopover flights with non-stop ones. As business and first-class seats require larger floor space, they are usually associated with higher emissions (Bofinger & Strand, 2013). The substitution of air travel with train travel is normally associated with higher costs and travel time, but it offers a more suitable environment for working and more comfort (Poggioli & Hoffman, 2022). However, this measure can only be applied to replace short-haul flights, and its efficacy depends on the geographical location. In Europe, it is particularly effective because of a relatively dense network of electrified railways compared, for example, to Canada, where the train network is much less developed, and trains are equipped with diesel engines (Poggioli & Hoffman, 2022). Stopover flights usually cover a longer distance than non-stop flights (Ciers et al., 2019). Ciers et al. (2019) calculated that implementing these three measures would cause a 36% reduction in air travel GHG emissions at the Swiss Federal Institute of Technology in Lausanne (EPFL) without a decrease in mobility.

Some measures are often discussed during debates and workshops on reducing air travel in academia but are only partially addressed in the literature. For example, to achieve more efficient air travel behavior, several activities could be combined into one trip by extending the duration of the trip. This would increase the benefits of such travel and enable academics to avoid other trips (Burian, 2018; Le Quéré et al., 2015). Another example is the reduction of fieldwork-related air travel. Previous research showed that the virtual format is not suited to replace fieldwork activities abroad (Smidvik et al., 2020; Thaller et al., 2021; Wenger, 2022). Other alternatives not yet covered by the literature could be collaborating with local stakeholders or performing multiple tasks in one longer sortie to reduce the number of trips to the study area.

Another measure often discussed is carbon offsetting. The purpose of carbon offsetting is to compensate for GHG emissions with climate mitigation projects (Kerner & Brudermann, 2021). It is theoretically possible to reduce the emissions of air travel through offsetting. However, this measure has been criticized because it requires no change in behavior and is seen as "greenwashing" that can have a rebound effect, leading instead to an increase in GHG emissions from air travel (Arsenault et al., 2019; Kerner & Brudermann, 2021; Schreuer et al., 2023).

1.2 The case of UZH / GIUZ

UZH is actively committed to sustainable development and to achieving climate neutrality by 2030. To reach this target, UZH has implemented measures to reduce GHG emissions deriving from canteen, energy consumption, air travel, and others (UZH, 2023a). Air travel emissions in the pre-

pandemic period accounted for the largest share of the university's GHG emissions (about 35% of the total emissions, Figure 1).

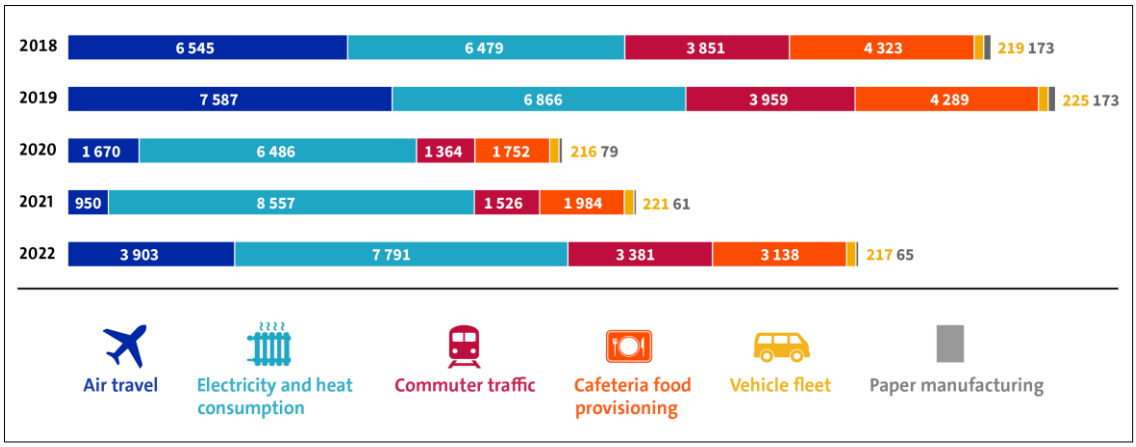

Figure 1: GHG emissions at UZH between 2018 and 2022 (UZH, 2023b).

A first step toward air travel reduction at UZH was taken internally by the Department of Geography (GIUZ) in 2017, when the Working Group on Air Miles Monitoring[1] (AMM Group) was created, and the Air Miles Reduction Goal was set as part of the Air Miles Reduction Program (AMM Initiative). The reduction target corresponded to a 25% decrease in air travel distance at GIUZ until 2025. The baseline for this objective was defined as the mean air travel distance during the reference period 2017-2019 (GIUZ, 2022). The AMM Group has collected flight data of the GIUZ scientific staff[2] (AMM data) since 2017. The AMM data is grouped at the thematic area level for privacy reasons and contains all air travel paid through UZH funds (GIUZ, 2020). This dataset is the basis for the annual Air Miles Monitoring & Reduction Report[3] (GIUZ, 2022).

Following the example of GIUZ, UZH launched a general air travel reduction program named “Make Science, Not Miles[4]” in 2021. The objective is to reduce the university’s air travel emissions by 53% until 2030, with the average of 2018-2019 as a baseline (UZH, 2023b). More specifically, the objective states that “flight-related greenhouse gas […] emissions may increase to a maximum of 60 percent of the pre-pandemic level […] in 2022 and must be reduced by at least 3 percent annually thereafter compared to the previous year. This corresponds to a total reduction in emissions of at least 53 percent by 2030” (UZH, 2023b).

The AMM Group adopted the university-wide 53% reduction target, and the two projects currently work in parallel, with the AMM Group still taking on a pioneering function.

[1] AMM website: https://www.geo.uzh.ch/en/department/sustainability/air-miles.html.
[2] In this work, "scientific staff” refers to all employees with and without a PhD, PhD candidates, professors and guests invited at the GIUZ.
[3] Link to the reports: https://www.geo.uzh.ch/en/department/sustainability/air-miles/reports.html.
[4] „Make Science, Not Miles” website: https://www.sustainability.uzh.ch/en/campus-operations/air-travel.html.

1.3 Problem statement and research questions

Reducing the volume of academic air travel is not a trivial action (Biørn-Hansen et al., 2021). Air travel is a central component of an academic career and is considered beneficial to one's reputation and success (Arsenault et al., 2019; Tseng et al., 2022). It was reported that physical presence is believed crucial to the dissemination of results, as well as for building a social network and creating and maintaining international contacts, which are in turn fundamental for the advancement of an academic career (Eriksson et al., 2020; Kreil, 2021). For all these reasons, the literature reports a "fear of not flying" (Nursey-Bray et al., 2019).

In 2020, the travel restrictions imposed after the outbreak of the COVID-19 pandemic brought academic air travel to a complete stop and forced academics to switch to a virtual format. This exposed the great potential of digital formats, as they cause less emissions and lead to increased inclusivity and accessibility (Skiles et al., 2022). Nevertheless, digital formats also showed some relative inherent limitations, such as the perceived lack or ineffectiveness of informal exchange, social interactions, and networking opportunities (Foramitti et al., 2021; Wenger, 2022).

While conferences, lectures, meetings, and examinations can potentially be conducted partly or entirely in a digital format, fieldwork requires physical travel to the study area. Therefore, it becomes particularly challenging to reduce fieldwork-related academic flights. The literature is extensive on possibilities for virtual conferences and meetings (e.g., Jäckle, 2019; Klöwer et al., 2020; van Ewijk & Hoekman, 2021), but it does not cover how to reduce fieldwork-related air travel.

Besides this, the acceptance of the AMM Initiative at GIUZ has yet to be studied. It is unclear what perception GIUZ scientific staff has of the reduction program and if they are willing and prepared to reduce their air travel as requested by UZH through the "Make Science, Not Miles" project. Because of the full stop in international travel caused by the global pandemic and the currently unfolding recovery (due to different international travel policies), it is difficult to identify a trend in the flight data and, thus, understand how flying behavior is changing in the long term.

Considering all this, the objective of this Master's Thesis is threefold. Firstly, it aims to characterize the air travel behavior at GIUZ and to quantify its impact in terms of GHG emissions. Secondly, it seeks to gather views and opinions of GIUZ scientific staff about the topic of academic air travel reduction. Lastly, it aims to evaluate potential voluntary reduction measures based on the willingness to be implemented by GIUZ scientific staff and their reduction potential. These goals are embodied in the following research questions:

- **RQ1**: What is the air travel behavior at GIUZ and what is its impact in terms of GHG emissions?
- **RQ2**: What are the opinions of the scientific staff regarding academic air travel reduction at GIUZ?
- **RQ3**: How willing is the scientific staff at GIUZ to adopt voluntary air travel reduction measures, and what is their reduction potential in terms of GHG emissions?

I introduced different possible reduction measures in Section 1.1. For this thesis, I selected six reduction measures that are consistent with the current vision of the AMM Group, which is that efforts to reduce emissions from air travel should be undertaken following a bottom-up approach. In addition, the reduction measures were selected by considering the specific context of GIUZ. The selected measures are the following:

Substituting air travel with train travel

This measure is intended to replace European flights thanks to Europe's relatively dense rail network (Poggioli & Hoffman, 2022).

Participating virtually in conferences and/or workshops

The COVID-19 pandemic caused the full stop of academic air travel and a switch to the virtual format. This has shown great potential to reduce air travel emissions (Foramitti et al., 2021; van Ewijk & Hoekman, 2021; Wenger, 2023).

Combining multiple purposes in one trip

This measure can increase the benefits of a trip and allow academics to avoid taking multiple trips to the same location. This measure is only briefly mentioned in the works by Burian (2018) and Le Quéré et al. (2015), but it is not yet discussed extensively.

Collaborating with locals and conducting longer fieldwork trips

Fieldwork is crucial for several research groups at GIUZ. Reduction measures for fieldwork-related air travel have not been discussed extensively in the literature. This measure was discussed at some workshops in which I took part. It aims to reduce the number of flights required to the study area.

Inviting guests virtually

As the GIUZ includes guests invited to GIUZ in the air travel emission balance, employing virtual communication on these occasions could reduce the environmental impact of air travel (Wenger, 2022).

Substituting stopover flights with non-stop flights

Stopover flights are associated with more GHG emissions compared to non-stop flights as they are less efficient and cover a greater distance (Ciers et al., 2019).

2 Methods

I analyzed the AMM data to characterize air travel behavior at GIUZ, quantify the related GHG emissions, and calculate the reduction potential of voluntary reduction measures. To gather the opinions of the scientific staff at GIUZ on the AMM Initiative and on voluntary reduction measures, I designed and implemented an online survey. In this section, I will outline my methodology.

2.1 Descriptive analysis of the AMM data

I performed a descriptive analysis of the AMM Data to characterize air travel behavior at GIUZ and quantify its GHG emissions.

2.1.1 AMM data

The AMM Group provided the data on GIUZ air travel used for this thesis. This dataset includes all flights that the scientific staff at GIUZ took between 2017 and 2022 and that were paid through UZH funds. This also includes flights taken by guests invited to GIUZ. The AMM data is grouped at the thematic area level for privacy reasons (GIUZ, 2020) and contains information about the year of the flights, the route, the flight class, the declared reason for the flights, the academic function of the passenger, the distance in kilometers, and the emissions expressed in kilograms of CO_2 equivalent (henceforth, *$kgCO_2$-eq*). These data are regularly used as the basis for the annual report on air travel monitoring and reduction at GIUZ, drafted by the AMM Group and published on the AMM Website (GIUZ, 2022).

Each record in the dataset corresponds to a flight segment. In other words, trips composed of an outbound flight and a return flight with one or more stopovers will have as many rows as the single segments of that trip. Depending on the analysis that has to be performed, the individual flight segments can be aggregated to obtain the outbound and return journeys by summing the distance and emissions of the individual flight segments. Similarly, these can be further aggregated to obtain the information concerning the entire roundtrip.

Defining precise terminology to distinguish the aggregation level of the flight is essential for a meaningful and correct analysis. The following terms will be used throughout this thesis to refer to the relative levels of flight information aggregation.

“Trip” is defined as a complete air travel trip. This may consist of either a single outbound flight (with no return flight associated) or an outbound and a return flight. Furthermore, it may be characterized by one or more stopovers. For more detail, if the trip consists of both the outbound and the return flight, it is referred to as a “Roundtrip”. In contrast, if the trip only consists of one outbound flight, it is referred to as a “One-Way Trip”.

The term "Journey" instead refers to one-way trips and the individual outbound or return flights that constitute roundtrips. In other words, "Journey" defines single air travel sections from the departure

location to the destination location without considering a possible return flight. If there were a return flight, this would be regarded as another independent journey.

Finally, the term "Flight leg" is used to describe a single segment of travel involving a direct flight between two specific points, regardless of whether this represents a non-stop journey or a single segment of a stopover journey.

To better understand these terms, I will illustrate an example (Figure 2). A GIUZ academic who wants to attend a conference in Los Angeles (LAX) books a ticket departing from Zurich (ZRH). The outbound flight has a stopover in Frankfurt (FRA), while the return flight is non-stop. This can be described as:

- A single trip, more specifically a roundtrip
- Two journeys
- Three flight-legs

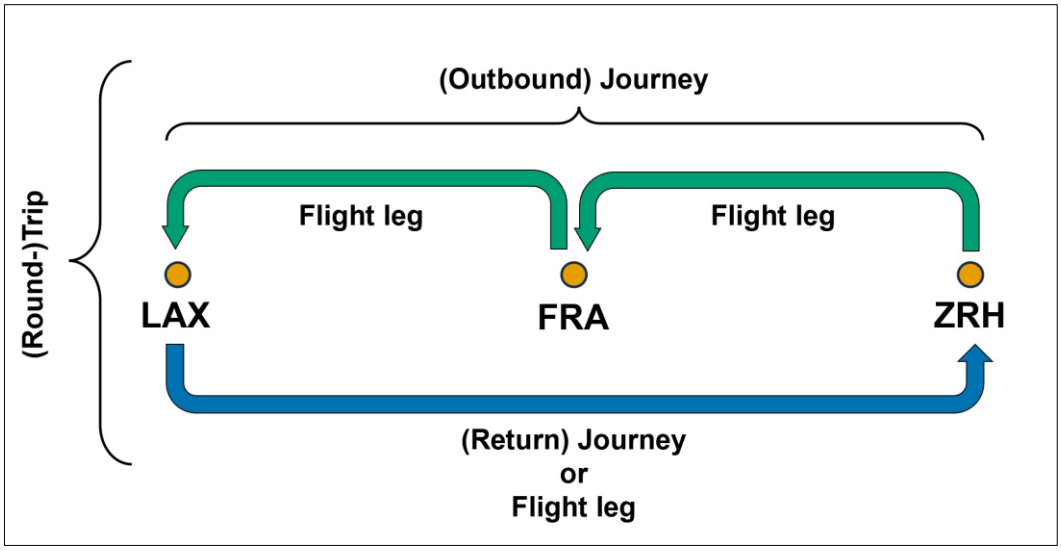

Figure 2: Example to visualize air travel terminology used in this thesis.

2.1.2 AMM data analysis

The descriptive analysis of the AMM data has been performed using the R software. The AMM Group had already carried out preprocessing and some visualizations for the AMM annual reports. Therefore, I could use and further develop the existing R code provided by the AMM Group.

Within the dataset, the entries represent single flight legs, which are stored using the IATA codes of departure and arrival airports. Based on these, journeys and trips can be retrieved by aggregating individual entries according to additional information in the dataset, such as unique trip-IDs and information regarding the departure and arrival airport of the journeys. The distance of each flight leg is calculated using the Haversine distance in R, while emissions are calculated automatically

using the GoClimate-API[5] in $kgCO_2$-eq. By starting with a level of detail equal to individual flight legs and aggregating these to journeys and trips, intermediate stops are also considered in calculating total emissions and distances, making this information remarkably accurate.

Each flight leg is provided with information regarding the thematic area in which the passenger is employed (Physical Geography, Human Geography, Remote Sensing, GIScience), their academic position (PhD student, employee without PhD, employee with PhD, professor, guest), and the reason for travel (conference/workshop, teaching, examination, fieldwork/excursion, project meeting, other). By aggregating distances and emissions based on these details, it is possible to perform a descriptive analysis to gain insight into the ecological footprint of GIUZ academic staff. In addition, calculating emissions per capita allows for comparable percentages of emissions from year to year. Therefore, it was necessary to use datasets containing the number of employees for each thematic area and position. These two datasets were also kindly provided by the AMM Group.

2.2 Online survey on academic air travel

To identify the opinions of GIUZ scientific staff regarding academic air travel reduction and possible voluntary reduction measures, I designed and implemented an online survey directed to the scientific staff of GIUZ.

2.2.1 Survey design

I created the online survey (see Appendix) using the online platform Unipark[6]. The survey opened with a brief introductory page explaining the study's objectives and a consent form to participate in the survey, afterwards it was composed of four main sections. In the first section, introductory questions were asked to obtain an overview of the air travel behavior of the participants. In addition, the perceived relevance of air travel for a successful academic career and the degree of approval of the AMM Initiative were questioned. Six voluntary reduction measures were proposed in the second part of the survey, and participants were asked to indicate their willingness to implement them. Several additional questions were asked, such as the rating of the feasibility of a specific reduction measure. In the third section of the survey, additional questions were asked regarding academic air travel reduction, particularly the concerns deriving from academic air travel reduction. In the last section, the participants' demographics were collected.

The survey was conducted in English, as I assumed that the scientific staff at GIUZ had sufficient knowledge of the English language. It was primarily composed of closed-ended questions with the option to leave a comment at the end of every main question/section. Both multiple-choice and single-choice questions were used. For the questions that aimed to collect the participants' opinions,

[5] GoCmilate – API website: https://www.goclimate.com/blog/flight-emissions-api/.
[6] Unipark website: https://www.unipark.com/.

6-step bipolar Likert scale questions were used. Whereas with an odd-numbered Likert scale, it would have been possible to express a neutral opinion, the use of the middle point can be ambiguous and might be chosen because of indecision, confusion as to the meaning of the question or because the participant finds the question too context-dependent (Kulas & Stachowski, 2013). However, Simms et al. (2019) investigated possible differences between odd and even scales and found no significant difference, thus concluding that the choice of an odd or even scale is not crucial in the accuracy of the answers.

With this in mind and being aware that the questions in this survey touch on important and complicated topics, I decided to include only 6-step Likert scales to incentivize the participants to reflect further and take a stance actively. To address cases of indecision, confusion, or context dependency, I always included a non-answer option ("Don't know / Prefer not to say") and the possibility to leave a comment.

The order of the sections on voluntary reduction measures was randomized. This was to avoid the possibility of the last proposed measure being systematically completed more summative and hastily than the other measures. This should ensure that the answers received similar attention during compilation. The same applies to the order of appearance of answers option for multiple-choice questions or for questions with no order of responses.

The order of all other questions, as well as the order of questions within the individual sections on reduction measures, remained the same for all participants. This was to ensure that the compilation of the survey followed a logical thread and was, therefore, lighter and easier to complete.

Filters were included in the survey to show participants only the questions that were relevant to them. For example, at the beginning of the survey, it was asked if the participant practiced fieldwork. If not, questions related to fieldwork were not shown, and vice versa. This made it possible to collect data only from people directly interested in the topic and thus have more representative responses.

Pretests were conducted to verify the proper technical functioning of the survey and to obtain feedback on the comprehensibility and construction of the questions. In addition to internal pretests done by myself and my supervisors, the AMM Group participated in a further pretest and provided valuable comments and suggestions.

After the final revision of the survey, the official invitation to the survey was sent out. This was done through a mailing list that allows all staff members of GIUZ to be reached at the same time. The mailing list used contained 289 addresses. The invitation email was sent out on March 21, 2023 (see Appendix). In addition, the survey was publicized by several GIUZ professors and employees and through a second email on April 3, 2023 by Prof. Ross Purves, current Head of the Department (see Appendix).

The survey could be completed during 18 days until April 7, 2023. After the participation window closed, I saved the collected data online within a private project in the Unipark platform used for the

online survey. In addition to that, I saved a copy of the data locally in my password-protected PC and in a private hard disk as a backup.

2.2.2 Survey data analysis

The analysis of the survey data was performed using the open-source software R. In a first phase, I visualized all the answers in a graphical form and calculated all the descriptive statistics. In the second phase, I investigated differences between groups of GIUZ academics for specific questions to obtain a more detailed analysis.

I defined five groups for this research: thematic area, academic position, gender, climate change expertise, and seniority of employment. In the last section of the questionnaire (demographics section), participants were asked to enter their thematic area, current academic position, and gender. I kept the division of thematic areas and academic positions consistent with that of the AMM data to allow for comparability. To indicate gender, it was possible to select "Male", Female", Non-binary", and "Other". For each question, selecting the option "Prefer not to answer" was possible if the participant did not want to share the information. I defined the other two categories based on definitions from the literature.

Whitmarsh et al. (2020) investigated the characteristics of air travel behavior of climate change researchers. In their work, they implemented an extensive international survey. I applied their methodology in my survey to distinguish between climate change experts and non-climate change experts. Inside the demographics paragraph, I asked: “Does your work involve researching or teaching on climate change or sustainability?”. The available response options were: “Yes - this is a major part of my work”, “Yes - this is a minor part of my work”, or “No”. Following the methodology by Whitmarsh et al., I considered climate change experts those who answered with the first option and as non-climate change experts those who selected either of the other two options. A “Prefer not to answer” option was available in this case too.

I followed the definition by the European Geosciences Union for the classification of employment seniority (EGU, 2023). This definition states that PhD candidates or practicing scientists who received their highest certificate (MSc or PhD) within the past seven years are considered early career researchers. This information was collected in the survey through the question about academic position and an additional question included in the demographics section that requested to indicate the academic age of the participant. The subtitle of the question consisted of the following text: "Academic age refers to the number of years you have been in the research field and performed active research (i.e., years since completion of your PhD)". Thanks to a filter, this question was not asked to respondents who had previously indicated that they were PhD students. It was possible to not provide this information by selecting the "Prefer not to answer" option.

I applied statistical tests to check for possible differences in the responses of these groups of academics. As the distribution of responses was not normal, I chose non-parametric statistical tests.

I used the Mann-Whitney-U-Test for questions with two variables and two steps, and the Kruskal-Wallis-Test for questions with two variables and more than two steps.

2.2.3 Sample description

Out of the 289 people contacted, a total of 101 GIUZ academics completed the survey. This corresponds to a response rate of 34.9%. The proportion between male and female respondents is well balanced, as illustrated in Figure 3 (45 male, 47 female, and one non-binary).

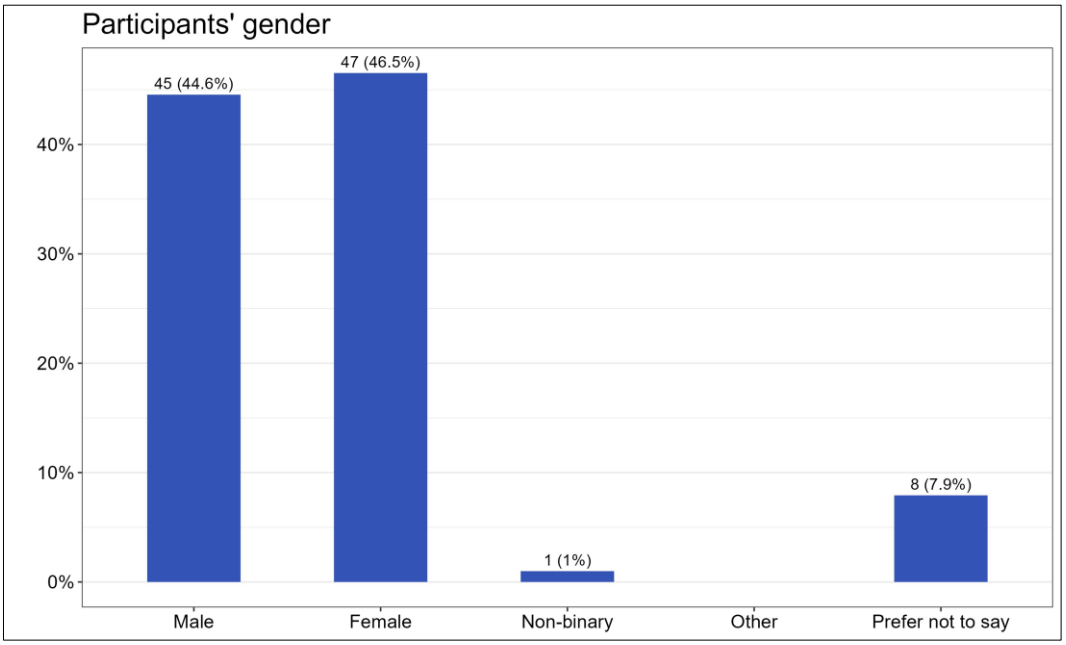

Figure 3: Responses to the question "With what gender do you identify?".

Table 1 shows that most respondents are employed in the Physical Geography thematic area (33 academics). Fewer participants are affiliated with the Human Geography thematic area (28 academics). At the same time, Remote Sensing and GIScience are the two thematic areas with the lowest number of participants (respectively 18 and 17). However, by normalizing the number of respondents for each thematic area with the actual number of employees per thematic area, Physical Geography, Human Geography, and GIScience have a very similar response rate (respectively 37.1%, 38.2%, and 38.6%), while Remote Sensing results more underrepresented in this sample with a response rate of only 18.6%.

Table 1: Thematic area of employment of the participants.

	Nr. respondents	*Total nr. employees (2022)*	*Response rate*
Physical Geography	33	89	37.1%
Human Geography	26	68	38.2%
Remote Sensing	18	97	18.6%
GIScience	17	44	38.6%

Most participants were employees with PhD (41) and PhD students (39) (Table 2). Furthermore, there are nine professors, four employees without PhD, two academics whose positions do not correspond to those proposed, and six people who preferred not to indicate their academic position. Although the number of professors who filled out the survey may seem low, it's the position better represented in the survey sample with a response rate of 56.3%. Employees with PhD and PhD students are less represented, with response rates of 47.1% and 38.2%, respectively. Since there is no information about the total number of employees without PhD working at GIUZ, I cannot calculate the response rate for that position.

Table 2: Academic position of the participants.

	Nr. respondents	*Total nr. employees (2022)*	*Response rate*
PhD Students	39	102	38.2%
Employees with PhD	41	87	47.1%
Professors	9	16	56.3%

2.3 Assessment of six voluntary reduction measures

In Section 1.3, I presented the six voluntary reduction measures that were proposed to the survey participants. Participants were asked about their willingness to implement each of these measures. This was done using 6-step Likert scales ranging from "Very unwilling" to "Very Willing".

For each measure, I produced GHG emission reduction scenarios (except for "Combining Multiple Purposes", for which it was not possible). The reduction scenarios were based on the travel behavior of scientific staff at GIUZ between 2017 and 2019, enclosed in the AMM data. First, I selected air journeys undertaken by GIUZ academics between 2017 and 2019 relevant to a specific reduction measure. This step is unique for each measure. The parameters used to select journeys are explained in the corresponding paragraphs within the results section of each measure. Afterward, I divided the total emissions of the selected journeys by the number of selected journeys, thus obtaining the average emissions of a journey that the reduction measure could remove. I then modeled a progressive reduction in the number of these journeys from a 0% reduction to a 100%

reduction. Finally, I multiplied the average emissions of an eliminable journey by the number of progressively reduced journeys. In this way, I obtained a linear progressive reduction expressed in $kgCO_2$-eq. To facilitate understanding, I will illustrate the procedure for calculating the reduction scenario of the "inviting guests virtual" measure as a practical example.

All reduction scenarios were calculated from a version of the AMM data aggregated to the journey level. To calculate the reduction scenario for the "inviting guests virtually" measure, I first selected the journeys taken by guests between 2017 and 2019 through a query on R. Then, I extrapolated the number of these journeys and calculated the total emissions of these journeys by summing the emissions of each selected journey. I then divided the total emissions of the guest journeys by the number of journeys taken by the guests. I thus obtained a measure of how much one guest's air journey emits on average. Next, I calculated a reduction from 0 to 100% (with 10% steps) of the number of journeys made by guests. By multiplying this result by the average emissions of a guest journey obtained above, I obtained the emission trend due to a reduction in the number of journeys made by guests ranging from 0 to 100%. The reduction potential obtained is thus an estimate based on the air travel behavior of scientific staff at GIUZ in the pre-COVID-19 period (2017-2019). It is visualized in a graph, in which the x-axis represents the total emissions from air travel (average 2017-2019), and the y-axis represents the percentage of implementation of the reduction measure. The reduction potential is illustrated with a yellow line, while the reduction target set by UZH is shown as a green dashed line. Also displayed around the reduction line is the error interval of the calculation of the average emissions of an eliminable journey. This is obtained by multiplying the standard error of the mean (obtained in the calculation of the average emissions of an eliminable journey) by the number of eliminable journeys. The result is an error interval proportional to the number of eliminable journeys available. To see an example of the outcome, compare with Figure 28.

3 Results

This Master's Thesis aims to obtain an overview of the air travel behavior of the scientific staff at GIUZ, their views on academic air travel reduction, and to evaluate six potential voluntary reduction measures based on the willingness to be implemented by scientific staff at GIUZ and their reduction potential. In this section, the result of the work is presented.

3.1 Air travel behavior at GIUZ and related GHG emissions

The first research question aims to obtain a deep insight into the air travel behavior at GIUZ and the consequent GHG emissions. To do this, I performed a descriptive analysis of the AMM data.

Figure 4A represents the evolution of GHG emissions from GIUZ air travel between 2017 and 2022 extracted from air travel data provided by the AMM Group. The blue line represents the air travel reduction target set by the UZH. Figure 4B shows the GHG emission trend expressed in $kgCO_2$-eq per capita. It was calculated by dividing the total annual GHG emissions by the yearly total number of employees at GIUZ.

In the pre-pandemic years (2017, 2018, 2019), total GHG emissions from air travel increased despite the establishment of the AMM Initiative in 2017. Total emissions increased from 540'300 $kgCO_2$-eq in 2017 to 623'100 $kgCO_2$-eq in 2018 to 645'000 $kgCO_2$-eq in 2019. Figure 4B, however, shows that the increase in per capita emissions between 2018 and 2019 was lower than that between 2017 and 2018 (2017: 2'039 $kgCO_2$-eq, 2018: 2'369 $kgCO_2$-eq, 2019: 2'425 $kgCO_2$-eq). Given the data's low availability, it is not possible to know whether this was an annual variation or a trend. In fact, in the following two years, total emissions dropped dramatically, influenced by the outbreak of the COVID-19 pandemic and the resulting restrictions on international travel (2020: 149'400 $kgCO_2$-eq, 2021: 114'600 $kgCO_2$-eq). In 2022, after the easing of the travel restrictions, total emissions increased again, reaching 409'700 $kgCO_2$-eq, or 68.0% of pre-pandemic levels (baseline 2017-2019).

In 2022, the reduction target set by the UZH became effective. This stipulates that emissions in 2022 may increase to a maximum of 60% of pre-pandemic levels. In this case study, this is equivalent to a threshold of 48'020 $kgCO_2$-eq. The reduction target is then lowered yearly by 3% compared to the previous year until 2030. In 2022, there has been an 8% overshot of the air travel reduction target at GIUZ.

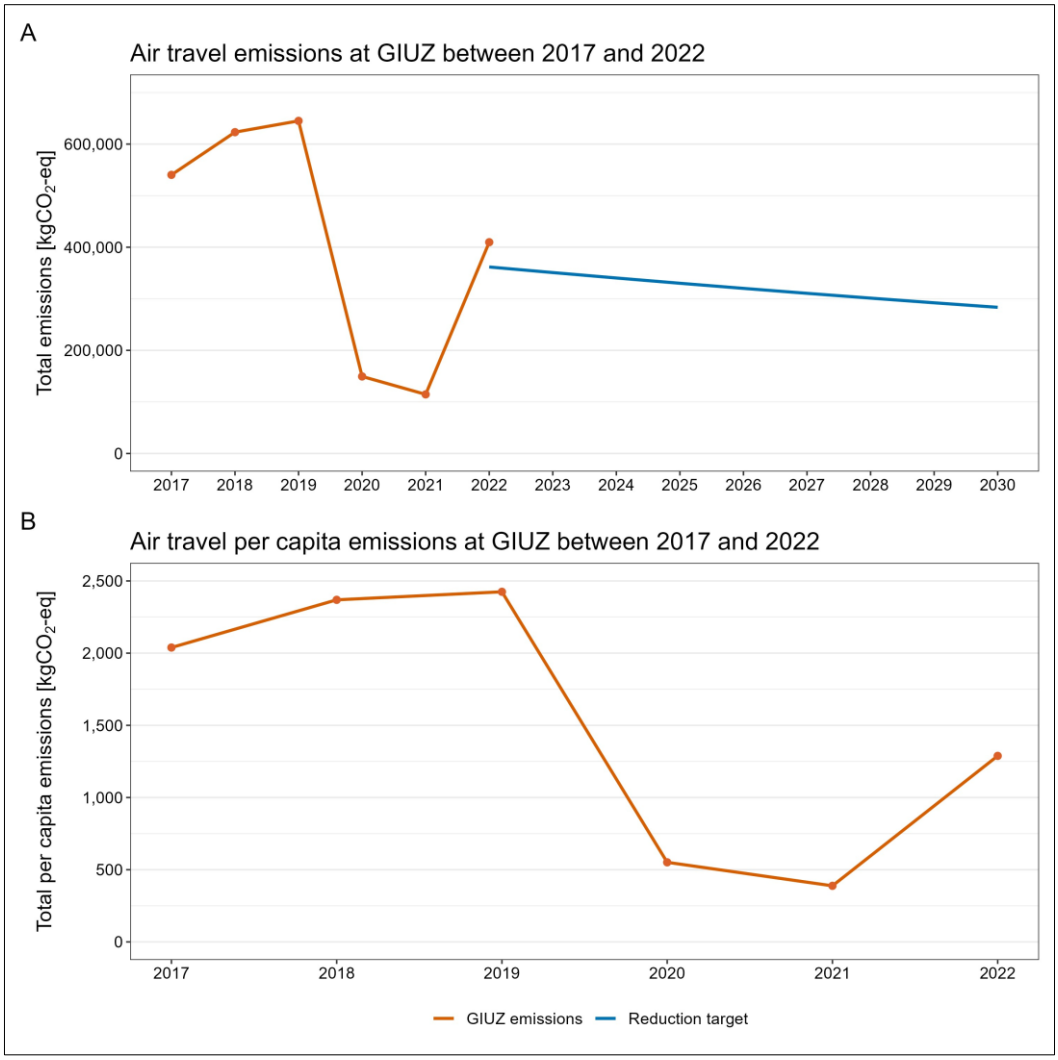

Figure 4: Air travel emissions (absolute and per capita) at GIUZ between 2017 and 2022.

Figure 5 illustrates the volume of journeys departing from Zurich Airport between 2017 and 2022, summarized by destination country. This means that the displayed dots do not include stopovers. Journeys that did not start from Zurich Airport, for example, intern flights during a more extended stay in the U.S., are also not shown.

The majority of air travel was to Europe and North America. The destination country with the most journeys was the United States of America (120 journeys). The second most visited country was the United Kingdom (78 journeys). South America and Asia were less visited than Europe and North America, but they were still highly visited. Africa and Australia were the continents with fewer journeys. The box focusing on Europe illustrates a relatively high number of journeys to Western Europe, while there were significantly fewer flights in Eastern Europe.

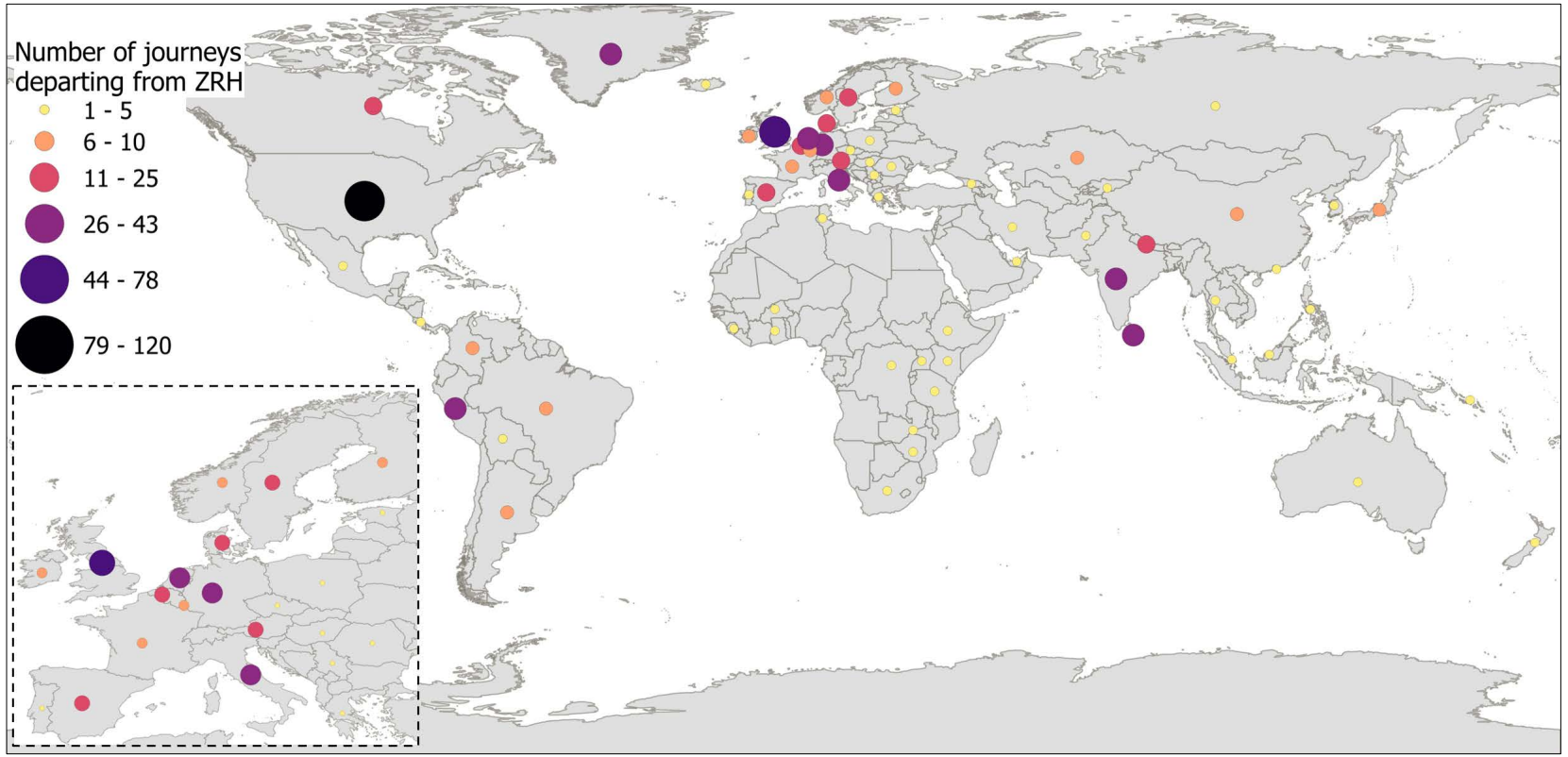

Figure 5: Visual representation of journeys departing from Zurich Airport summarized by destination country. Stopover journeys and journeys that do not depart from Zurich Airport are not considered.

Figure 6 represents the ten most visited cities via air travel departing from Zurich Airport between 2017 and 2019, both by number of journeys (Figure 6A) and emissions (Figure 6B). Amsterdam had the most journeys between 2017 and 2022, with 40 journeys over the six years. Among these destinations, three other European cities can be noted: London (3rd, 30 journeys), Rome (5th, 29 journeys), and Vienna (9th, 19 journeys). In line with the definition of "journey" provided in Section 2.1.1, only the final destinations of outbound flights from Zurich were considered in this analysis. Thus, stopovers were not included. European destinations disappeared from the ranking when emissions were considered instead and were replaced by destinations significantly farther from Zurich. Indeed, in first place there is Colombo, Sri Lanka, with 73'700 $kgCO_2$-eq, equivalent to about 7% of the total emissions from journeys departing from Zurich between 2017 and 2022. The remaining destinations in this ranking were either in North America, South America, or Asia.

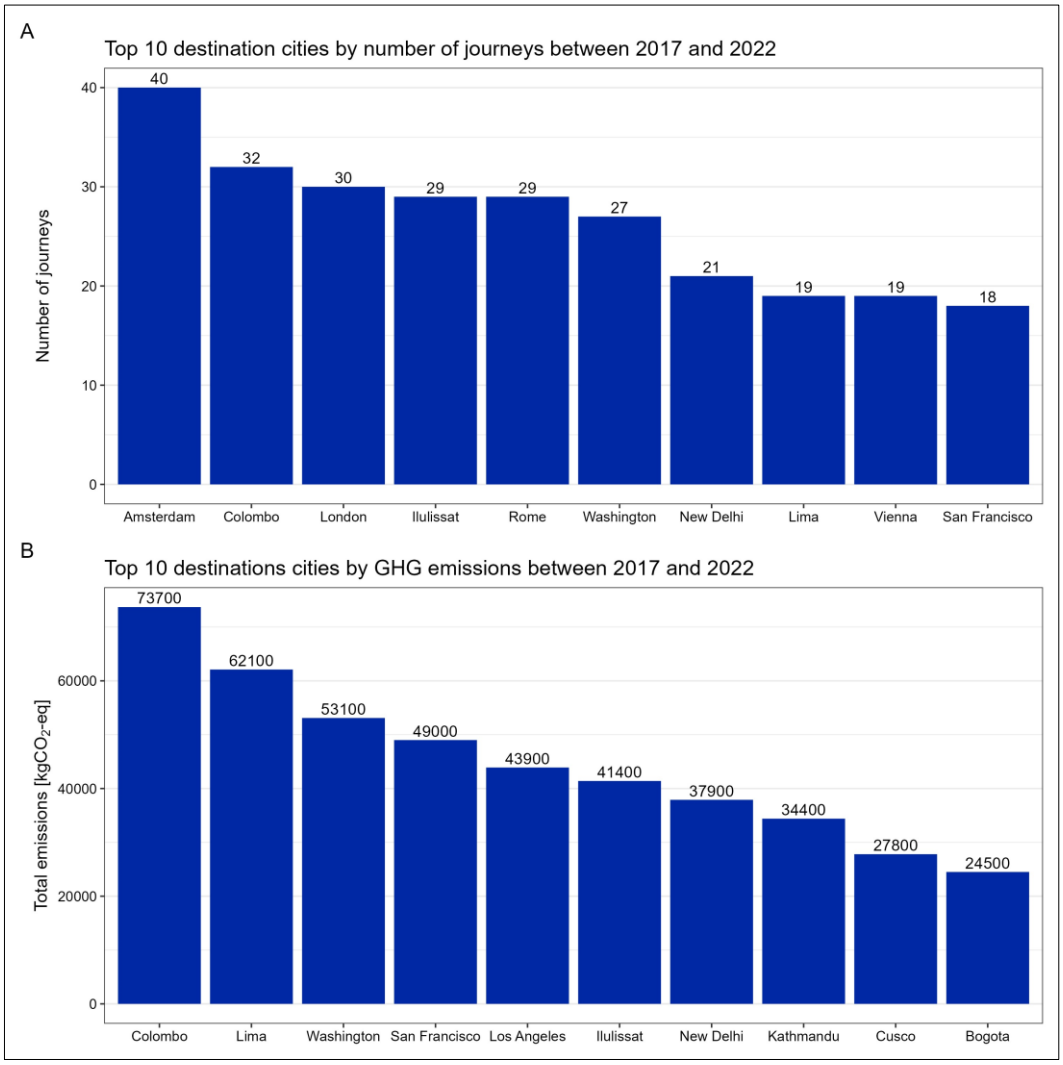

Figure 6: Most visited cities by number of journeys (A) and by GHG emissions (B) between 2017 and 2022. Only journeys departing from Zurich Airport have been considered.

According to the Civil Aviation Authority's definition (CAA, 2023), short-haul flights have a distance of less than 1500km (roughly equivalent to a flight from Zurich to Stockholm), medium-haul flights between 1500 and 3500km, and long-haul flights more than 3500km (approximately equal to a flight between Zurich and Tiblisi). Table 3 shows the journeys performed by scientific staff at GIUZ between 2017 and 2022 aggregated based on this definition. There were 784 short-haul journeys during the study period, which is equivalent to 43.4% of all journeys. Long-haul journeys accounted for 49.4% of the total journeys (892). This number does not include stopover journeys but only considers journeys from the departure airport to the final destination airport. Although the percentage of journeys was similar between short-haul and long-haul flights, emissions varied greatly. In fact, short-haul journeys accounted for 11% of total emissions, while long-haul journeys accounted for 85%.

Table 3: Statistics of short-, medium- and long-haul journeys at GIUZ between 2017 and 2022.

	Nr. journeys	*Percentage of journeys*	*Emissions [kgCO_2-eq]*	*Percentage of emissions*
Short-haul	784	43.4%	272’600	11%
Medium-haul	131	7.2%	96’800	3.9%
Long-haul	892	49.4%	2’112’700	85.1%
Total	1’807	100%	2’482’100	100%

Figure 7 shows the total yearly GHG emissions aggregated by air travel purposes in absolute numbers (Figure 7A) and as a percent stacked bar chart (Figure 7B). Three primary travel purposes caused most emissions from air travel at GIUZ. These are conferences and/or workshops, fieldwork and/or excursions, and project meetings. In the years before the COVID-19 pandemic, the share of emissions linked to conferences and/or workshops has been relatively constant, with an average of 37.5% (2017: 36.8%, 2018: 34.0%, 2019: 41.6%). On the other hand, the emission’s share for fieldwork and/or excursions and for project meetings has been much more variable while always remaining an important portion of the total emissions. Air travel decreased dramatically in 2020 and 2021, which were significantly impacted by the COVID-19 pandemic. The remaining emissions were mainly for conferences in 2020 (66.8%) and fieldwork in 2021 (64.4%). In 2022, a trend similar to that of pre-pandemic years was observed. In fact, the largest shares of emissions were related to conferences and/or workshops followed by fieldwork and/or excursions. In contrast, emissions for project meetings remained lower than in the pre-COVID period.

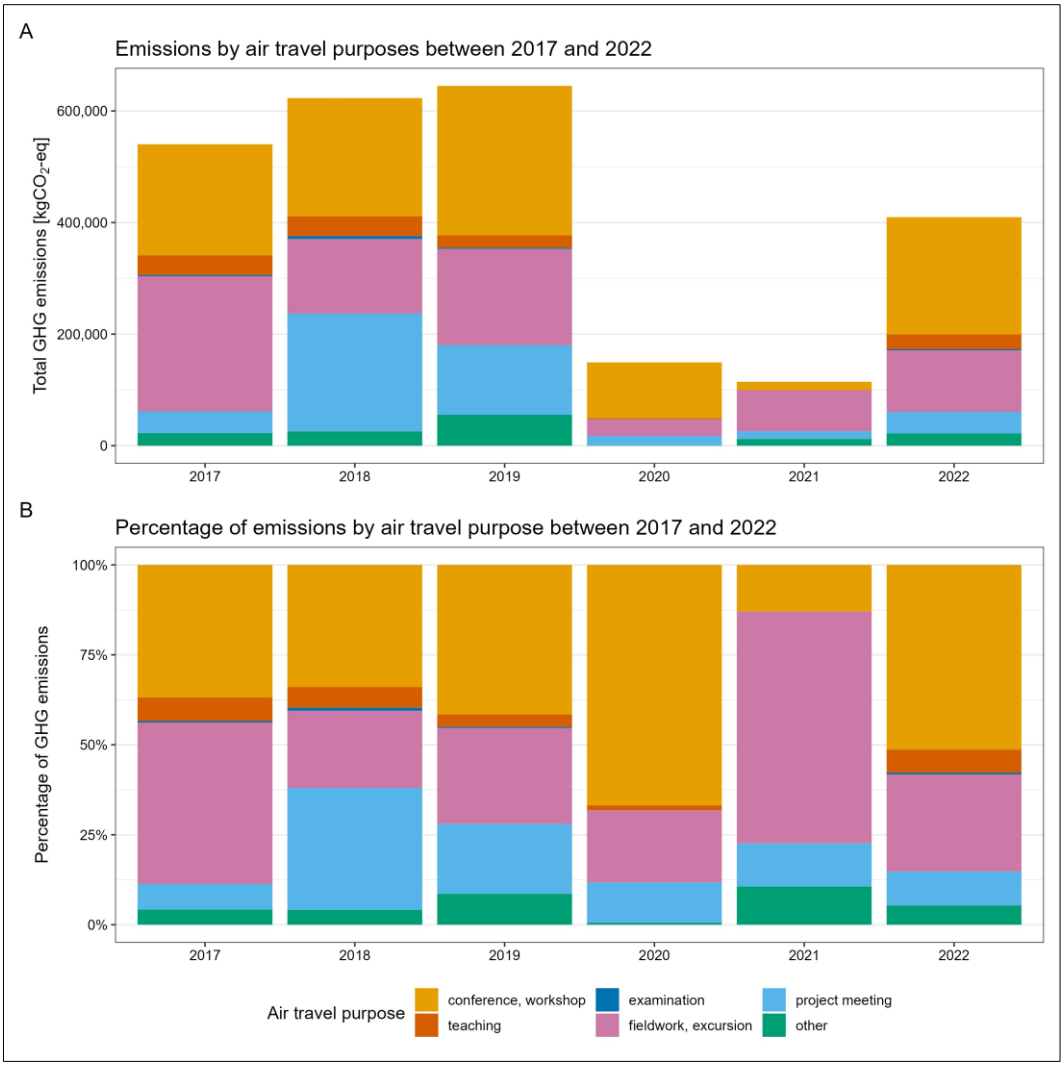

Figure 7: Air travel emissions at GIUZ between 2017 and 2022 aggregated by travel purpose, in absolute numbers (A) and percentage (B).

Figure 8 shows per capita GHG emissions broken down by thematic area in absolute numbers (Figure 8A) and as a percent stacked bar chart (Figure 8B). Most emissions were attributable to Physical Geography and Human Geography in all years except 2020. In pre-COVID-19 years, the average percentage of the emissions was 32.4% for Physical Geography and 29.6% for Human Geography. In these years, The GIScience thematic area has steadily decreased its emissions, while Remote Sensing has done the opposite. The average percentage of Remote Sensing emissions between 2017 and 2019 was 20.1%, while for GIScience, it was 17.8%. In 2022, Human Geography emissions were 53.1% of total emissions, while those linked with Physical Geography were 24.3%. Remote Sensing and GIScience percentages remained low, 13.2% and 9.4%, respectively.

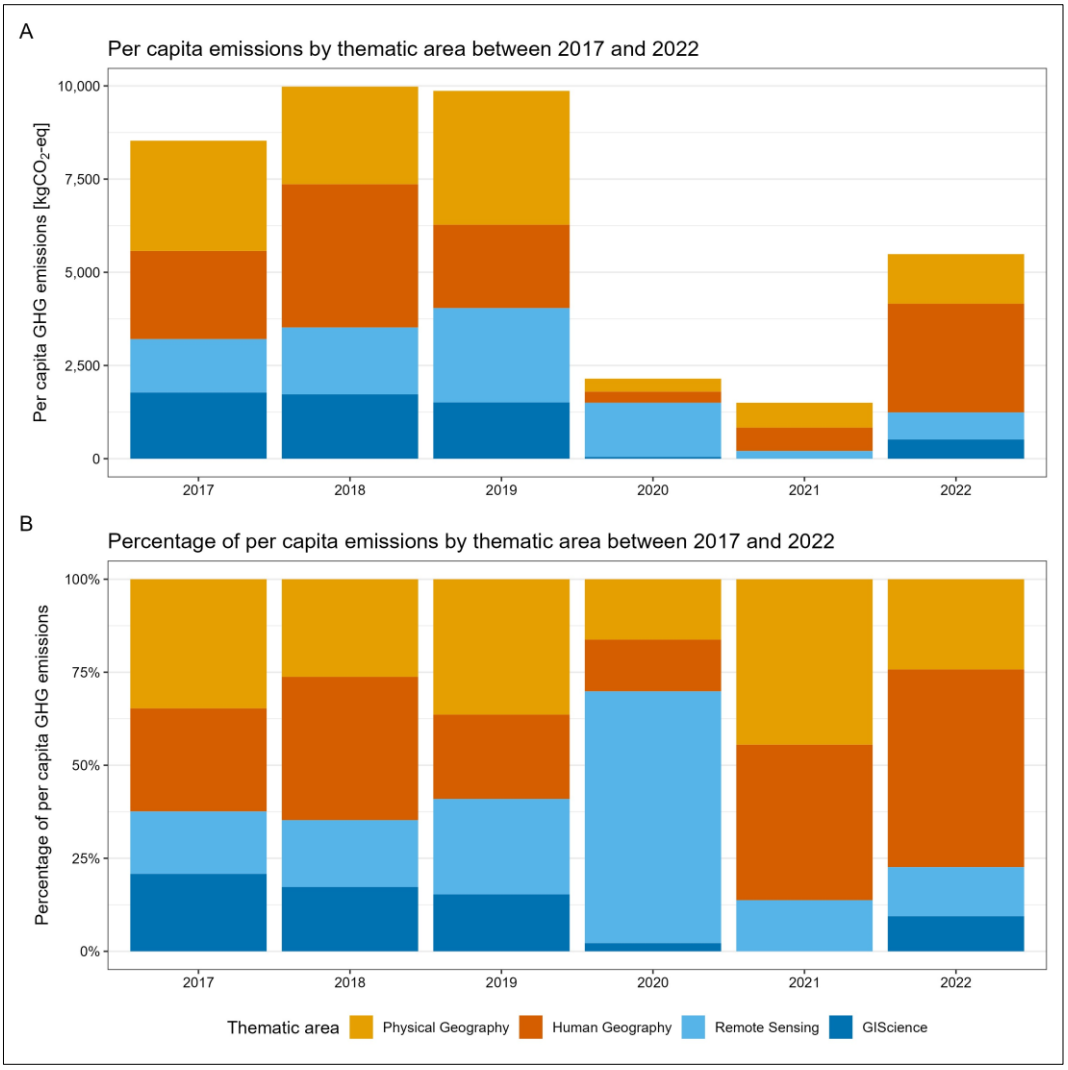

Figure 8: Air travel emissions aggregated by GIUZ thematic area, in per capita terms (A) and as percentage of per capita emissions (B).

Lastly, Figure 9 shows the yearly per capita GIUZ air travel emissions divided by academic position in absolute numbers (Figure 9A) and percentage bar chart (Figure 9B). The academics responsible for the fewer emissions were PhD candidates. In fact (not counting 2020 and 2021, which are not representative because of very few opportunities to fly), the proportion of emissions related to PhD candidates never exceeded 7.6%. Employees with PhD were responsible for slightly more emissions, however, they too had a relatively low proportion, never higher than 13.8% (not counting 2020 and 2021). Most of the emissions were related to the air travel of professors and guests. In fact, the summed proportions of these two groups were never lower than 81.8% (not counting 2020 and 2021). Guests were responsible for a slightly higher proportion than professors. In fact, on average (again without counting 2020 and 2021), guests were responsible for 46.2% of the emissions, while professors 38.2%.

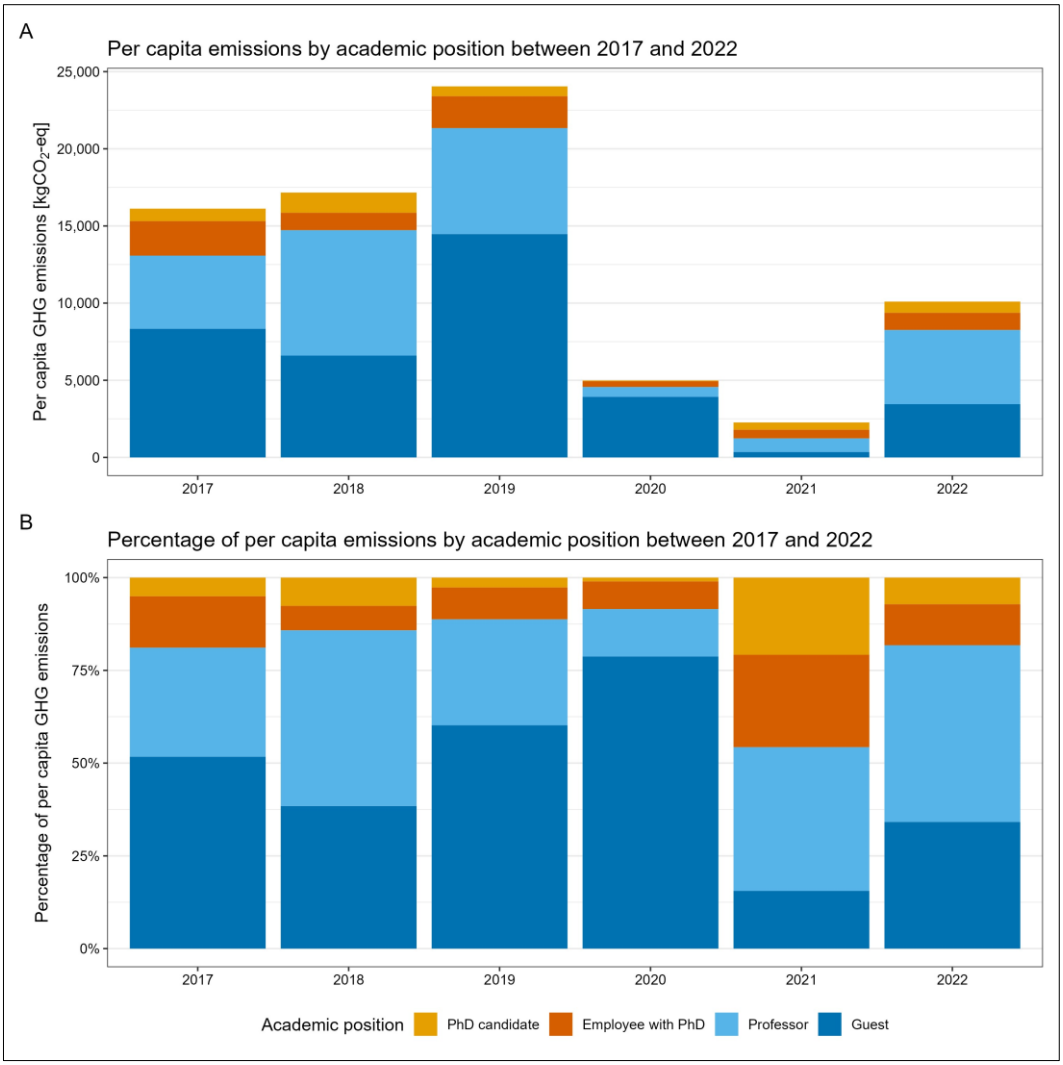

Figure 9: Air travel emissions aggregated by academic position, in per capita terms (A) and as percentage of per capita emissions (B).

3.2 Academics' opinion on air travel reduction at GIUZ

I designed and implemented an anonymous online survey directed to the scientific staff at GIUZ to obtain opinions and views on the topic of academic air travel reduction at GIUZ and on possible voluntary reduction measures. This section illustrates the results obtained in the survey regarding the opinions on academic air travel reduction.

Figure 10 illustrates the answers to the question "Generally, how relevant do you consider air travel for your academic work?". The possible answers consisted of a 6-step Likert scale ranging from "Very irrelevant" to "Very relevant."

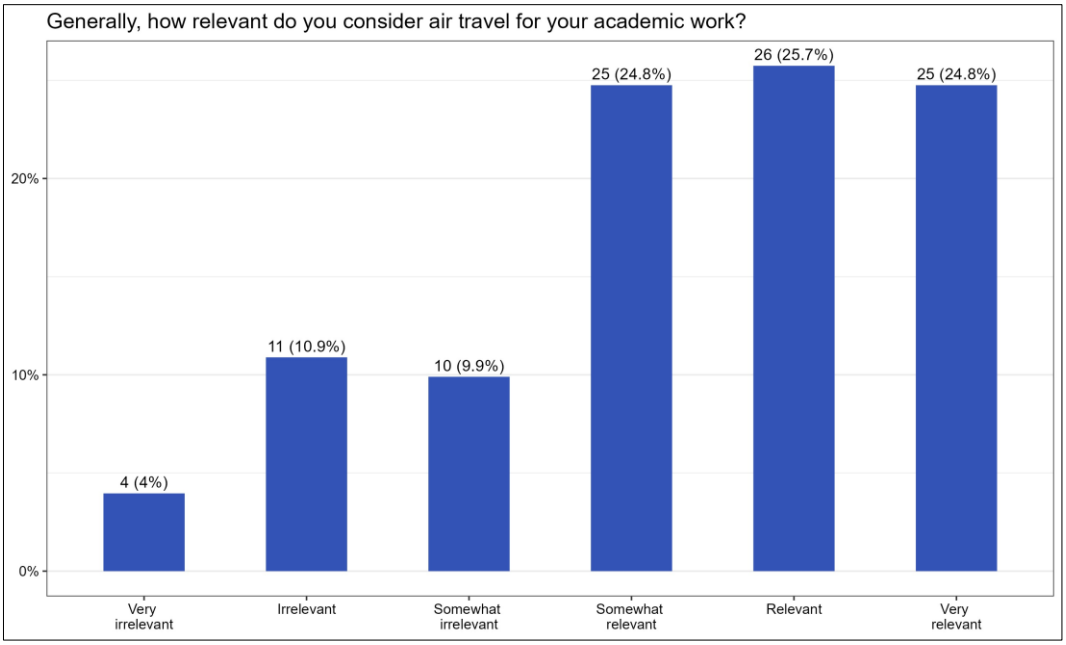

Figure 10: Relevance of air travel for academic career at GIUZ. Results from the online survey.

Around three-quarters of the sample, 76 respondents out of 101, considered air travel to be somewhat relevant, relevant, or very relevant for a successful academic career. The remaining 25 academics answered “somewhat irrelevant”, “irrelevant” or “very irrelevant”, with only four of those considering air travel very irrelevant for an academic career.

Figure 11 allows for a more detailed look into those answers. The responses have been divided in accordance with the five groups exposed in Section 2.2.2, namely thematic areas, academic position, gender, climate change expertise, and stage of academic career.
Considering the medians in Figure 11, all groups considered air travel to be between “Somewhat relevant” and “Relevant” for academic work, except for employees without PhD, who considered it in the middle between somewhat relevant and somewhat irrelevant (Figure 11B). Employees without PhD were, therefore, the group that considered air travel less critical for their careers. PhD students considered it slightly more important (“Somewhat relevant”), while employees with PhD and professors considered it relevant. Similarly, senior academics considered air travel more important than early career scientists did. A difference can also be observed between male and female employees, where the male group showed a higher relevance level than the female one. All differences were statistically tested with the Mann-Whitney-U or Kruskal-Wallis tests, and no statistical significance was found (the p-values are provided in the figure).

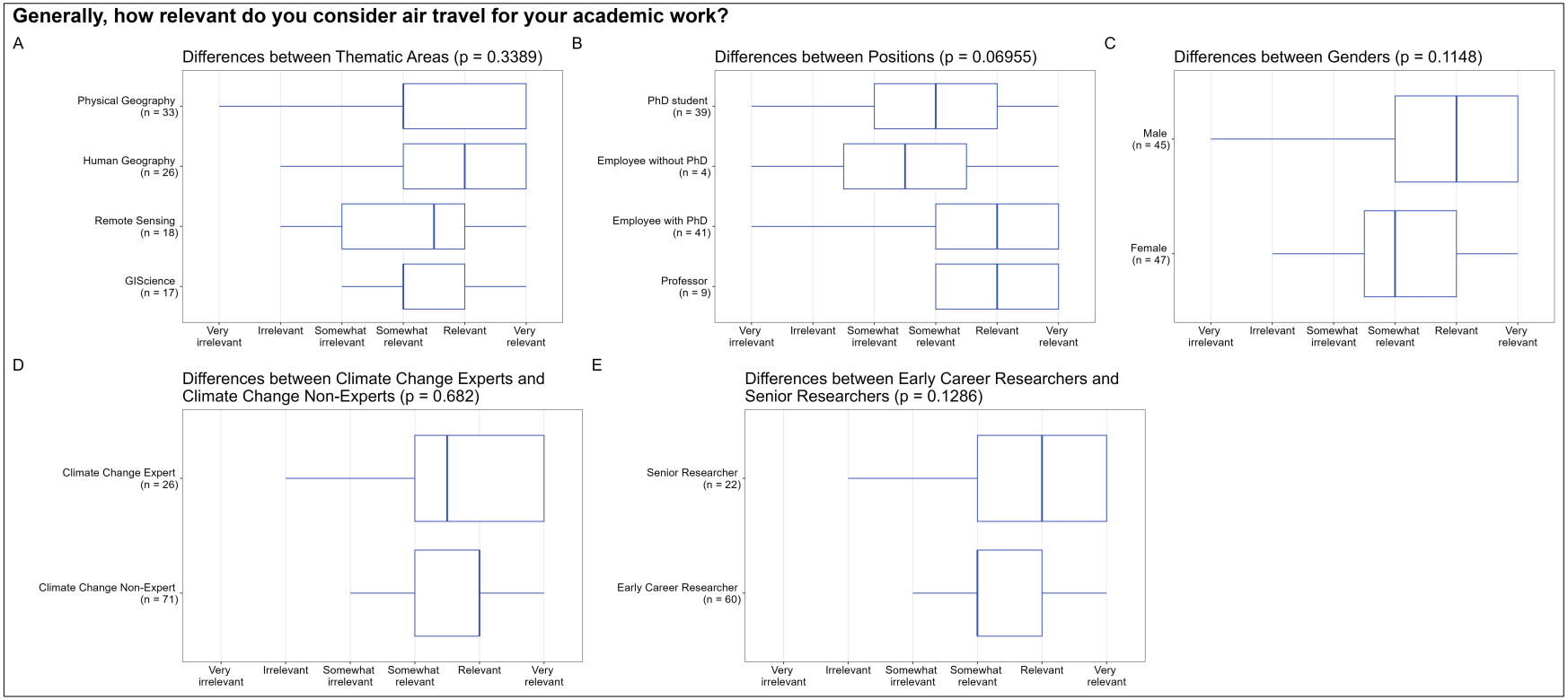

Figure 11: Differences in relevance of air travel for academic career between thematic areas (A), academic positions (B), gender (C), climate change expertise (D) and seniority of employment (E). No significant difference was found.

Figure 12 shows the responses to the question "Do you approve of the Air Miles Monitoring initiative at GIUZ?". The possible answers consisted of a 6-step Likert scale ranging from "Strongly disapprove" to "Strongly approve". The level of approval was very high, with only three respondents out of 100 who answered “Somewhat disapprove”, “Disapprove”, and “Strongly disapprove”. The remaining 97 respondents somewhat approved, approved, or strongly approved of the AMM Initiative. Slightly more than half of the respondents (53 people) selected “strongly approve” as an answer.

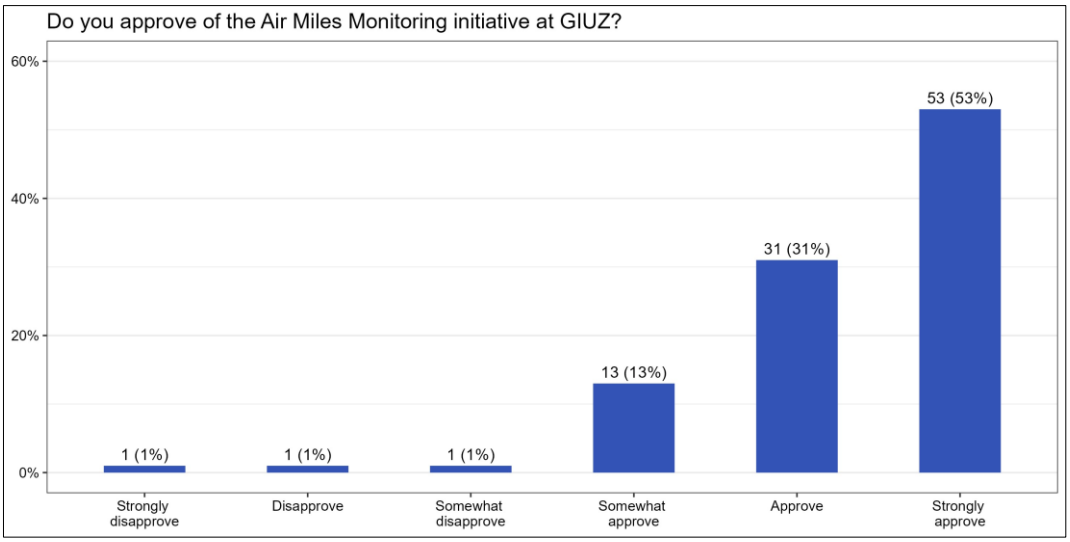

Figure 12: Approval of the AMM Initiative at GIUZ. Results from the online survey.

Differences in the answers of the investigated groups can be visualized in Figure 13. Medians showed that all groups approved or strongly approved of the AMM initiative. Figure 13C and 13E showed no difference in approval between genders and between career stages. Differences could be distinguished in the other cases. Physical Geography and GIScience showed the highest approval across all thematic areas (median = “Strongly Approve”). Slightly lower approval was shown by Human Geography as the median was found between “Approve” and “Strongly approve”, while for Remote Sensing, the median was found on “Approve”. These differences were minor and not statistically significant (Fig. 13A). In Figure 13B, all groups’ median was found on “Strongly approve”, except for employees with PhD, which was found on “Approve”. These differences were not statistically significant. A statistically significant difference was found in Figure 13D between climate change experts and non-experts, where the first approved significantly more of the AMM Initiative ($p = 0.007839$).

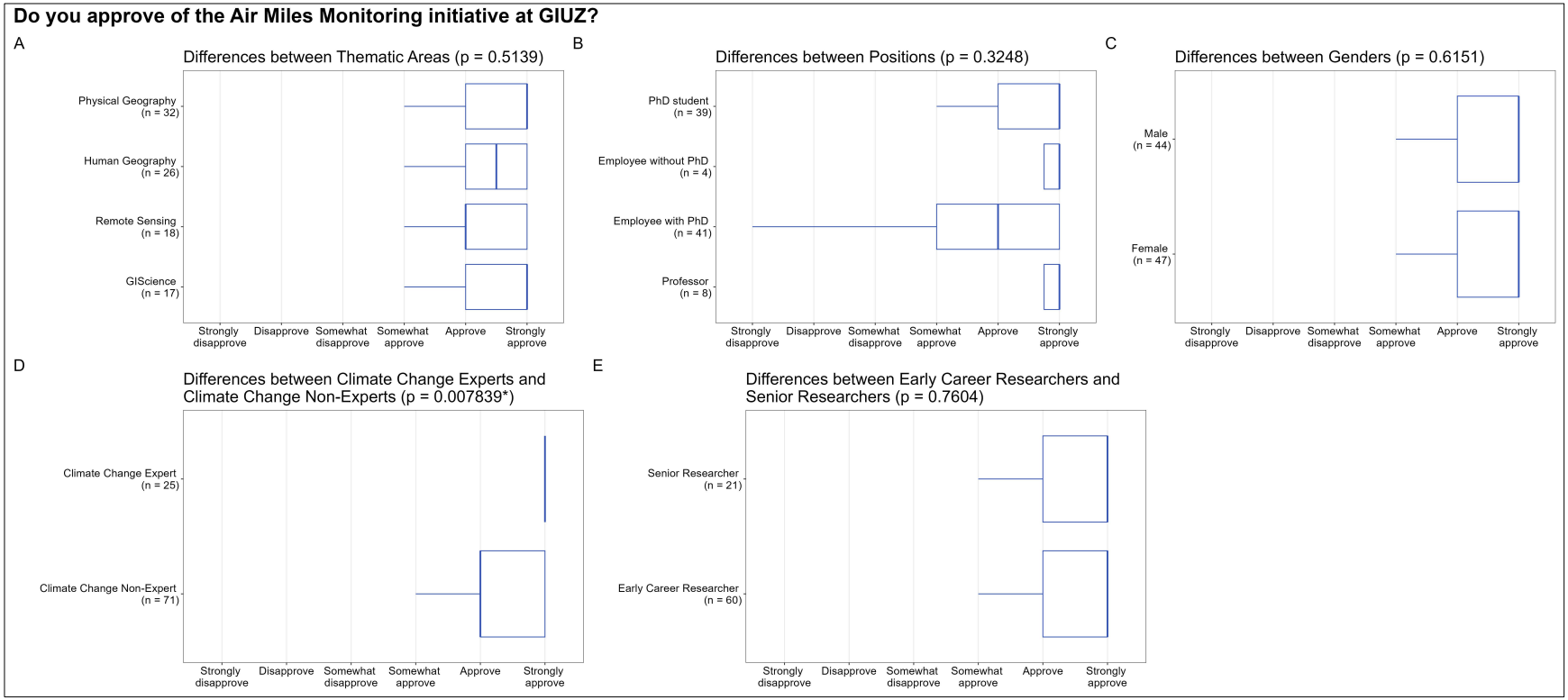

*Figure 13: Differences in approval of the AMM Initiative at GIUZ between thematic areas (A), academic positions (B), gender (C), climate change expertise (D) and seniority of employment (E). Statistically significant differences are marked with *.*

The participants had the chance to express their possible concerns about air travel reduction at GIUZ. The question stated: “Do you worry about any of the following as potential consequences if you reduce your academic air travel?” and was taken from Kreil’s survey (2020). All answer options, as well as the responses, are displayed in Figure 14.

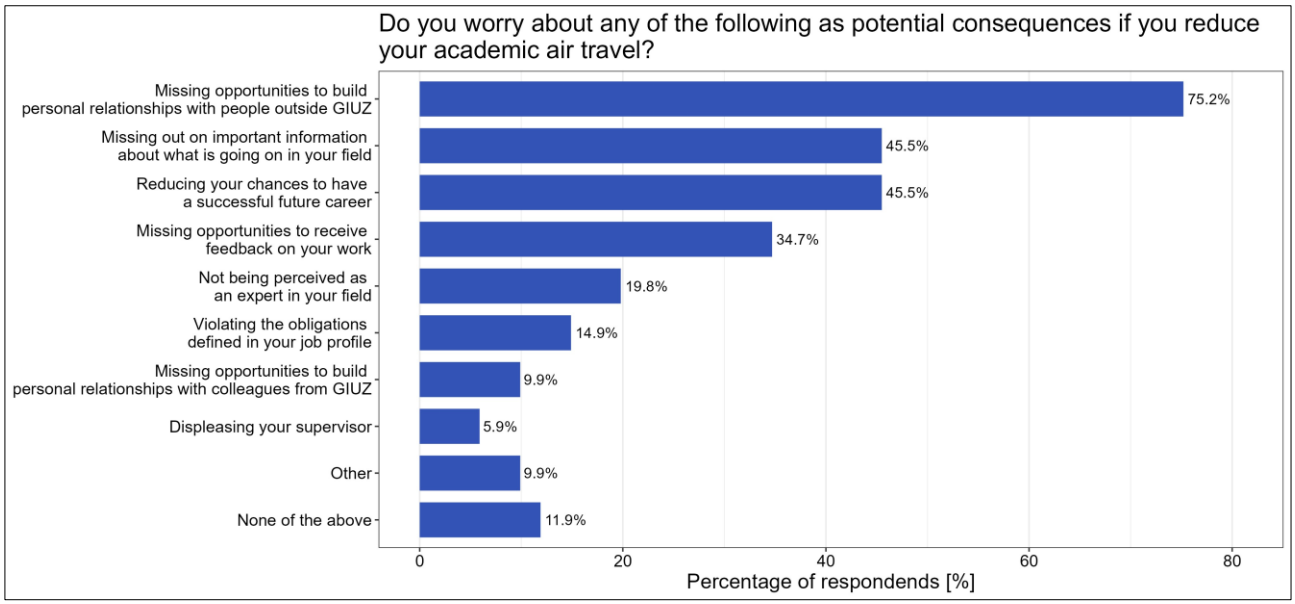

Figure 14: Concerns about air travel reduction at GIUZ. Results of the online survey.

The main concern for GIUZ academics deriving from the reduction of air travel was missing opportunities to build personal relationships with people outside GIUZ. In fact, 75.2% of the respondents (N = 101) selected this answer option. Other two answers option with a high response rate were “Missing out on important information about what is going on in your field” and “Reducing your chances to have a successful future career”. In both cases, 45.5% of the respondents selected these answers. “Missing opportunities to receive feedback on your work” was chosen by 34.7% of the respondents. All other options were selected by under 20% of the sample. 11.9% of the respondents selected “None of the above”, meaning they were not worried about reducing air travel.

In the same way as above, in Figure 15, the differences between thematic area, academic position, gender, climate change expertise, and stage of academic career are visualized. In general, the Human Geography thematic area was most concerned about a possible reduction in air travel. In fact, Human Geography showed the highest number of responses for the concerns “Missing opportunities to build personal relationships with people outside GIUZ”, “Missing out on important information about what is going on in your field” and “Reducing your chances to have a successful future career”. Fig. 15B shows that PhD students were less concerned about air travel reduction compared to other positions. Professors were the most concerned about “Missing opportunities to build personal relationships with people outside GIUZ” and “Missing out on important information

about what is going on in your field” but they were the least worried about “Reducing your chances to have a successful future career”. In general, female academics were more concerned about air travel reduction, particularly about a possible reduction of the chances of having a successful future career. Climate change experts were less concerned about missing opportunities to build personal relationships with people outside GIUZ than non-experts but were more worried about not being perceived as an expert in their field. Finally, early career scientists were more concerned about their chances of a successful future career and about not receiving feedback for their work than senior scientists.

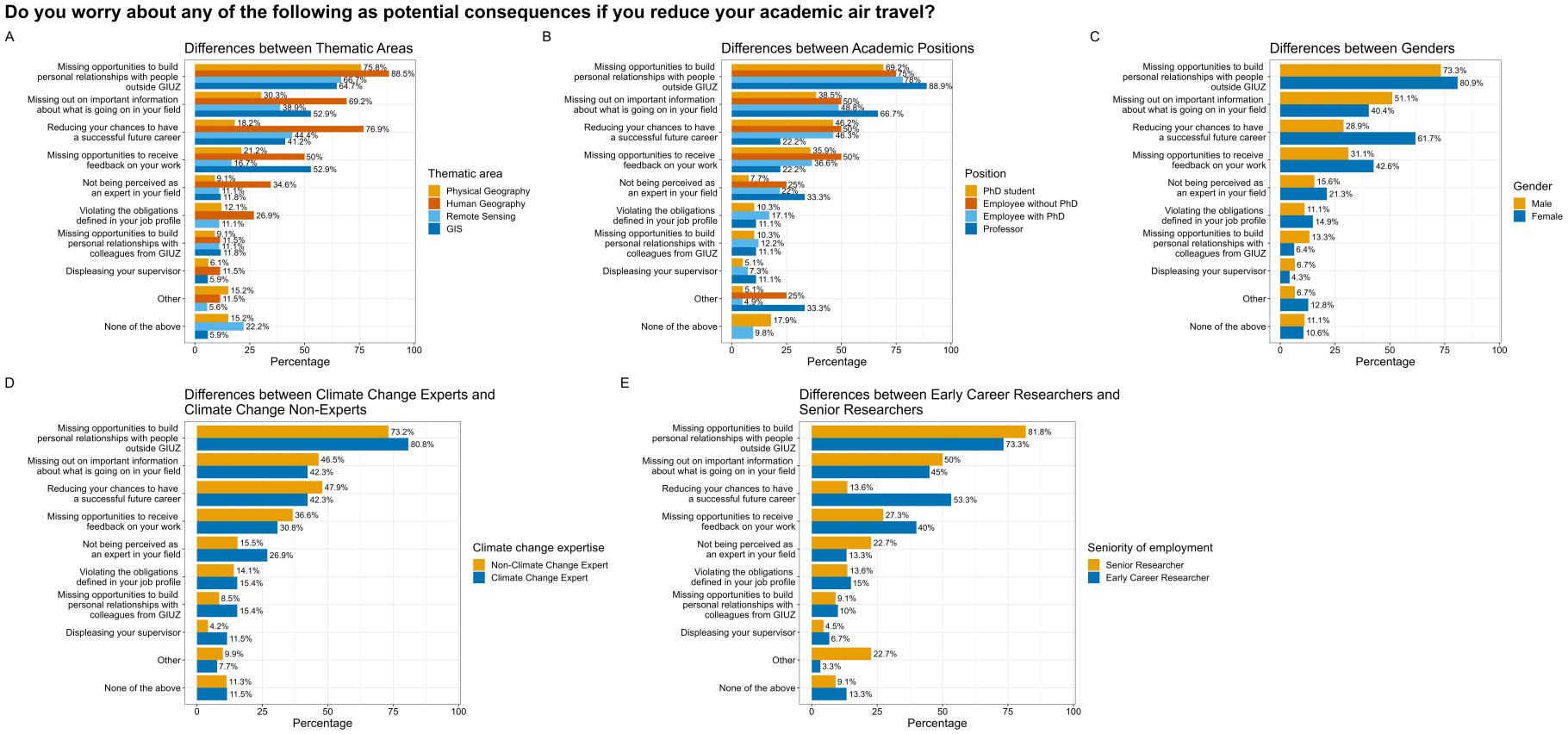

Figure 15: Differences in concerns about air travel reduction at GIUZ between thematic areas (A), academic positions (B), gender (C), climate change expertise (D) and seniority of employment (E).

3.3 Assessment of six voluntary reduction measures

I identified six voluntary measures to reduce air travel emissions in the literature and proposed them in the online survey directed to the scientific staff at GIUZ to measure the willingness to implement them. Additionally, I calculated the reduction potential of each measure for the specific case study of GIUZ based on the flight data of GIUZ scientific staff between 2017 and 2019. In this section, the results of these two processes are shown.

3.3.1 Substituting air travel with train travel

The substitution of air travel with train travel is generally only possible for European flights. Acceptance for this possible voluntary reduction measure has been asked in the online survey by differentiating between daytime and nighttime train travel. The responses are displayed in Figure 16.

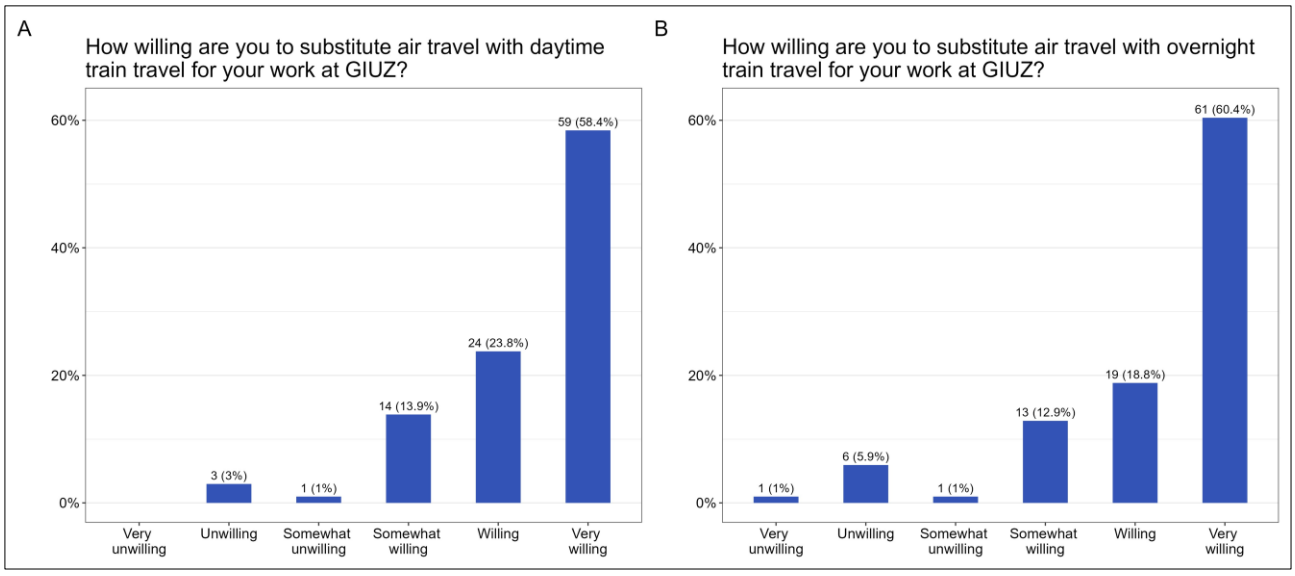

Figure 16: Willingness to travel by daytime train (A) or overnight train (B) for work trips at GIUZ. Results of the online survey.

Generally, the willingness was high in both cases, with four respondents unwilling or somewhat unwilling to substitute air travel with daytime train travel (N = 101) and eight somewhat unwilling, unwilling, or very unwilling to replace it with overnight train travel (N = 101). More than half of the respondents were very willing to substitute air travel with daytime or nighttime train travel (59 for daytime train travel, 61 for nighttime train travel).

Many factors can influence the willingness to travel by train. I identified the main recurring train travel barriers in the literature (Schreuer et al., 2023). I then included a question in the survey to verify if these have ever been perceived as obstacles to train travel from GIUZ academics. Responses are illustrated in Figure 17.

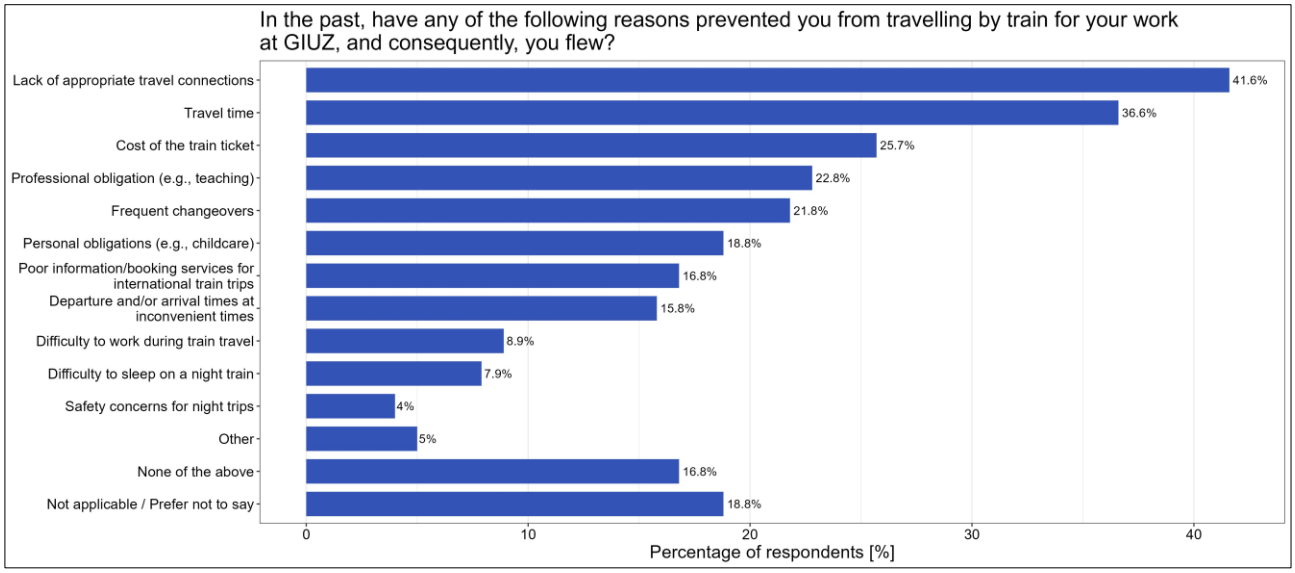

Figure 17: Train travel barriers at GIUZ. Results of the online survey.

The main travel barriers were lack of appropriate travel connections (41.6%, N = 101) and travel time (36.6%). Other important barriers that have prevented people from traveling by train at least once included ticket cost (25.7%), professional and personal obligations (22.8%, 18.8%), frequent changes (21.8%), poor information and booking services (16.8%), and departure or arrival times at inconvenient times (15.8%). The problems that were selected least often (less than 9% of respondents have selected those) were difficulty working or sleeping during train travel (8.9% and 7.9%), and safety concerns for night trains (4%). 16.8% of respondents never experienced any train travel barriers (both proposed and other).

At the end of each section regarding a reduction measure, it was possible to leave a comment. For this measure, the main comments were about family and work obligations that drive people to favor air travel because of the shorter travel time and the higher cost of train tickets compared to plane tickets. Other comments pointed out the complexity of booking European train tickets. In addition, some participants argued that GIUZ should cover the upgrade to first class.

Analyzing the actual flight data at GIUZ made it possible to compute the reduction potential of a complete substitution of air travel with train travel. All air journeys with departure or arrival airport ZRH were selected for this scenario. Only air journeys that may be substituted with train travel of a maximum of 8 hours have been considered. The choice of this threshold has been made due to data availability. In fact, train travel times have been obtained from the online tool Chronotrains[7]. This tool allows the user to select a European city and displays an isochrone map showing train travel time from the chosen city within a radius of a maximum of 8 hours. Chronotrains assumes 20 minutes

[7] Chronotrains, an online tool available at https://www.chronotrains.com/.

interchanges and connects stations less than 10km away by simulating a travel speed of 9km/h, which is faster than walking but slower than biking (Benjamintd, 2023). Figure 18 is a screenshot of the 8-hour isochrone starting from Zurich. Some major stations that can be reached in under 8 hours traveling by train from Zurich are London, Berlin, Paris, Rome, and Vienna.

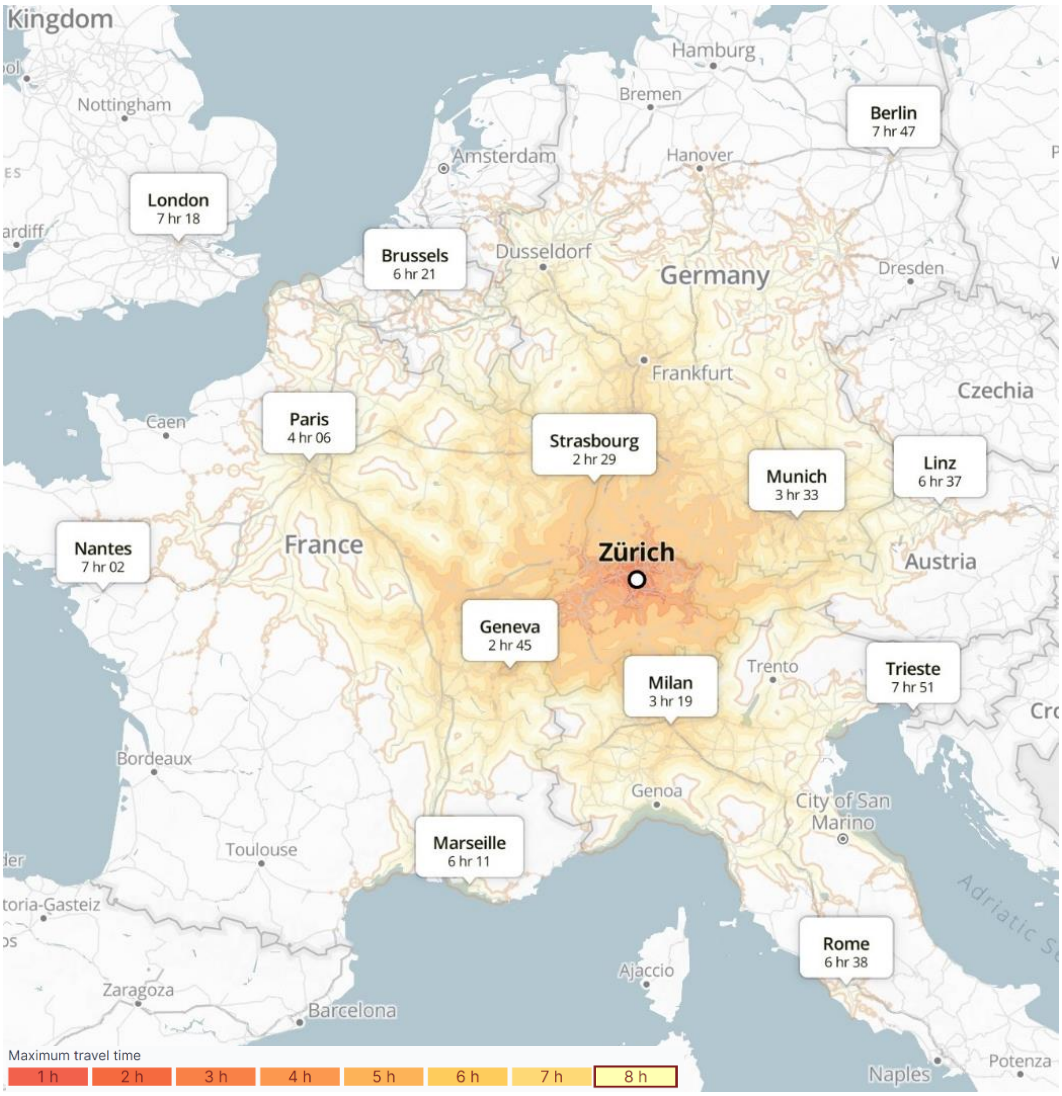

Figure 18: Cities reachable in a maximum of 8 hours by train (Benjamintd, 2023).

It was not possible to import the isochrone in R. Therefore, I had to select the reachable cities manually. Firstly, I identified all the countries included in the isochrone. Then, in R, I filtered all journeys departing from ZRH and arriving in one of the extrapolated countries or vice versa. I then manually selected the journeys to or from the airports included in the isochrone. By doing this, I obtained all air journeys that an 8-hour or less train travel could substitute. After that, I computed the mean emissions of one replaceable air journey and multiplied it by the scaled number of replaceable journeys to obtain a scenario with a variable percentage of air travel substitution. The result is shown in Figure 19.

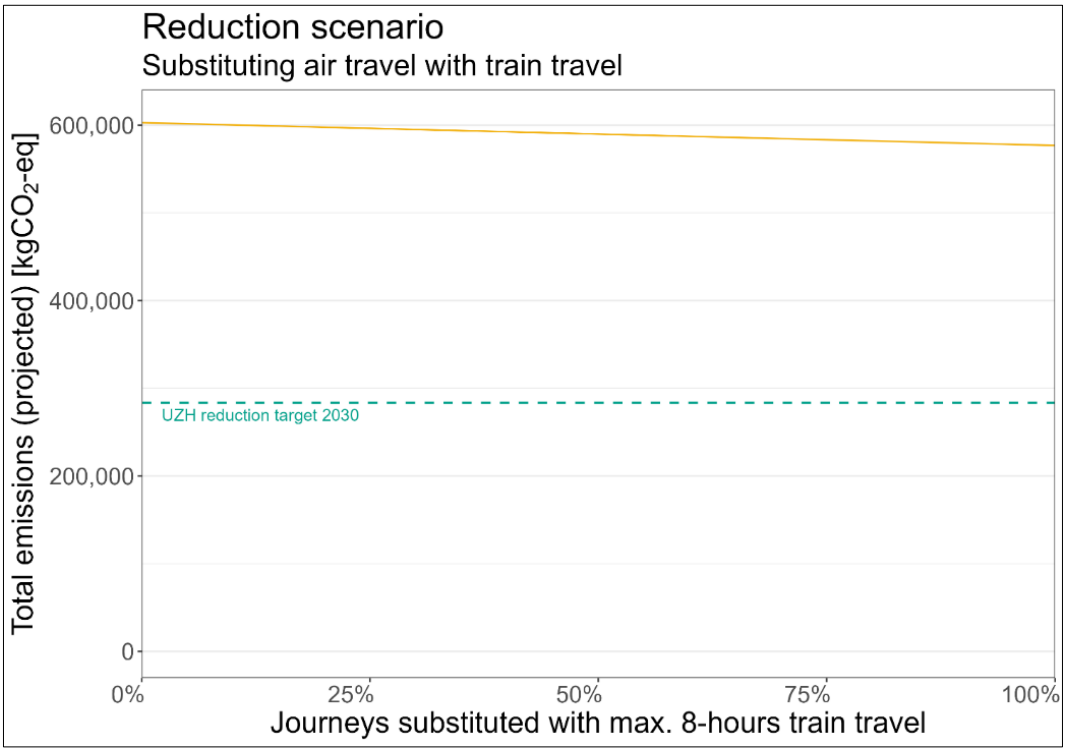

Figure 19: Reduction scenario for "substituting air travel with train travel" based on the average yearly air travel emissions at GIUZ between 2017 and 2019.

Substituting air travel with train travel lasting a maximum of 8 hours would have a limited effect on the total emissions of GIUZ. Even with a 100% substitution, the reduction in air travel GHG emissions would only be about 4.3%, which is far less than the 53% reduction target set by UZH for 2023.

3.3.2 Participating virtually in conferences and/or workshops

Virtual formats are intended to decrease emissions deriving from flights for conferences and/or workshops, which represent one of the main flight reasons at GIUZ, as shown in Section 3.1. The willingness to participate virtually in conferences and/or workshops is displayed in Figure 20.

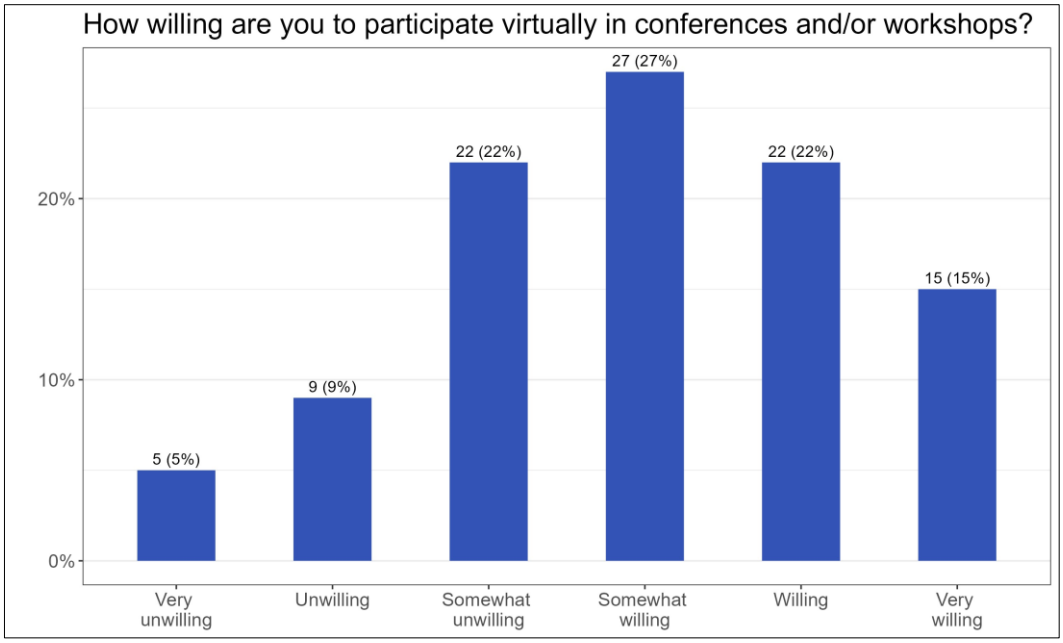

Figure 20: Willingness to participate virtually in conferences and/or workshops at GIUZ. Results of the online survey.

More than a third of respondents (36%, N = 100) were somewhat unwilling, unwilling, or very unwilling to participate virtually in conferences and/or workshops. Approximately half of the respondents (49%), however, answered “somewhat willing” or “willing”, while the remaining 15% “very willing”.

The comments about this measure were mainly focused on the perceived inefficacy of virtual networking. Many others emphasized the importance of in-person conference attendance for early career researchers to develop a strong network and establish new collaborations. Some comments pointed out some advantages of virtual conferences, such as convenience and the ability to attend only interesting sessions.

The reduction scenario of this measure considered all air journeys taken by GIUZ employees (i.e., not by guests) that have as sole travel purpose “conference and/or workshops”. The mean emissions of one of such journeys have been computed and used to produce the reduction scenario, as explained in Section 2.3. The result is presented in Figure 21.

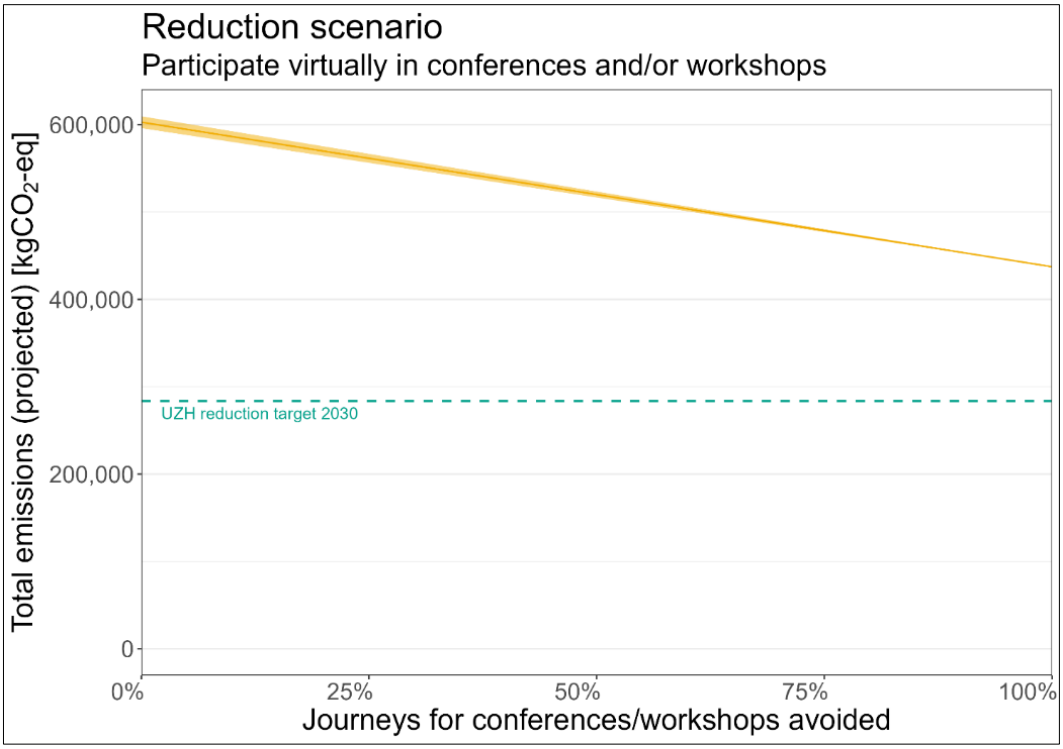

Figure 21: Reduction scenario for "participating virtually in conferences and/or workshops" based on the average yearly air travel emissions at GIUZ between 2017 and 2019.

A complete elimination of air journeys for conferences and/or workshops would cause a 27.4% reduction in air travel GHG emissions, which corresponds to a reduction of about half of that required to reach the 53% UZH reduction target.

3.3.3 Combining multiple purposes in one trip

As illustrated in Figure 22, combining multiple purposes in one air trip was highly accepted as a voluntary reduction measure. In fact, 64 respondents out of 101 were very willing to combine multiple purposes in one trip. Only four people were somewhat unwilling, unwilling, or very unwilling, while the remaining 33 were somewhat willing or willing.

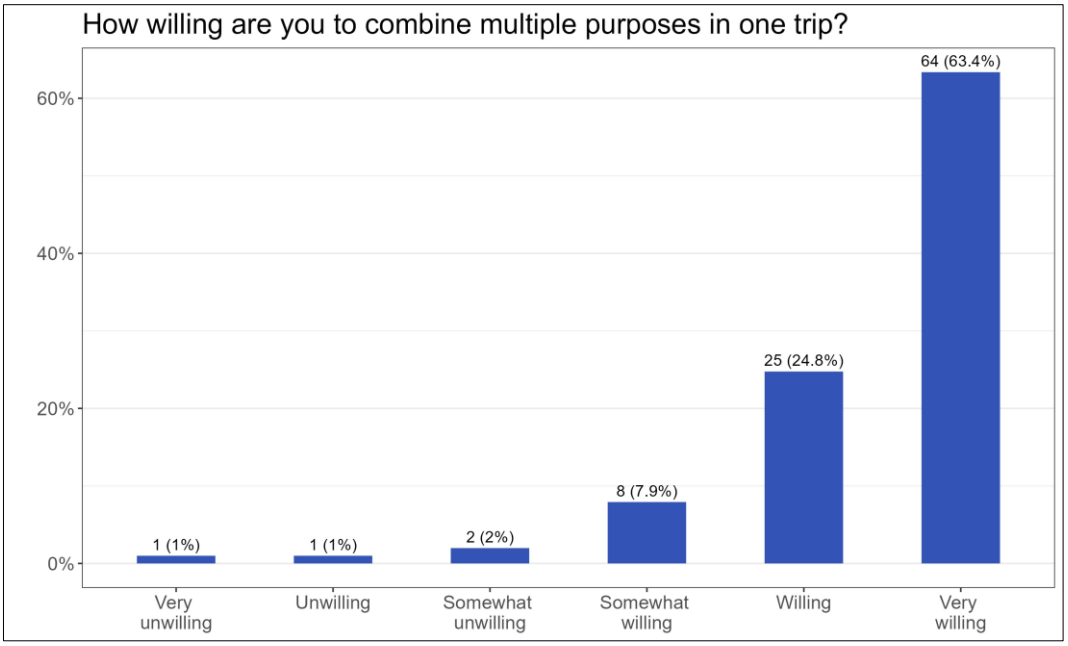

Figure 22: Willingness to combine multiple purposes in one trip at GIUZ. Results from the online survey.

Combining multiple purposes is generally a beneficial practice for academics, not only in terms of emissions reduction but also because it allows for saving money, time, travel organization, and more. However, combining multiple purposes in one trip may, in some cases, not be easy to organize and execute. Therefore, even if the willingness degree is high, it should also be compared with the perceived feasibility of this practice. In the survey, the question "How feasible do you consider the possibility of combining multiple purposes in one trip for you?" was asked. The answers are shown in Figure 23.

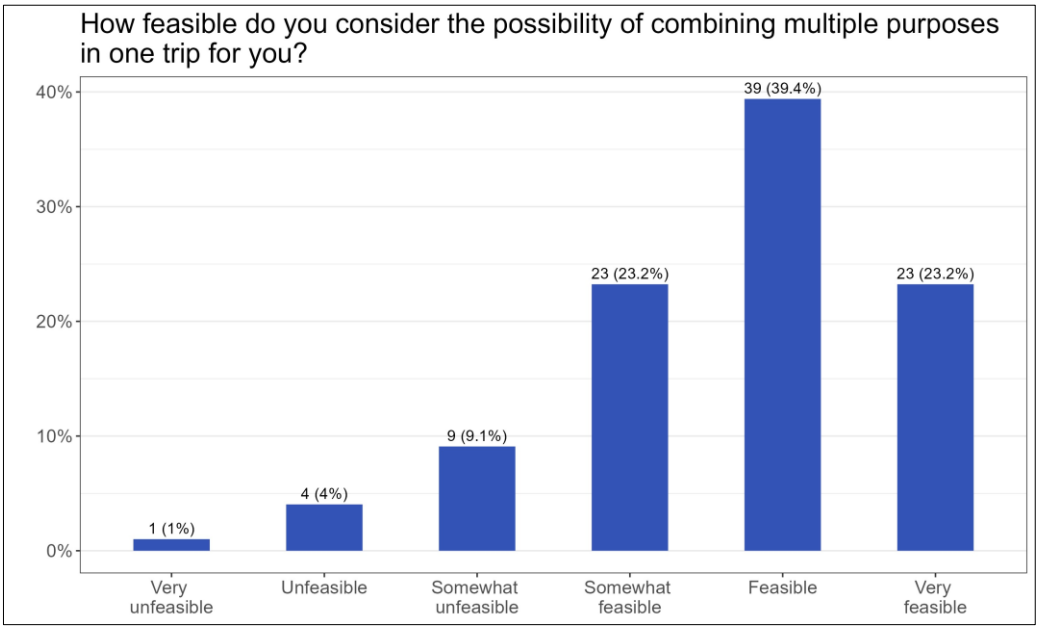

Figure 23: Feasibility of "combining multiple purposes". Results from the online survey.

This measure was generally considered feasible. In fact, 86% of the respondents (N = 99) considered it somewhat feasible, feasible, or very feasible, while the remaining 14% somewhat unfeasible, unfeasible, or very unfeasible. Only one person felt like combining multiple purposes was very unfeasible. The most selected answer option was “feasible”, with 39 respondents.
Comments were mainly focused on family and professional obligations that hinder being abroad for an extended period and the difficulty (and sometimes impossibility) of finding multiple activities in the same location during the same period. Many other comments mentioned that combining multiple purposes is possible with good organization and has already been done successfully.

For this reduction measure, producing a reduction scenario has not been possible. In fact, it was not possible to estimate from the AMM data how many air journeys could have been avoided. For this reason, in this subsection, there is no reduction scenario.

3.3.4 Collaborating with locals and conducting longer fieldwork trips

According to the demographics collected in the online survey, about half of the sample (N = 101), 51.5%, performs fieldwork outside of Switzerland. This confirms the importance of a reduction measure for fieldwork. This measure comprises two elements: a possible collaboration with local stakeholders and the conduction of longer fieldwork trips, both of which would reduce the number of trips necessary. Both components of this measure have been proposed in the survey. Responses are illustrated in Figure 24.

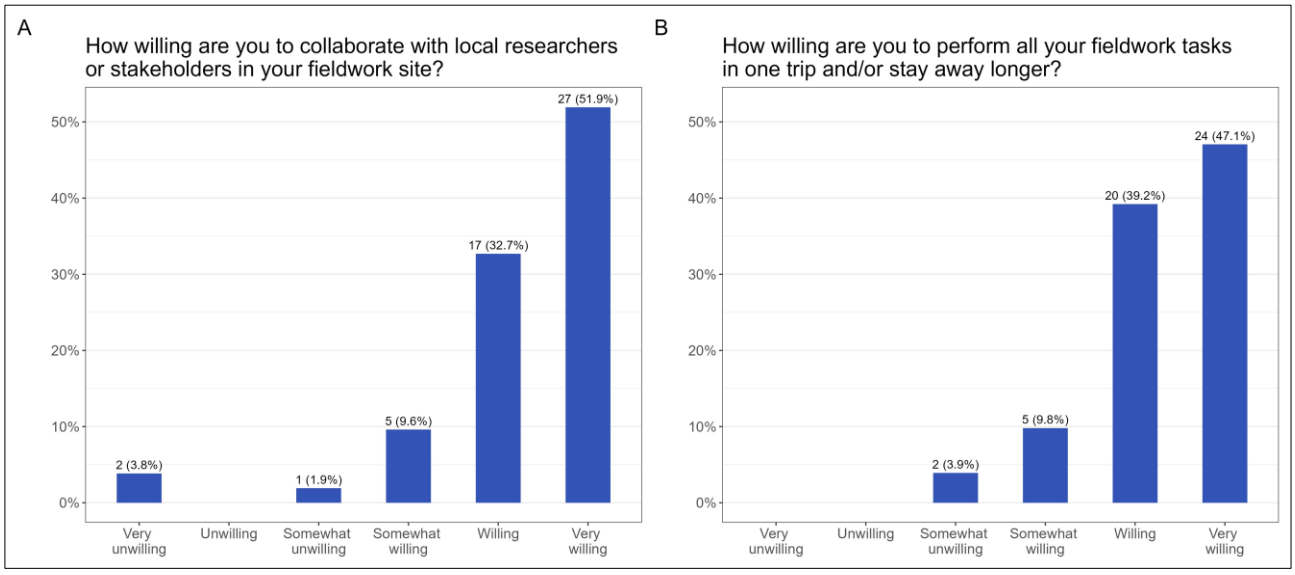

Figure 24: Willingness to collaborate with locals and conduct longer fieldwork trips at GIUZ. Results from the online survey.

Questions related to fieldwork were shown only to people who perform fieldwork outside of Switzerland through the implementation of a filter. For this reason, the sample size was greatly

reduced (Figure 24A: N = 52, Figure 24B: N = 51). Generally, the willingness degree was high in both cases. Only two respondents rated as “very unwilling” to collaborate with local stakeholders, and one respondent as “somewhat unwilling”. All other responses to that question were either “somewhat willing” (5), “willing” (17), or “very willing” (27). Almost all respondents were also somewhat willing (5), willing (20), or very willing (24) to stay away longer to the fieldwork site. Only two people selected “somewhat unwilling”.

The degree of feasibility has also been asked in this case. The answers are shown in Figure 25.

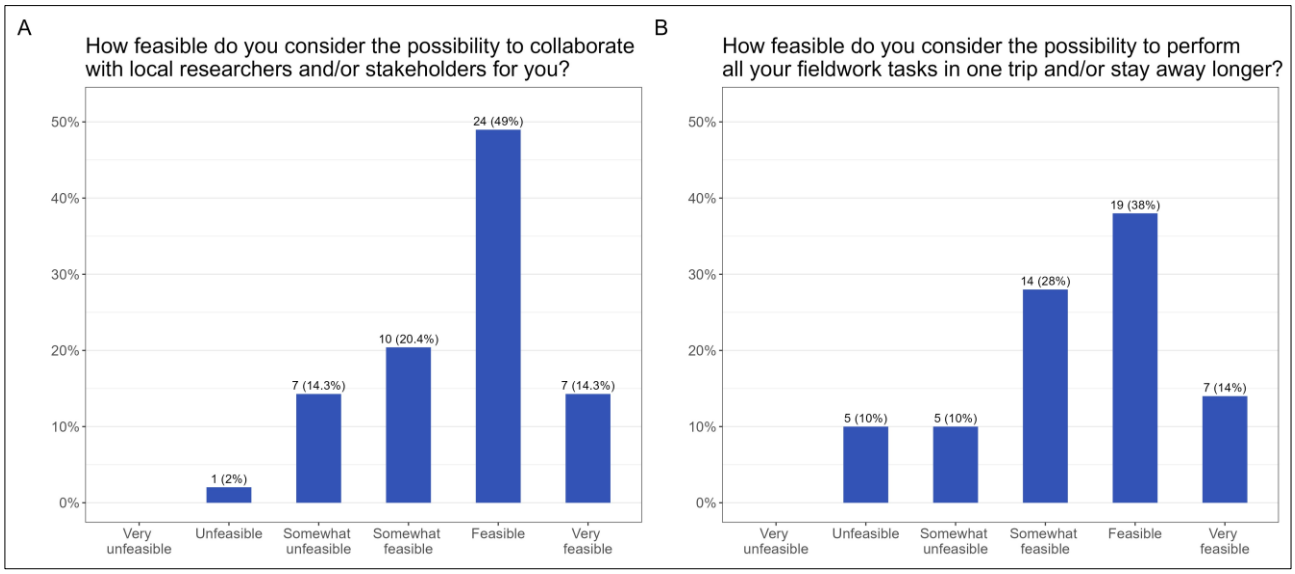

Figure 25: Feasibility of “collaborating with locals and conducting longer fieldwork trips”. Results from the online survey.

In Figure 25A, the feasibility level was high. About half of the respondents (49%, N = 49) selected “feasible”. Eight participants considered collaborations with stakeholders unfeasible (2%) or somewhat unfeasible (14.3%), while the remaining 17 considered it somewhat feasible (20.4%) or very feasible (14.3%). In Figure 25B, the feasibility level was slightly lower. However, still, 40 participants out of 50 selected “somewhat feasible” (28%), “feasible” (19%), or “very feasible” (7%), while the remaining ten selected “unfeasible” (10%) or “somewhat unfeasible” (10%). In both figures, none of the participants selected “very unfeasible”.

Comments regarding this measure contained several successful examples of both collaborations and longer fieldwork trips. However, many comments indicated that cooperation with locals cannot be carried out depending on the cultural and social context because it is complicated or ineffective. Moreover, it was mentioned that at least one trip would always be necessary. Other comments referred to family and professional obligations and the fact that data must often be collected at different points in time, making it impossible to carry out all fieldwork tasks in one sortie.

To compute the reduction scenario of this measure, I selected all air journeys taken by GIUZ employees with the sole travel purpose of fieldwork. The resulting graph is displayed in Figure 26.

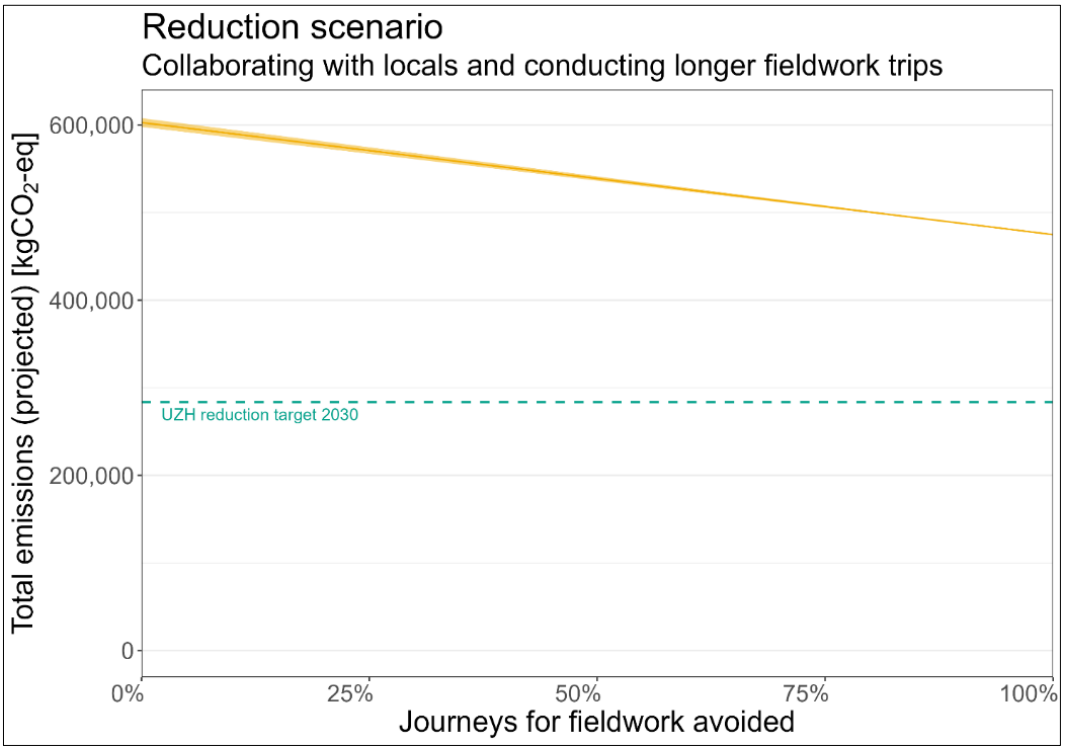

Figure 26: Reduction scenario for "collaborating with locals and conducting longer fieldwork trips" based on the average yearly air travel emissions at GIUZ between 2017 and 2019.

A complete elimination of all air journeys for fieldwork would cause a 21.2% reduction in air travel GHG emissions, which is slightly less than half of the 53% reduction called for by UZH.

3.3.5 Inviting guests virtually

As illustrated in Figure 9, GHG emissions deriving from air travel of guests invited to GIUZ accounted for the largest share of total emissions per academic position in 2017, 2019, and 2020. Inviting guests virtually could, therefore, significantly contribute to achieving the UZH reduction target. Illustrated in Figure 27 are the responses to the question "Generally, how willing are you to invite guests virtually?". Using a filter, this question has only been asked to participants who already had invited one or more guests to GIUZ. This way, the question targeted the audience directly affected by the issue, and the responses were more representative. On the other hand, this reduced the sample size to N = 25.

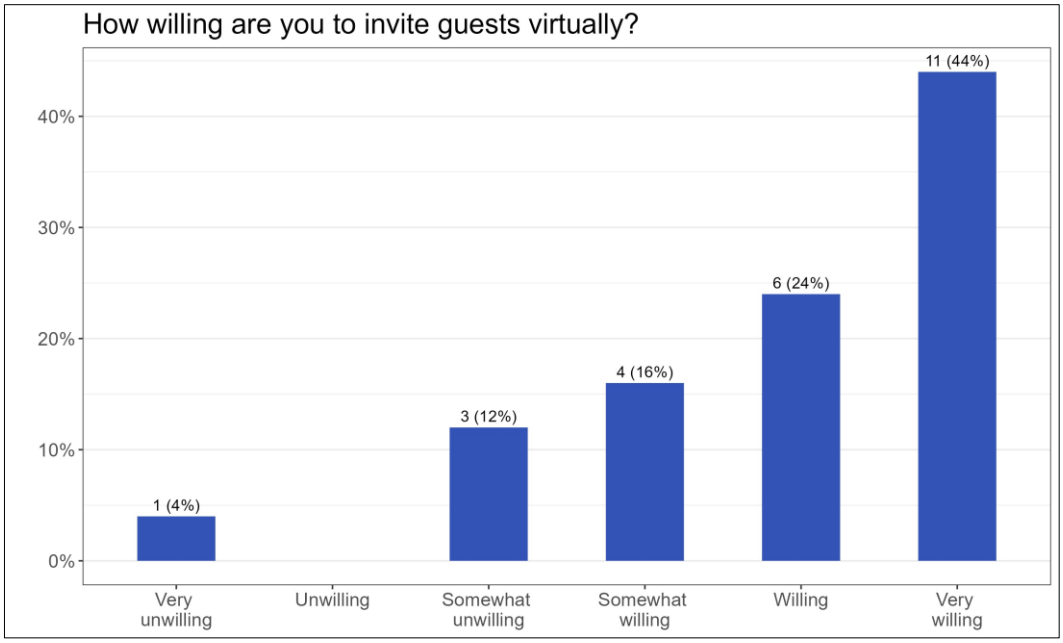

Figure 27: Willingness to invite guests virtually at GIUZ. Results from the online survey.

The willingness to invite guests virtually was high, with only one respondent who selected “very unwilling” and three more who selected “somewhat unwilling”. Slightly less than half of the sample size (11 respondents) were very willing to invite guests virtually, while the remaining were somewhat willing (4) or willing (6). Nobody selected the option “unwilling”.

Similar to virtual conference attendance, the ineffectiveness of virtual networking was also mentioned in the comments regarding this measure. It was also pointed out that the virtual format is particularly suitable for short, recurring meetings.

To compute the reduction scenario of this measure, all air journeys taken by guests invited to GIUZ have been selected. The resulting plot is shown in Figure 28.

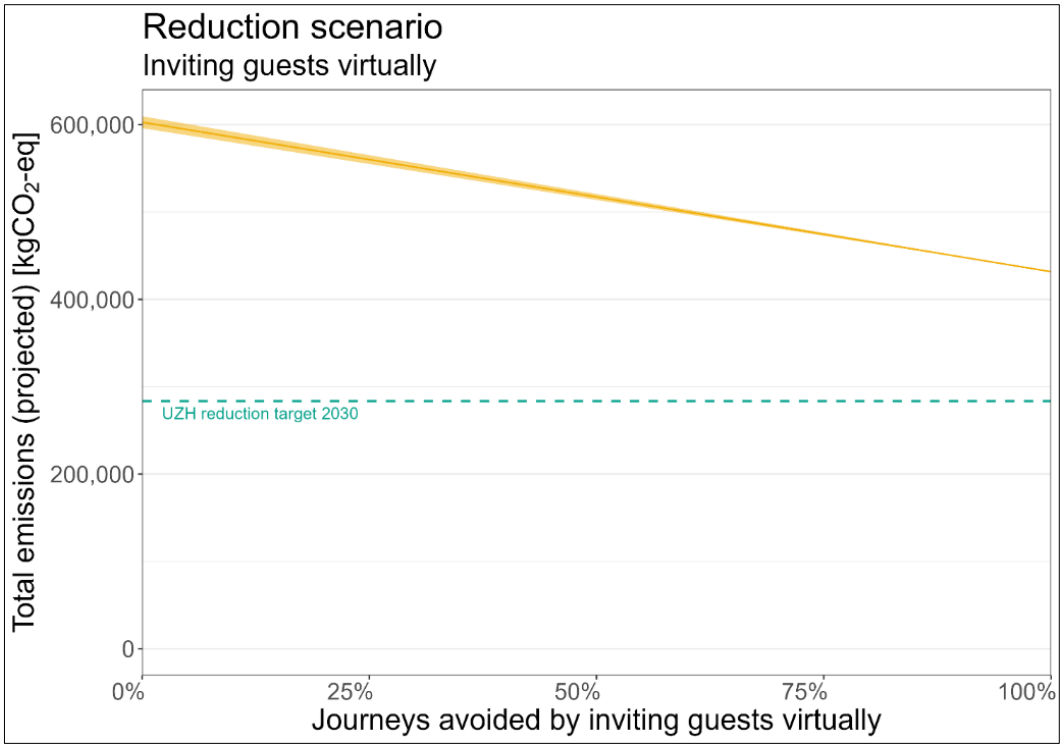

Figure 28: Reduction scenario for "inviting guests virtually" based on the average yearly air travel emissions at GIUZ between 2017 and 2019.

The maximum reduction potential of inviting guests virtually would correspond to a reduction of 28.4%, slightly more than half the 53% UZH reduction target.

3.3.6 Substituting stopover flights with non-stop flights

Figure 29 illustrates the willingness to substitute stopover air journeys with non-stop journeys. For this question, a filter was used that showed the question only to participants who stated that they had flown at least once for their work at GIUZ. For this reason, the sample size was reduced to N = 70.

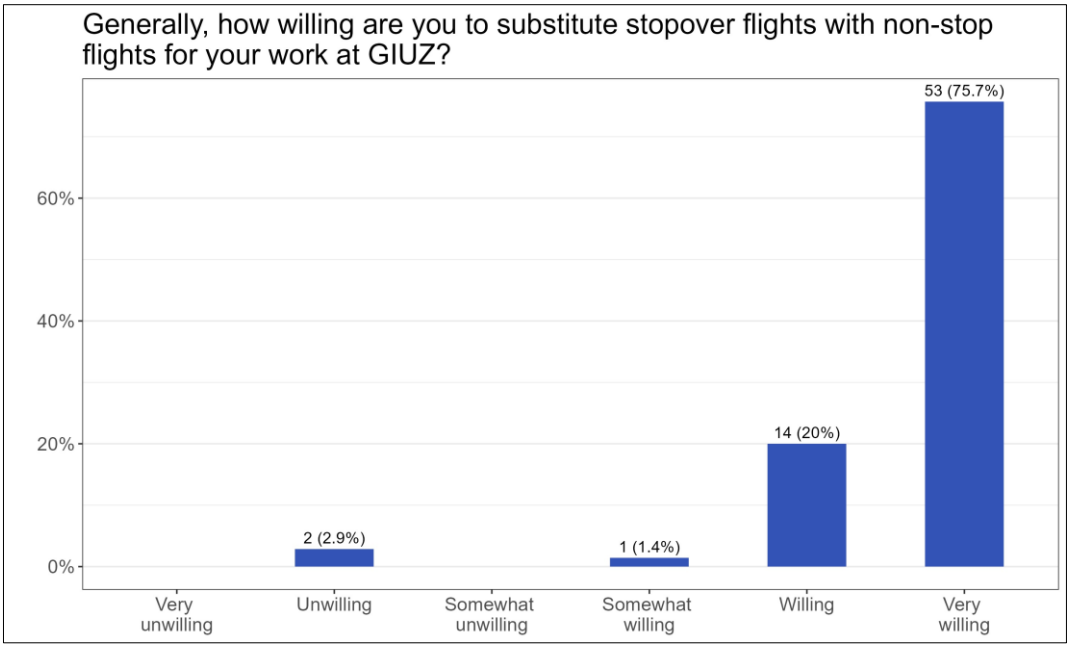

Figure 29: Willingness to substitute stopover flights with non-stop flights at GIUZ. Results from the online survey.

Most respondents (75.7%) were very willing to substitute stopover flights with non-stop flights. 14 more participants were willing to do so, one was somewhat willing, and two more were unwilling. Nobody selected the options “very unwilling” or “somewhat unwilling”.

The comments pointed out that the choice of a stopover or non-stop journey is often determined by the price of airfare, and the cost is not covered by the individual academic, so the choice is not solely up to them.

The reduction scenario for this measure has been produced by Ella Alleman and Cyril Geistlich in the context of a semester project (Alleman & Geistlich, 2023. It shows the potential emission reduction by substituting stopover air journeys departing from Zurich Airport with commercially available direct journeys also departing from Zurich Airport (Figure 30).

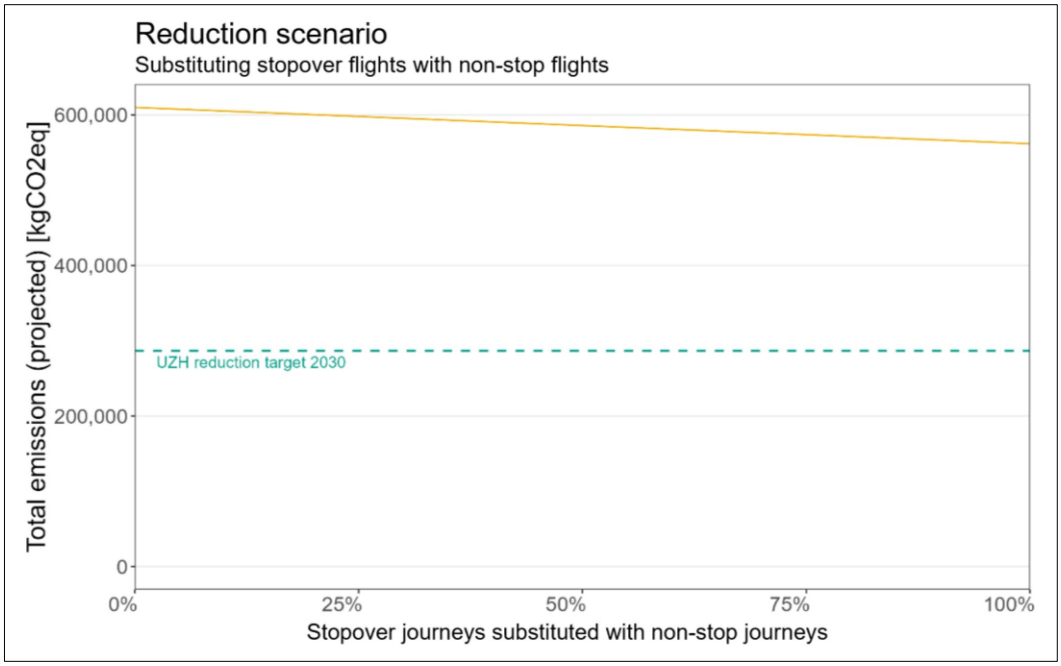

Figure 30: Reduction scenario for "substituting stopover flights with non-stop flights" based on the average yearly air travel emissions at GIUZ between 2017 and 2019. Adapted from (Alleman & Geistlich, 2023).

Substituting all air journeys departing from ZRH with commercially available journeys would cause a 7.9% reduction in GHG emissions from air travel at GIUZ.

3.3.7 Comparison of the six emission reduction measures

In Figure 31, the maximum reduction potentials are plotted against the mean willingness levels obtained in the survey to compare the measures considering both reduction effect and acceptance.

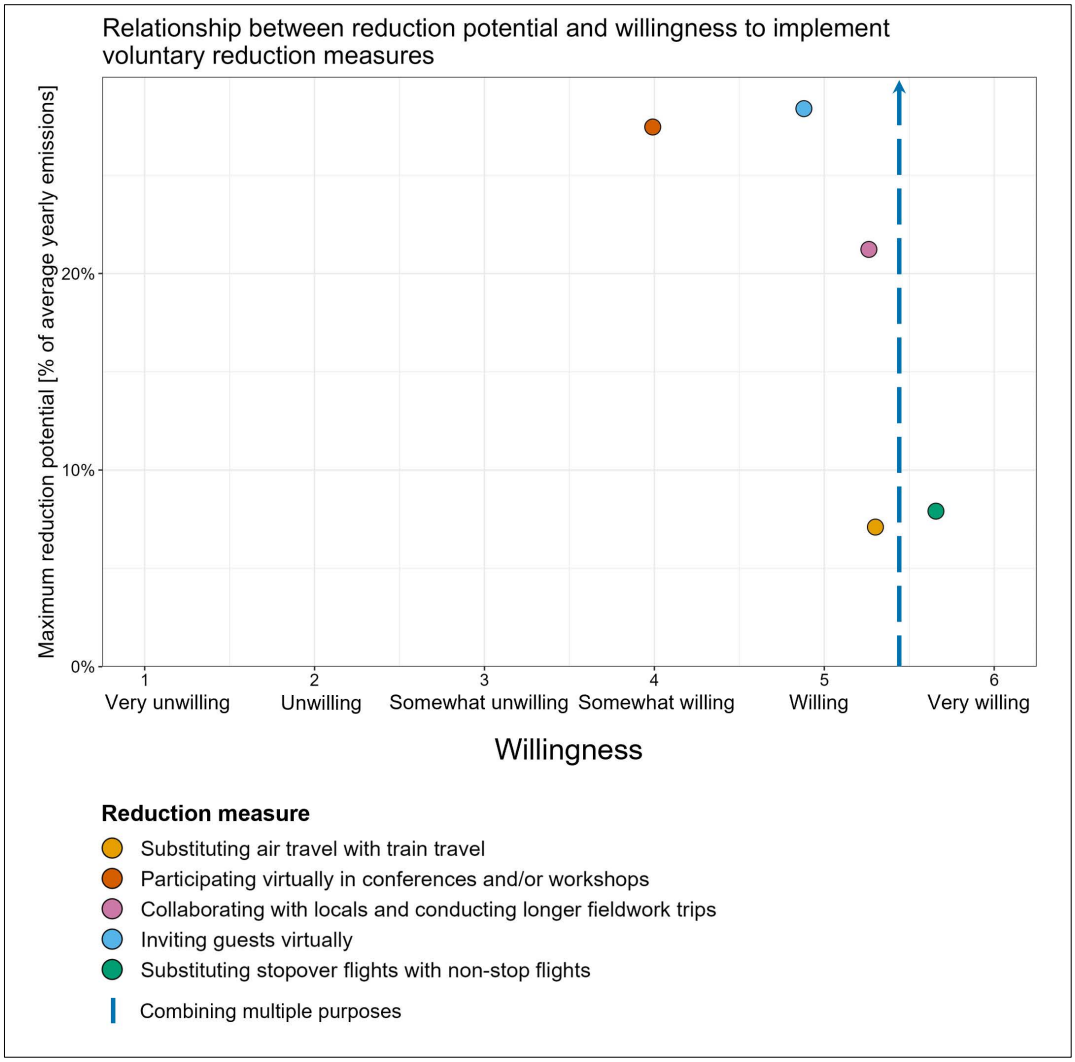

Figure 31: Relationship between maximum reduction potential and mean willingness to implement voluntary reduction measures. The dashed blue line indicates the willingness to implement the measure "combining multiple purposes". The arrow at the top of the line indicates that the reduction potential could be higher than 30% (it could not be calculated).

All measures obtained a willingness rating greater than or equal to 3.99, which corresponds to "somewhat willing". Thus, all measures obtained a positive acceptance rating. The reduction potential ranged from 4.3% to 28.4%. Note that for the measure "combining multiple purposes" it was not possible to produce a reduction scenario. Therefore, this measure was represented with a line. "Participating virtually in conferences and/or workshops" and "inviting guests virtually" were the measures with the highest reduction potential, but at the same time they were also the measures with the lowest willingness. Specifically, "participating virtually in conferences and/or workshops" received the lowest willingness with a value of 3.99, but had a maximum reduction potential of 27.8%, while “inviting guests virtually" obtained a willingness value of 4.88 and a maximum reduction potential of 28.4%. The measures "collaborating with locals and conducting longer fieldwork trips" and "substituting air travel with train travel" had very similar levels of willingness (5.26 and 5.30). However, there was an important difference in their maximum reduction potential. The former had a

reduction potential of 21.2%, while the latter only 4.3%. The measure with the highest level of willingness was "substituting stopover flights with non-stop flights" (5.65), but its reduction potential was only 7.9%. Combining multiple purposes was the measure with the second highest level of willingness (5.45). Unfortunately, even in the literature, there was no information that would allow an estimate of the emission impact.

The maximum reduction potential and the mean willingness have been tested for possible correlation using Pearson's R test. A relatively strong negative correlation was found with a correlation coefficient of -0.76.

4 Discussion

In the previous sections, I outlined the results obtained from the descriptive analysis of AMM data, the online survey, and the comparison of reduction potential and willingness to implement six voluntary reduction measures. In this section, I will discuss and compare the findings with previous research.

4.1 Air travel behavior at GIUZ and related GHG emissions

The results showed that GIUZ academics fly worldwide to conduct research. This is an indication of GIUZ's high level of internationality. Most of the journeys are directed to North America and Western Europe. Arsenault et al. (2019) also found that most academics fly to North America and Europe. Their study is based on data obtained from the Université de Montréal, Canada, thus, it is not optimally comparable with this thesis as the geographical location and context of the two universities are different. However, the results of Arsenault et al. (2019) showed that the nation with the most flights in Europe is France, while my results showed that France has less than ten journeys over the study period, few compared to other European countries. Assuming that France is similarly attractive for both institutions and knowing that a train journey between Zurich and Paris is about four hours (Benjamintd, 2023), this might be an indication that most GIUZ academics travel by train to Paris.

The findings showed that although the percentages of short-haul and long-haul journeys are similar, the difference in total emissions is extremely large (11% of emissions are produced by short-haul journeys and 85% by long-haul journeys). This result gives a strong sense of the enormous impact of a long-haul journey compared to a short-haul journey in terms of absolute emissions. This suggests that even a slight decrease in long-haul air travel could greatly affect total emissions.

Before the COVID-19 pandemic, the total air travel volume at GIUZ increased, reaching 2'425 $kgCO_2$-eq per capita in 2019. In 2022, total emissions increased to 68% of the pre-pandemic levels (mean 2017-2019), corresponding to an 8% overshoot of the UZH reduction target for 2022. GHG emissions are analyzed at the annual scale, as this is the highest level of detail that can be obtained from the AMM data. The years 2020 and 2021 are distorted due to the COVID-19 outbreak and must be interpreted accordingly. The first COVID-19 case in Switzerland was confirmed on February 25, 2020 (SWI, 2020). The first travel restrictions were implemented in March 2020. Therefore, it was still possible to travel freely during the first two months of that year. International travel was strongly restricted during the years 2020 and 2021. In 2022, travel restrictions have been lifted almost all around the world. This pattern can be recognized in Figure 4. In 2020 and 2021, the air travel emissions were nearly eliminated.

Between 2017 and 2019, emissions from air travel increased. This occurred despite the establishment of the AMM initiative and the related air travel emission reduction target in 2017. The establishment of the AMM initiative, therefore, did not have an immediate effect in 2018. Figure 4B shows that between 2018 and 2019, per capita emissions had a less pronounced increase than

between 2017 and 2018. Due to the outbreak of COVID-19, which nearly zeroed out GHG emissions from air travel, it is impossible to know whether this was the beginning of a trend caused by the implementation of the AMM initiative or purely an annual variation. In 2022, after the removal of most travel restrictions, the emission increased again, overshooting by 8% the UZH reduction target for 2022.

Between 2017 and 2019, the main reasons for air travel at GIUZ were conferences, fieldwork, and project meetings. In 2022, conferences were responsible for about half of air travel emissions, representing the largest share of emissions among all air travel purposes. These findings are consistent with the literature. Wynes et al. (2019), in a study at the University of British Columbia, Canada, found that conferences were the main reason for academic air travel (60%), followed by fieldwork (16%). The percentage of fieldwork-related air travel at a university varies depending on the disciplines pursued (Whitmarsh et al., 2020). At GIUZ, fieldwork is an integral part of several research groups, and since it is a small institution compared to the University of British Columbia, this could explain the higher proportion of emissions related to fieldwork.

Each of the four GIUZ thematic areas has different air mobility needs. The results showed that Physical Geography and Human Geography have higher air travel volumes than Remote Sensing and GIScience. This is related to the characteristics of the research being carried out by a specific research group. For example, the Physical Geography thematic area performs measurements in Greenland or the Himalayas, while Human Geography performs fieldwork in Asia or Africa. On the other hand, Remote Sensing and GIScience do not have a strong fieldwork component in their research and consequently fly less.

Finally, the results showed that across GIUZ academic positions, professors and GIUZ guests are the most frequent flyers. The carbon footprint of a GIUZ employee in the pre-pandemic period (2017-2019) was about 2'278 kgCO_2-eq, roughly equivalent to a flight from Zurich to Sri Lanka or a roundtrip between Zurich and Georgia. However, this measure is not highly representative of all GIUZ employees, as air travel emissions are distributed differently across academic positions. The results showed that professors and guests fly considerably more than employees with PhD and PhD students. Several other studies also reported that air travel increases with seniority (Ciers et al., 2019; Poggioli & Hoffman, 2022; Schrems & Upham, 2020; Whitmarsh et al., 2020).

4.2 Academics' opinion on air travel reduction at GIUZ

The results showed that most GIUZ academics consider air travel relevant to their careers. This is consistent with other studies. Wenger (2021, 2022) conducted two surveys at ETHZ asking professors (in 2021) and scientific staff without professors (in 2022) how important they considered air travel to be for their careers. She found that 86% of the professors and 56% of the scientific staff without professors considered air travel relevant to their careers. Also in my results, professors

considered air travel more important than other staff members. Figure 11B illustrates this, with professors' answers clustering around the "relevant" option, while those of the rest of the scientific staff tended to lean towards "irrelevant" responses. The different sample sizes should be pointed out, which could also affect this interpretation. In fact, there are far fewer professors (n = 9) than PhD employees (n = 41) and PhD students (n = 39).

Another study that found similar results was conducted by Nursey-Bray et al. (2019) at the University of Adelaide, Australia. It was found that 94.5% of the participants considered air travel important for their work. The higher response rate in this case study should be contextualized geographically, as travel options are very different between continental Europe and Australia. In continental Europe, it is possible to travel internationally in relatively few hours by train, also thanks to night train connections. This is not possible in Australia, where to travel internationally, it is necessary to fly.

The result showed that the GIUZ scientific staff strongly supports the AMM Initiative. This finding aligns with the results from Wenger's surveys at ETHZ, where 75% of all professors and 79% of the scientific staff without professors approved the air travel reduction program (Wenger, 2021a, 2022). At GIUZ, approval seems to be slightly higher, with only 3% of participants indicating their disapproval of the project. The difference between professors and the rest of the scientific staff is minimal in Wenger's results. Similarly, the results obtained in this paper are not statistically significant. However, professors' responses are highly clustered around the "strongly approve" option, showing the strongest approval across GIUZ academic positions. Again, it is necessary to emphasize the difference in sample size, which may influence the difference in the dispersion of responses.

The main concerns about decreasing air travel are missing chances to create personal relationships with people outside GIUZ, missing out on important information about what is going on in their field, and reducing their chances of a successful future career. These results are very similar to those obtained in the work by Kreil (2020), from which this question was taken. In both cases, the two main concerns were missing opportunities to build relationships with people outside the home institution and reducing the chances of having a successful career.

Responses to these questions showed no statistically significant differences, with the exception of climate change experts, who approve significantly more of the AMM Initiative than non-climate change experts. Concerns about the reduction of air travel were not analyzed statistically. Further research should address these differences in more detail to adapt the reduction strategy to individual GIUZ thematic areas equitably.

4.3 Assessment of six voluntary reduction measures

Comparing participants' willingness to implement six voluntary air travel reduction measures with their reduction potential revealed a negative relationship between reduction potential and willingness to implement. Results showed that the two measures with the highest reduction potential are also

those with the lowest willingness (though always positive), while the two measures with the lowest reduction potential showed high willingness.
The measures with the highest reduction potential involve a restriction on travel, while those with the lowest potential do not restrict mobility but propose travel alternatives. This highlights a trade-off between willingness to implement and mobility restrictions. Similar findings were observed by Schreuer et al. (2023) at the University of Graz, Austria, where it was found that academics favored more measures that included alternatives to flying rather than flying restrictions.
Two main clusters can be visually identified when plotting the measures' reduction potential against their willingness (Figure 31). The measures "participating virtually in conferences and/or workshops" and "inviting guests virtually" can be summarized in the first cluster themed "virtual communication". The measures "substituting air travel with train travel" and "substituting stopover flights with non-stop flights" make up the second cluster, defined as "choice of means of transport".

The **first cluster**, "**virtual communication**", is characterized by high air travel reduction potentials and low willingness values. Literature suggests that virtual communication can shrink temporal and geographic distances and thus replace short- and long-haul air travel (Poggioli & Hoffman, 2022). In this case study, virtual communication is applied to the case of conferences and/or workshops and the invitation of guests. As shown in Figure 7, conferences and workshops are one of the reasons why GIUZ academics fly the most. Similarly, emissions related to guests' journeys account for the largest share of air travel emissions at GIUZ divided by academic position (Figure 9). This explains the high levels of reduction potential for virtual communication.
In contrast to the high reduction potential, this cluster features relatively low values of willingness. There are several possible reasons to explain the relatively low willingness levels. Conference attendance is one of the central aspects of an academic career (Chalvatzis & Ormosi, 2021). It is considered crucial for networking, increasing visibility, and thus a successful career (Hopkins et al., 2019; Storme et al., 2013). There is evidence showing that presenting research at scientific conferences has positive effects on academic careers (de Leon & McQuillin, 2020). Besides this, traveling to conferences is a desirable option for mixing business and leisure, which is often referred to as "conference tourism" (Høyer, 2009).
These aspects are at risk of being jeopardized if in-person conference participation is substituted with virtual attendance. The leisure part of the travel is lost due to the loss of the physical conference location. Furthermore, the literature reports that networking during virtual conferences is perceived as strongly ineffective (Foramitti et al., 2021; Wenger, 2022).
This is confirmed by the comments left in the survey. The most recurring issue among these comments was indeed the ineffectiveness of networking in the virtual format. It was reported that the opportunity to meet new people is missed as this mainly happens outside the official part of the conference, for example, during coffee breaks or in the hallways. However, studies have shown that

virtual networking is not impossible and can be encouraged, for example, by implementing networking sessions designated explicitly for this purpose (Wenger, 2023).
Another recurring item in the open comments was the importance of in-person attendance at conferences for early career researchers to take advantage of the great potential for networking and building collaborations. This argument was also identified by Storme et al. (2013).
Other comments showed that virtual communication is more suitable for project meetings than for conferences. This is consistent with other studies (Schreuer et al., 2023; Wenger, 2021a, 2022), where virtual communication was found more effective for shorter meetings with people already known than for conferences. This might explain why the level of willingness of the "inviting guests virtually" measure is higher than that of "participating virtually in conferences and/or workshops" since some guests are invited to the GIUZ only for short project meetings.
Although the lowest among the measures considered, the willingness levels of this cluster are still positive as they correspond to “somewhat willing”. This is also confirmed by the many favorable comments and various positive experiences shared through the open comments collected in the survey. The literature illustrates several advantages of virtual conferences over in-person conferences. They are significantly lower in cost, which leads to larger audiences (Skiles et al., 2022). They are more inclusive as they allow for a greater diversity of gender, geographical origin, and career title (Poggioli & Hoffman, 2022; Skiles et al., 2022). They also enable greater accessibility for academics with disabilities or family obligations (Reshef et al., 2020; Skiles et al., 2022). Furthermore, virtual conferences allow only attending selected sessions without investing time and expense in a trip (Wenger, 2023). This last point was also mentioned in the comments in the survey.

The **second cluster**, “**choice of means of transport**”, does not influence the unfolding of the trip's activities but rather the format of the itinerary. The measures of this cluster have the lowest reduction potential but some of the highest willingness.
The measure of replacing European air travel with train travel only affects short-haul journeys, which are responsible for a restricted share of the total air travel emissions, as medium and long-haul flights emit significantly more GHG emissions (Table 3 and Figure 4). Therefore, the reduction potential is lower than that of the measures that focus on intercontinental journeys. The measure of replacing stopover journeys with non-stop journeys targets long-haul flights to increase their efficiency. Thus, the reduction potential is limited.
Ciers et al. (2019), in their case study at EPFL, found that with these two reduction measures, a 24% reduction in GHG emissions from air travel could be achieved (15% by substituting air travel with rail travel and 9% by substituting stopover flights with non-stop ones). Their results are slightly higher than those obtained here due to substantial differences in the two methodologies. Ciers and colleagues considered rail substitution for flights under 800km, including flight legs that are part of a stopover journey. In addition, they assumed that all stopover journeys were commercially available

as non-stop ones, which is often not the case. However, in both cases, it has been shown that a substantial emissions reduction can be achieved without reductions in travel.

Consistent with the findings of Schreuer et al. (2023), the relatively high willingness to implement the measures of this cluster could be related to the fact that they do not affect mobility. By not giving up travel, the opportunities for face-to-face relationships and in-person networking are not jeopardized. In addition, as illustrated in Figure 18, UZH's central location, along with Europe's relatively dense rail transportation network and multiple long-distance night train options, makes it possible to reach several European cities relatively quickly and with low environmental impact. I assume these elements are relevant in explaining the high willingness for the measure "substituting air travel with train travel".

Despite this cluster's high level of willingness, Figure 5 and Figure 6 showed that GIUZ academics take a significant number of European flights. This suggests that there are obstacles that make GIUZ academics prefer air travel over train travel. Schreuer et al. (2023) identified several train travel barriers based on which I designed a question asked in the survey ("In the past, have any of the following reasons prevented you from traveling by train for your work at GIUZ, and consequently, you flew?", Figure 17). The results showed that the main obstacles are lack of travel connections, travel time, ticket cost, and frequent changes, which are usually higher than in the case of air travel. Work and family obligations also represent a barrier. Open comments on substituting air travel with train travel focused mainly on family obligations. The comments also mentioned the ticket price as a barrier to choosing a non-stop flight.

Travel time and cost are often considered important train travel barriers in academic air travel (Whitmarsh et al., 2020). Academics with work or family obligations cannot stay too long abroad (Storme et al., 2013). Whitmarsh et al. (2020) found that academics with children fly more than those without children and hypothesized it is to decrease time away from home, as traveling by air is usually faster than by train. This is consistent with the comments collected in the survey. The ticket price (both for train travel and non-stop flights) falls within the budget of the research group/project, which is limited. Therefore, the decision of the means of transportation is not solely up to the individual academic.

The remaining two measures, "collaborating with locals and conducting longer fieldwork trips" and "combining multiple purposes", could be grouped under the more general topic of "efficient organization of activities abroad". Both show similar willingness levels, but since I could not calculate a reduction potential for the measure "combining multiple purposes", I will discuss them separately below.

The measure "collaborating with locals and conducting longer fieldwork trips" has not yet received much coverage in the literature. However, fieldwork is at the core of many academic disciplines and requires significant travel (Whitmarsh et al., 2020). As shown in Figure 7 and supported by the

literature (Whitmarsh et al., 2020; Wynes et al., 2019), together with conferences, fieldwork is one of the main reasons why academics fly. While conference attendance is widespread across all GIUZ thematic areas, fieldwork practices are less prominent in GIScience and Remote Sensing compared to Physical and Human Geography. This explains the lower reduction potential of this measure compared with conference substitution.

The results showed high willingness and feasibility levels of this measure (Figure 24 and Figure 25). In the comments on this measure, many mentioned positive experiences. Despite this, some comments state that air travel for fieldwork cannot be eliminated entirely or replaced through collaborations with locals and that at least one or more trips are needed. This point is also mentioned in the study of Tseng et al. (2022). In addition, staying away for extended periods is often impossible due to family or work obligations, as pointed out in several comments and supported by the literature (Hopkins et al., 2019; Storme et al., 2013).

Despite the high willingness, it is very likely that the effectiveness of this measure heavily depends on the type of fieldwork to be done. In studies that require seasonal measurements with highly specific instruments, for example, implementing this measure is not possible, as noted by one comment.

A reduction potential for the measure “combining multiple purposes” is not available, as it is impossible to know which journeys could have been avoided by combining multiple activities in one trip. To my knowledge, no studies have attempted to model the reduction potential of this measure quantitatively. However, I would expect the reduction potential to be relatively low since this measure only succeeds in lowering air travel emissions if one trip is given up after combining multiple activities into another. As also mentioned in the comments, I assume it is rather challenging to implement this measure consistently due to the difficulty of finding multiple relevant purposes in the same region in the same period. On the other hand, since this measure can affect long-distance trips, even a limited number of trips avoided would have a considerable impact.

Combining multiple purposes in one trip increases the benefits of travel, whether in the case of a combination of various work activities or a combination of work and leisure, such as family vacations (Poggioli & Hoffman, 2022). However, to be truly effective, this must mean forgoing another trip. It is important that this measure does not become a component of a justification mechanism for air travel that does not entail any behavioral change. In addition, the comments point out that this measure cannot be implemented in the case of work or family commitments, as in the case of the previous measure.

Despite this, the willingness to implement this measure is among the highest in this study. This could be related to comments stating that this measure is already being implemented. However, it can be challenging to determine whether the combination of multiple purposes in one trip actually causes the forgoing of other trips.

4.4 Limitations

This work includes some limitations. Firstly, it is a one-case study focusing on only one university department. As a result, the number of people investigated is limited, and the responses are highly context-dependent.

The aggregation of AMM data at the level of GIUZ thematic area and the temporal resolution of one year limit the analyses that can be performed. Having data with a higher level of precision could allow more accurate spatial and temporal patterns to be identified and enable better characterization of flight behavior at GIUZ.

In the calculation of the reduction scenarios, emissions from conducting online conferences were not considered. This is because from the AMM data, it is not possible to trace how many conferences were visited and thus calculate the emissions from holding as many online conferences. Emissions related to train travel were also not considered. This means that the maximum reduction potential might be slightly overestimated.

Concerning the online survey, the results may have been influenced by self-selection bias. Since the survey was voluntary, it is possible that those who were most interested in the topic or had strong positions might have been more likely to participate. However, this effect may have been diminished due to the advertising of the survey by GIUZ professors.

Participants might also have been affected by the acquiescence bias (Graeff, 2005) and thus may have tended to answer questions positively even if their actual opinion was more negative. I tried to avoid this by designing the questions as neutrally as possible.

The topic of the reduction of academic air travel is rather emotional and personal. Conducting a survey allowed me to collect a large amount of data, but it did not enable participants to justify their answers. To seek to remedy this, I included open-ended comments at the end of each section. However, conducting qualitative interviews would have allowed a better analysis of individual reasoning.

4.5 Further research

Given the relevance of academic air travel reduction, further research should be done on this issue. Regular measurement of the approval and progress of the AMM Initiative and comparison with emission trends would be helpful so that continuous and effective development of the project can be pursued.

In addition, as mentioned above, a more detailed analysis of the differences between the groups of academics proposed above should be conducted to investigate the relative causes and possible repercussions. This would be important for the equitable development of the emission reduction project at GIUZ.

The results showed that fieldwork-related air travel at GIUZ accounts for a large share of emissions and that the willingness to reduce it is high. In addition, little literature is available on this topic.

Therefore, there is great potential for future research on this complex topic, which should be further explored by involving directly interested academics to explore examples of best practices and possible measures.

Furthermore, this study only considered voluntary reduction measures. Future research may examine the reduction potential and acceptance of other possible measures, such as incentives for ground-based travel or emission caps.

5 Conclusion

UZH has set the target of climate neutrality by 2030. As a consequence, a reduction target has been set at GIUZ whereby air travel GHG emissions have to be reduced by 53% by 2030 (baseline average 2017-2019). Reducing GHG emissions deriving from academic air travel is a difficult task as academics perceive air travel to be a critical aspect of a successful academic career (Storme et al., 2013; Wenger, 2021a). Pressure to reduce academic air travel GHG emissions is increasing, and a growing number of universities are setting reduction targets (Poggioli & Hoffman, 2022).

In this context, the objective of this Master's Thesis is threefold. Firstly, it aims to characterize air travel behavior at GIUZ and to quantify its impact in terms of GHG emissions. Secondly, it seeks to gather views and opinions of GIUZ scientific staff about the topic of academic air travel reduction. Lastly, it aims to evaluate voluntary reduction measures based on the willingness to be implemented by GIUZ scientific staff and their reduction potential.

To do this, I conducted a descriptive analysis of the AMM data provided by the AMM Group, designed and implemented an online survey directed to the scientific staff at GIUZ to gather opinions on academic air travel reduction and on possible voluntary reduction measures, and developed reduction scenarios from the AMM data.

The results from the descriptive analysis of AMM data (**RQ1**) showed that GIUZ academics fly mainly to North America and Western Europe. In 2022, after the sharp drop in air travel emissions caused by COVID-19 in 2020 and 2021, emissions increased again, exceeding the GIUZ reduction target for 2022 by 8%. Most of GIUZ air travel emissions (85%) are produced by long-haul journeys, even though the number of long-haul journeys is only slightly higher than that of short-haul journeys. Considering the purposes of air travel, most emissions derive from trips for conferences, workshops, and fieldwork. Professors and guests cause most emissions from air travel, while employees with PhD and PhD students fly much less.

Results regarding GIUZ academics' opinions on air travel reduction (**RQ2**) showed that air travel is considered relevant for a successful academic career. However, GIUZ academics strongly approve of the AMM Initiative. The main concerns about reducing air travel are losing networking opportunities, missing out on important information about what is happening in the study field, and reducing the chances of having a successful career.

The analysis of voluntary air travel reduction measures in terms of willingness and emission reduction potential (**RQ3**) showed that the scientific staff at GIUZ is willing to implement voluntary reduction measures and that these have a considerable reduction potential.

A negative relationship between willingness and reduction potential was found. Measures with high willingness levels showed low reduction potential, while measures with low willingness values showed high reduction potential. The measures related to virtual communication (participating virtually in conferences and inviting guests virtually) showed high values of reduction potential but low values of willingness (lower when related to the other measures investigated but still positive in

absolute terms). Virtual communication reduces the necessity for academics to travel, which contributes to lower emissions from air travel. However, virtual networking is perceived as ineffective, and thus negatively affects willingness.

Measures affecting the choice of means of transport (substituting air travel with train travel and substituting stopover flights with non-stop flights) showed high levels of willingness but low reduction potential. These measures do not restrict the mobility of academics but only affect the choice of transportation mode, which has a limited effect on emissions.

The findings showed that although academic air travel is considered relevant to a successful career, the approval of the reduction program and the willingness to implement voluntary air travel reduction measures at GIUZ are high. This denotes a widespread awareness among GIUZ academics of the environmental impact of academic air travel and a willingness to take action to reduce it. This is important as it is critical to have the approval of the scientific staff to pursue a policy and achieve a reduction goal (Schreuer et al., 2023).

However, the literature reports cases of "attitude-behavior gap", whereby academics are aware of the environmental impact of flying and are willing to reduce their air travel, but despite this, they continue to fly extensively (Nursey-Bray et al., 2019; Schrems & Upham, 2020). This phenomenon may be driven by social norms, fear of being disadvantaged, the perceived necessity to fly, or lack of alternatives (Nursey-Bray et al., 2019; Schrems & Upham, 2020; Schreuer et al., 2023). Studies have suggested that information and awareness are insufficient to reduce academic air travel, but institutional change and support are needed to reduce air travel without career repercussions (Schreuer et al., 2023; Whitmarsh et al., 2020). Further research at GIUZ is needed in the coming years to determine whether the high willingness values found in this study will translate into actual behavioral change and thus lead to emission reductions. This work identified categories of flights that show particularly high reduction potential. For example, it was found that long-haul journeys have a significantly greater impact in terms of GHG emissions compared to short-haul journeys. However, GIUZ academics showed less willingness to implement measures that restrict long-haul journeys compared to short-haul journeys. On the one hand, this indicates that reducing short-haul journeys may prove to be easier. On the other hand, this confirms what has been expressed by Schreuer et al. (2023), namely that systemic change is needed to reduce air travel emissions successfully. At the same time, this change must be prompted by individual academics. For this to succeed, however, there must be efficient and sustainable alternatives in the long run. Therefore, it is important to identify and address the barriers hindering academics from reducing their air travel behavior. One prominent example is the development of virtual communication with efficient networking possibilities, which would make long-haul journeys less essential to a successful academic career (Wenger, 2023). Such developments in infrastructure and approaches are needed to facilitate the cultural change required to efficiently and equitably transform academic air travel behavior.

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7 Appendices

7.1 Invitation email

Betreff:[giuz] Survey about airmiles monitoring/reduction @ GIUZ --- please participate
Datum: Tue, 21 Mar 2023 08:33:32 +0000
Von: Rocco Bagutti <rocco.bagutti@uzh.ch>
An:giuz@lists.geo.uzh.ch <giuz@lists.geo.uzh.ch>

Dear members of the GIUZ

The Department of Geography is actively engaged in efforts to reduce its environmental impact. An integral part of this aim is the reduction of academic air travel through the Air Miles Monitoring (AMM) initiative.

In this context, my Master's Thesis aims to identify and gather different perspectives and opinions on the AMM initiative at GIUZ and on different voluntary reduction measures to decrease greenhouse gas emissions from academic air travel and compare this data with the air miles data collected at GIUZ. To achieve this objective, a survey addressed to the scientific staff working at GIUZ since 2022 or earlier has been designed.

The survey can be accessed here until Friday 07.04.2023: https://ww3.unipark.de/uc/ATGIUZ/
Participation is, of course, anonymous and voluntary, and does not require familiarity with the AMM initiative. Completion requires about 15 minutes.

Thank you very much for your participation in this survey.

Sincerely,
Rocco Bagutti

MSc Student GIS

7.2 Reminder email

Betreff:[giuz] Reminder: Survey about airmiles monitoring/reduction @ GIUZ --- please participate
Datum: Mon, 3 Apr 2023 17:06:48 +0000
Von:GEO Head of Department <head.department@geo.uzh.ch>
Kopie (CC):giuz@lists.geo.uzh.ch <giuz@lists.geo.uzh.ch>

Dear All,

This is a kind reminder to participate in the **survey about airmiles monitoring and reduction** in the context of Rocco Bagutti's Master's Thesis. The results will also help us as a Department in considering what measures we might implement, and what their likely acceptance is.

The survey can be accessed here **until Friday 07.04.2023**: https://ww3.unipark.de/uc/ATGIUZ/

Participation is, of course, anonymous and voluntary, and does not require familiarity with the AMM initiative. Completion requires about 15 minutes.

Thank you very taking the time to complete this survey.

All the best,

Ross

Liebe Alle,

Hiermit möchte ich euch daran erinnern, an der Umfrage zur Erfassung und Reduzierung von Flugreisen am GIUZ im Rahmen der Masterarbeit von Rocco Bagutti teilzunehmen. Die Ergebnisse werden uns als Institut auch dabei helfen, zu überlegen, welche Massnahmen wir umsetzen könnten und wie hoch die Akzeptanz dafür wird.

Die Umfrage kann bis zum kommenden Freitag, den 07.04.2023, unter folgendem Link ausgefüllt werden: https://ww3.unipark.de/uc/ATGIUZ/

Die Teilnahme ist anonym und freiwillig und setzt keine Kenntnisse über die AMM-Initiative voraus. Die Umfrage ist nur auf Englisch verfügbar und dauert etwa 15 Minuten.

Vielen Dank für Ihre Teilnahme an dieser Umfrage.

Beste Grüsse,

Ross

7.3 Online survey

Some questions in the survey required the participants to provide quantitative measures regarding their air travel behavior (such as yearly number of flights or number of guests invited). At the beginning of the survey, participants were divided into two groups based on whether they had started their employment at GIUZ before or after 2020. When answering quantitative questions, participants who started working at GIUZ before 2020 had to refer to the years between 2017 and 2019. The other group was asked to refer to the year 2022. This is because 2020 and 2021 were severely impacted by the COVID-19 pandemic, which made travel impossible or very difficult. The year 2022 may still carry some effects of the pandemic, but it is the most comparable year with those before COVID-19. Since many questions do not require referring to a specific year, the idea of excluding all participants who started working at GIUZ after the COVID-19 pandemic outbreak was discarded. Ultimately, none of these quantitative questions were included in this Master's Thesis.

The survey can be found on the following pages.
The first two questions (section 1) were asked to all participants.
Participants who started working at GIUZ in 2023 were directed to the final page since the survey was designated only for employees who started working at GIUZ in 2022 or earlier (section 2).
Section 3 was only shown to people who started working at GIUZ before 2020.
Section 4 was only shown to people who started working at GIUZ between 2020 and 2022.
Section 5 was the final page that closed the survey for all participants.

Some survey questions were taken from previous work for comparability (Jobin & Siegrist, 2020; Wenger, 2021b, 2021a, 2022; Whitmarsh et al., 2020). Some questions were designed based on elements from the literature (Schreuer et al., 2023). Not all questions asked in the survey were discussed in the thesis.

University of Zurich[UZH]

Welcome, and thank you for your participation!

This survey is conducted as part of Rocco Bagutti's Master's Thesis at UZH's Department of Geography (GIUZ).

The aim of the survey is to gather different perspectives and opinions on the Air Miles Monitoring initiative at GIUZ and on different voluntary reduction measures to decrease greenhouse gas emissions from academic air travel. Data obtained from this survey will be analyzed together with the air miles data collected at GIUZ to compare and contrast views on air travel reduction measures with their actual reduction potential.

The survey is aimed at the scientific staff who have been working at GIUZ since 2022 or earlier. The survey will take about 15 minutes to complete. Participation is voluntary. It is possible to withdraw from the survey at any time without any explanations by closing the browser. In this case, the data entered will not be recorded or analyzed. All the information provided will be collected, stored, and evaluated in an anonymized form.

For further inquiries about the survey, please contact Rocco Bagutti at rocco.bagutti@uzh.ch.

☐ I voluntarily participate in this survey and agree to the processing of my personal data in accordance with the above-mentioned information.

I don't want to participate

START THE SURVEY

Questionnaire

1 Intro

In what year did you start working at GIUZ?

Do you perform fieldwork outside of Switzerland for your work at GIUZ?

Fieldwork is understood as data collection, interaction and collaboration with stakeholders, and maintenance of machines and measuring instruments abroad.

- ◯ Yes
- ◯ No

2 Filter Start GIUZ 2023

v_13 Start GIUZ	In what year did you start working at GIUZ? - Start GIUZ (From page 1: Intro)	equal	2023

2.1 Final page start GIUZ 2023

Thank you very much for your participation!

Unfortunately, the survey is designed only for scientific staff who have been working at GIUZ since 2022 or before. For this reason, you will not be able to complete the rest of the survey. You may close the window now.

The results of this survey will be published in Rocco Bagutti's Master Thesis. You will receive an e-mail with a link to the final version of this Thesis when it will be published (end of 2023).

3 Filter Start GIUZ before 2020

v_13 Start GIUZ	In what year did you start working at GIUZ? - Start GIUZ (From page 1: Intro)	less	2020

3.1 Flights estimations <2020

Consider the timespan between 2017 and 2019 to answer the questions below.

In this survey, one plane trip refers to an outbound and return flight, including stopovers.

	none	less than one	one	two	three	four	five or more	don't know / prefer not to say
On average, how many plane trips did you take for your work at GIUZ per year?								
On average, how many plane trips **in Europe** did you take for your work at GIUZ per year?								
On average, how many plane trips did you take **to attend conferences or workshops** for your work at GIUZ per year?								
On average, how many plane trips did you take **to conduct fieldwork outside of Switzerland** per year?								

Have you invited one or more guests who flew to reach GIUZ between 2017 and 2019?

- ◯ Yes
- ◯ No

Consider the timespan between 2017 and 2019 to answer the questions below.

On average, how many guests per year have you invited who flew to GIUZ?

Please indicate the number of invited guests who flew to GIUZ for every purpose listed below.

If you did not invite guests for one or more of the following purposes please enter "0".

Flew to GIUZ for conferences and/or workshops	
Flew to GIUZ for teaching	
Flew to GIUZ for examinations	
Flew to GIUZ for fieldwork and/or excursions	
Flew to GIUZ for project meetings	
Flew to GIUZ for other reasons	

3.2 Perceived importance of air travel

Generally, how relevant do you consider air travel for your academic work?

- ◯ Very irrelevant
- ◯ Irrelevant
- ◯ Somewhat irrelevant
- ◯ Somewhat relevant
- ◯ Relevant
- ◯ Very relevant
- ◯ Don't know / Prefer not to say

You may add additional comments on the irrelevance or relevance of air travel for your work at GIUZ here (optional):

3.3 Familiarity with AMM

Before this survey, had you heard about the Air Miles Monitoring initiative at GIUZ, which aims to address, quantify, and reduce the number of air travels at GIUZ?

- ◯ Yes
- ◯ No

Background information on the Air Miles Monitoring initiative at GIUZ

The Air Miles Monitoring **(AMM) initiative was launched in 2018 with the aim to address, quantify, and reduce the number of air travels at GIUZ. The initiative collects air travel data, calculates and analyses air travel statistics, and produces annual reports to contribute to achieving the Air Miles Reduction Goal. This goal was set in 2019 by the GIUZ Direktorium and corresponds to a 25% reduction in air miles by 2025 compared to the reference period 2017-2019.**

In 2021 the AMM initiative adopted the university-wide goal of reducing greenhouse gas emissions from air travel by at least 53% by 2030 compared to the reference period 2018-2019.

Do you approve of the Air Miles Monitoring initiative at GIUZ?

- ◯ Strongly disapprove
- ◯ Disapprove
- ◯ Somewhat disapprove
- ◯ Somewhat approve
- ◯ Approve
- ◯ Strongly approve
- ◯ Don't know / Prefer not to say

You may add additional comments on disapproval or approval of the Air Miles Monitoring initiative at GIUZ here (optional):

3.4 Introduction on measures

On the next six pages we will ask you questions about the following voluntary reduction measures:

- **Substituting air travel with train travel**
- **Participating virtually in conferences and/or workshops**
- **Combining multiple purposes in one trip**
- **Collaborating with locals and conducting longer fieldwork trips**
- **Inviting guests virtually**
- **Substituting stopover flights with non-stop flights**

On the next five pages we will ask you questions about the following voluntary reduction measures:

- **Substituting air travel with train travel**
- **Participating virtually in conferences and/or workshops**
- **Combining multiple purposes in one trip**
- **Inviting guests virtually**
- **Substituting stopover flights with non-stop flights**

3.5.1 Substituting air travel with train travel

Substituting air travel with train travel

In general, how willing are you to substitute air travel with overnight or daytime train travel for your work at GIUZ?

	Very unwilling	Unwilling	Somewhat unwilling	Somewhat willing	Willing	Very willing	Don't know / Prefer not to say
Overnight train travel							
Daytime train travel							

What is the maximum duration you are willing to travel by train instead of flying for your work at GIUZ?

- ◯ I would always choose to fly
- ◯ Up to 1 hour
- ◯ Between 1 and 2 hours
- ◯ Between 2 and 6 hours
- ◯ Between 7 and 8 hours
- ◯ Longer than 8 hours
- ◯ Don’t know / Prefer not to say

Imagine GIUZ covers the price difference of a train trip compared to a flight, therefore making them cost the same. Considering this, what is maximum duration you are willing to travel by train instead of flying for your work at GIUZ?

- ○ I would always choose to fly
- ○ Up to 1 hour
- ○ Between 1 and 2 hours
- ○ Between 2 and 6 hours
- ○ Between 7 and 8 hours
- ○ Longer than 8 hours
- ○ Don't know / Prefer not to say

In the past, have any of the following reasons prevented you from travelling by train for your work at GIUZ, and consequently, you flew?

Please select any that apply to you.

Travel barriers

- ☐ Cost of the train ticket
- ☐ Travel time
- ☐ Poor information/booking services for international train trips
- ☐ Lack of appropriate travel connections
- ☐ Frequent changeovers
- ☐ Departure and/or arrival times at inconvenient times
- ☐ Safety concerns for night trips
- ☐ Difficulty to sleep on a night train
- ☐ Difficulty to work during train travel

Obligations

- ☐ Professional obligation (e.g., teaching)
- ☐ Personal obligations (e.g., childcare)
- ☐ Others (please specify):
- ☐ None of the above
- ☐ Not applicable / Prefer not to say

You may add additional comments on the substitution of air travel by train here (optional):

3.5.2 Participating virtually in conferences and/or workshops

Participating virtually in conferences and/or workshops

Generally, how willing are you to participate virtually in conferences and/or workshops?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don't know / Prefer not to say

You previously indicated that you, on average, took #v_303# plane trips per year to participate in conferences and/or workshops between 2017-2019.

Imagine that all conferences and workshops offered virtual attendance. Considering this, how many conferences and/or workshops of those enumerated above would you be willing to attend virtually?

- ◯
- ◯ Don't know / Prefer not to say

Imagine that all conferences and workshops offered virtual attendance. Considering this, do you think that the average number of conferences and/or workshops you attend annually would change?

- ◯ Yes, 1 to 2 more conferences/workshops
- ◯ Yes, 3 to 5 more conferences/workshops
- ◯ Yes, more than 5 more conferences/workshops
- ◯ No, the same number of conferences/workshops
- ◯ Yes, 1 to 2 fewer conferences/workshops
- ◯ Yes, 3 to 5 fewer conferences/workshops
- ◯ Yes, more than 5 fewer conferences/workshops
- ◯ Don’t know / Prefer not to say

You may add additional comments on the virtual participation to conferences and/or workshops here (optional):

3.5.3 Combining multiple purposes in one trip

Combining multiple purposes in one trip

Generally, how willing are you to combine multiple purposes in one trip (e.g., flying to a conference on another continent and staying longer to also visit a collaborating research group and/or do fieldwork in this region)?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

How feasible do you consider the possibility of combining multiple purposes in one trip for you?

- ◯ Very unfeasible
- ◯ Unfeasible
- ◯ Somewhat unfeasible
- ◯ Somewhat feasible
- ◯ Feasible
- ◯ Very feasible
- ◯ Don't know / Prefer not to say

Please elaborate on the unfeasibility/feasibility of combining multiple purposes in one trip (optional):

3.5.4 Filter Fieldwork - Yes

v_16 Fieldwork	Do you perform fieldwork outside of Switzerland for your work at GIUZ? - Fieldwork (From page 1: Intro)	equal 1

3.5.4.1 Collaborating with locals and conducting longer fieldwork trips

Collaborating with locals and conducting longer fieldwork trips

Generally, how willing are you to collaborate with local researchers or stakeholders in your fieldwork site so that they can take on certain research tasks (e.g., measurements, data collection) and thus you can reduce your number of trips to the fieldwork area?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

How feasible do you consider the possibility to collaborate with local researchers and/or stakeholders for you?

- ◯ Very unfeasible
- ◯ Unfeasible
- ◯ Somewhat unfeasible
- ◯ Somewhat feasible
- ◯ Feasible
- ◯ Very feasible
- ◯ Don't know / Prefer not to say

Please elaborate on the unfeasibility/feasibility of the possibility to establish a collaboration with locals (optional):

Generally, how willing are you to perform all your fieldwork tasks in one trip or to reduce the number of trips to the fieldwork site by performing more tasks in one trip and staying for a longer duration?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

How feasible do you consider the possibility to perform all your fieldwork tasks in one trip or to reduce the number of trips to the fieldwork site by performing more tasks in one trip for you and staying for a longer duration?

- ◯ Very unfeasible
- ◯ Unfeasible
- ◯ Somewhat unfeasible
- ◯ Somewhat feasible
- ◯ Feasible
- ◯ Very feasible
- ◯ Don't know / Prefer not to say

Please elaborate on the unfeasibility/feasibility of the possibility to perform all your fieldwork tasks in one trip or to reduce the number of trips to the fieldwork site by performing more tasks in one trip for you (optional):

3.5.5 Inviting guests virtually

Inviting guests virtually

Generally, how willing are you to invite guests virtually?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_437# guests per year to conferences and/or workshops.

Out of these, how many guests would you be willing to invite to participate virtually?

- ◯ _____
- ◯ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_437# guest per year to conferences and/or workshops.
Would you be willing to invite this guest to participate virtually?

- ◯ Yes
- ◯ No
- ◯ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_442# guests per year for teaching.
Out of these, how many guests would you be willing to invite to participate virtually?

- ◯ _____
- ◯ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_442# guest per year for teaching.
Would you be willing to invite this guest to participate virtually?

- ◯ Yes
- ◯ No
- ◯ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_447# guests per year for examinations.
Out of these, how many guests would you be willing to invite to participate virtually?

- ○ _____
- ○ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_447# guest per year for examinations.
Would you be willing to invite this guest to participate virtually?

- ○ Yes
- ○ No
- ○ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_452# guests per year for fieldwork and/or excursions.
Out of these, how many guests would you be willing to invite to participate virtually?

- ○ _____
- ○ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_452# guest per year for fieldwork and/or excursions.
Would you be willing to invite this guest to participate virtually?

- ○ Yes
- ○ No
- ○ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_457# guests per year for project meetings.
Out of these, how many guests would you be willing to invite to participate virtually?

- ○ _____
- ○ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_457# guest per year for project meetings.
Would you be willing to invite this guest to participate virtually?

- ○ Yes
- ○ No
- ○ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_462# guests per year for other reasons.
Out of these, how many guests would you be willing to invite to participate virtually?

- ○ _____
- ○ Don't know / Prefer not to say

You previously indicated that between 2017 and 2019 you invited on average #v_462# guest per year for other reasons.
Would you be willing to invite this guest to participate virtually?

- ○ Yes
- ○ No
- ○ Don't know / Prefer not to say

Compared to inviting a guest to GIUZ in-person, how suitable do you consider virtual alternatives for guests' participation for the following purposes?

	Very unsuitable	Unsuitable	Somewhat unsuitable	Somewhat suitable	Suitable	Very suitable	Don't know / Prefer not to say
For conferences and/or workshops	⌄						
For teaching	⌄						
For examinations	⌄						
For fieldwork and/or excursions	⌄						
For project meetings	⌄						

You may add additional comments on the virtual attendance of guests here (optional):

3.5.6 Substituting stopover flights with direct flights

Substituting stopover flights with non-stop flights

Generally, how willing are you to substitute stopover flights with non-stop flights for your work at GIUZ?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don't know / Prefer not to say

Imagine the following scenario. You need to fly to another continent for your work at GIUZ. There are two different flights available from Zurich Airport. One is a non-stop and more expensive flight, the other flight has a stopover and is cheaper.
How much more would you be willing to pay for the non-stop flight compared to the stopover flight?

- ◯ I would always take the stopover flight
- ◯ 1-10%
- ◯ 11-20%
- ◯ 21-30%
- ◯ 31-40%
- ◯ 41-50%
- ◯ More than 50%
- ◯ Don’t know / Prefer not to say

Imagine the following scenario. You need to fly to another continent for your work at GIUZ. There are only stopover flights from Zurich Airport. Alternatively, you can reach Frankfurt Airport by train in 4 hours and from there take a non-stop flight to your destination.
How willing are you to travel to Frankfurt Airport by train and from there take a non-stop flight to reach your destination?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

You may add additional comments on the substitution of stopover flights with non-stop flights here (optional):

3.6 Concern about climate change

Please indicate how much you disagree or agree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree	Don't know / Prefer not to say
Climate change has severe consequences for humans and nature.							
Climate protection is important for our future.							
We must protect the climate's delicate equilibrium.							
I worry about the climate's state.							

3.7 Additional questions

Do you take any active actions to reduce or keep your academic air travel low?

- ◯ Yes
- ◯ No, but I would like to do so in the future
- ◯ No
- ◯ Prefer not to say

What active actions do you take to reduce or keep your academic air travel low?

Please select any that apply to you.

- ☐ Using virtual presence as an alternative to air travel
- ☐ Travelling by land-based transportation as an alternative to air travel
- ☐ Combining multiple travel purposes into one trip
- ☐ Favoring direct flights over stopover flights
- ☐ Other (please specify):
- ☐ Prefer not to say

Do you worry about any of the following as potential consequences if you reduce your academic air travel?

Please answer to this question regardless of whether you have reduced or intend to reduce your academic air travel. You may select more than one answer.

- [ ] Missing opportunities to receive feedback on your work
- [ ] Not being perceived as an expert in your field
- [ ] Missing out on important information about what is going on in your field
- [ ] Missing opportunities to build personal relationships with colleagues from GIUZ
- [ ] Missing opportunities to build personal relationships with people outside GIUZ
- [ ] Violating the obligations defined in your job profile
- [ ] Displeasing your supervisor
- [ ] Reducing your chances to have a successful future career
- [ ] Other (please specify):
- [ ] None of the above
- [ ] Prefer not to say

Within the past two months, how often have you spoken with other people at GIUZ (colleagues, students, ...) about the Air Miles Monitoring initiative and/or about the topic of greenhouse gas emissions from academic air travel?

- ○ Never
- ○ 1-2 times
- ○ 3-5 times
- ○ 6-10 times
- ○ More than 10 times
- ○ Don't know / Prefer not to say

How important do you rate the following factors when planning air travel for your work at GIUZ?

Please select any that apply to you.

	Very unimportant	Unimportant	Somewhat unimportant	Somewhat important	Important	Very important	Not applicable / Prefer not to say
Price of flight ticket							
Trip time							
Trip distance							
Flight schedule (i.e., arrival/departure time)							
Loyalty to a specific airline							
Environmental ranking of the airline							
Environmental ranking of specific flights							
No stopovers							

3.8 Demographics

Which GIUZ division do you work at?

If several apply, please choose your primary affiliation.

- ◯ Physical Geography
- ◯ Human Geography
- ◯ Remote Sensing
- ◯ Geographic Information Science and Systems
- ◯ Support and Management
- ◯ Prefer not to say

Which position do you hold at GIUZ?

- ◯ PhD student
- ◯ Employee without PhD
- ◯ Employee with PhD
- ◯ Professor
- ◯ Other (please specify):
- ◯ Prefer not to say

Does your work at GIUZ involve researching or teaching climate change or sustainability?

- ◯ Yes, this is a major part of my work
- ◯ Yes, this is a minor part of my work
- ◯ No
- ◯ Prefer not to say

What is your academic age?

Academic age refers to the number of years you have been in the research field and performed active research (i.e., years since completion of your PhD).

- ◯
- ◯ Prefer not to say

How old are you?

- ◯
- ◯ Prefer not to say

Do you have children?

- ◯ Yes, children aged less than 18-years-old
- ◯ Yes, children aged 18-years-old or older
- ◯ No
- ◯ Prefer not to say

With what gender do you identify?

- ◯ Male
- ◯ Female
- ◯ Non-binary
- ◯ Other
- ◯ Prefer not to say

4 Filter Start GIUZ 2020-22

	v_13 Start GIUZ	In what year did you start working at GIUZ? - Start GIUZ (From page 1: Intro)	greater equal	2020
and	v_13 Start GIUZ	In what year did you start working at GIUZ? - Start GIUZ (From page 1: Intro)	less equal	2022

4.1 Flights estimations 2020-22

Consider the year 2022 to answer the questions below.

In this survey, one plane trip refers to an outbound and return flight, including stopovers.

	none	one	two	three	four	five or more	don't know / prefer not to say
In 2022, how many plane trips did you take for your work at GIUZ?							
In 2022, how many plane trips **in Europe** did you take for your work at GIUZ?							
In 2022, how many plane trips did you take **to attend conferences or workshops** for your work at GIUZ?							
In 2022, how many plane trips did you take **to conduct fieldwork outside of Switzerland**?							

Have you invited one or more guests who flew to reach UZH in 2022?

- ◯ Yes
- ◯ No

In 2022, how many guests have you invited who flew to GIUZ?

Please indicate the number of invited guests who flew to GIUZ for every purpose listed below.
If you did not invite guests for one or more of the following purposes please enter "0".

Flew to GIUZ for conferences and/or workshops	
Flew to GIUZ for teaching	
Flew to GIUZ for examinations	
Flew to GIUZ for fieldwork and/or excursions	
Flew to GIUZ for project meetings	
Flew to GIUZ for other reasons	

4.2 Perceived importance of air travel

Generally, how relevant do you consider air travel for your academic work?

- ◯ Very irrelevant
- ◯ Irrelevant
- ◯ Somewhat irrelevant
- ◯ Somewhat relevant
- ◯ Relevant
- ◯ Very relevant
- ◯ Don't know / Prefer not to say

You may add additional comments on the irrelevance or relevance of air travel for your work at GIUZ here (optional):

4.3 Familiarity with AMM

Before this survey, had you heard about the Air Miles Monitoring initiative at GIUZ, which aims to address, quantify, and reduce the number of air travels at GIUZ?

- ◯ Yes
- ◯ No

Background information on the Air Miles Monitoring initiative at GIUZ

The Air Miles Monitoring **(AMM) initiative was launched in 2018 with the aim to address, quantify, and reduce the number of air travels at GIUZ. The initiative collects air travel data, calculates and analyses air travel statistics, and produces annual reports to contribute to achieving the Air Miles Reduction Goal. This goal was set in 2019 by the GIUZ Direktorium and corresponds to a 25% reduction in air miles by 2025 compared to the reference period 2017-2019.**

In 2021 the AMM initiative adopted the university-wide goal of reducing greenhouse gas emissions from air travel by at least 53% by 2030 compared to the reference period 2018-2019.

Do you approve of the Air Miles Monitoring initiative at GIUZ?

- ◯ Strongly disapprove
- ◯ Disapprove
- ◯ Somewhat disapprove
- ◯ Somewhat approve
- ◯ Approve
- ◯ Strongly approve
- ◯ Don't know / Prefer not to say

You may add additional comments on disapproval or approval of the Air Miles Monitoring initiative at GIUZ here (optional):

4.4 Introduction on measures

On the next six pages we will ask you questions about the following voluntary reduction measures:

- **Substituting air travel with train travel**
- **Participating virtually in conferences and/or workshops**
- **Combining multiple purposes in one trip**
- **Collaborating with locals and conducting longer fieldwork trips**
- **Inviting guests virtually**
- **Substituting stopover flights with non-stop flights**

On the next five pages we will ask you questions about the following voluntary reduction measures:

- **Substituting air travel with train travel**
- **Participating virtually in conferences and/or workshops**
- **Combining multiple purposes in one trip**
- **Inviting guests virtually**
- **Substituting stopover flights with non-stop flights**

4.5.1 Substituting air travel with train travel

Substituting air travel with train travel

In general, how willing are you to substitute air travel with overnight or daytime train travel for your work at GIUZ?

	Very unwilling	Unwilling	Somewhat unwilling	Somewhat willing	Willing	Very willing	Don't know / Prefer not to say
Overnight train travel							
Daytime train travel							

What is the maximum duration you are willing to travel by train instead of flying for your work at GIUZ?

- ◯ I would always choose to fly
- ◯ Up to 1 hour
- ◯ Between 1 and 2 hours
- ◯ Between 2 and 6 hours
- ◯ Between 7 and 8 hours
- ◯ Longer than 8 hours
- ◯ Don’t know / Prefer not to say

Imagine GIUZ covers the price difference of a train trip compared to a flight, therefore making them cost the same. Considering this, what is maximum duration you are willing to travel by train instead of flying for your work at GIUZ?

- ◯ I would always choose to fly
- ◯ Up to 1 hour
- ◯ Between 1 and 2 hours
- ◯ Between 2 and 6 hours
- ◯ Between 7 and 8 hours
- ◯ Longer than 8 hours
- ◯ Don’t know / Prefer not to say

In the past, have any of the following reasons prevented you from travelling by train for your work at GIUZ, and consequently, you flew?

Please select any that apply to you.

Travel barriers

- [ ] Cost of the train ticket
- [ ] Travel time
- [ ] Lack of appropriate travel connections
- [ ] Frequent changeovers
- [ ] Departure and/or arrival times at inconvenient times
- [ ] Safety concerns for night trips
- [ ] Difficulty to sleep on a night train
- [ ] Difficulty to work during train travel
- [ ] Poor information/booking services for international train trips

Obbligations

- [ ] Personal obligations (e.g., childcare)
- [ ] Professional obligation (e.g., teaching)
- [ ] Others (please specify):
- [ ] None of the above
- [ ] Not applicable / Prefer not to say

You may add additional comments on the substitution of air travel by train here (optional):

4.5.2 Participating virtually in conferences and/or workshops

Participating virtually in conferences and/or workshops

Generally, how willing are you to participate virtually in conferences and/or workshops?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don't know / Prefer not to say

You previously indicated that you took #v_27# plane trips in 2022 to participate in conferences and/or workshops.

Imagine that all conferences and workshops offered virtual attendance. Considering this, how many conferences and/or workshops of those enumerated above would you be willing to attend virtually?

- ◯ _____
- ◯ Don't know / Prefer not to say

Imagine that all conferences and workshops offered virtual attendance. Considering this, do you think that the average number of conferences and/or workshops you attend annually would change?

- ◯ Yes, 1 to 2 more conferences/workshops
- ◯ Yes, 3 to 5 more conferences/workshops
- ◯ Yes, more than 5 more conferences/workshops
- ◯ No, the same number of conferences/workshops
- ◯ Yes, 1 to 2 fewer conferences/workshops
- ◯ Yes, 3 to 5 fewer conferences/workshops
- ◯ Yes, more than 5 fewer conferences/workshops
- ◯ Don’t know / Prefer not to say

You may add additional comments on the virtual participation to conferences and/or workshops here (optional):

4.5.3 Combining multiple purposes in one trip

Combining multiple purposes in one trip

Generally, how willing are you to combine multiple purposes in one trip (e.g., flying to a conference on another continent and staying longer to also visit a collaborating research group and/or do fieldwork in this region)?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

How feasible do you consider the possibility of combining multiple purposes in one trip for you?

- ◯ Very unfeasible
- ◯ Unfeasible
- ◯ Somewhat unfeasible
- ◯ Somewhat feasible
- ◯ Feasible
- ◯ Very feasible
- ◯ Don't know / Prefer not to say

Please elaborate on the unfeasibility/feasibility of combining multiple purposes in one trip (optional):

4.5.4 Filter Fieldwork - Yes

v_16 Fieldwork	Do you perform fieldwork outside of Switzerland for your work at GIUZ? - Fieldwork (From page 1: Intro)	equal 1

4.5.4.1 Collaborating with locals and conducting longer fieldwork trips

Collaborating with locals and conducting longer fieldwork trips

Generally, how willing are you to collaborate with local researchers or stakeholders in your fieldwork site so that they can take on certain research tasks (e.g., measurements, data collection) and thus you can reduce your number of trips to the fieldwork area?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

How feasible do you consider the possibility to collaborate with local researchers and/or stakeholders for you?

- ◯ Very unfeasible
- ◯ Unfeasible
- ◯ Somewhat unfeasible
- ◯ Somewhat feasible
- ◯ Feasible
- ◯ Very feasible
- ◯ Don't know / Prefer not to say

Please elaborate on the unfeasibility/feasibility of the possibility to establish a collaboration with locals (optional):

Generally, how willing are you to perform all your fieldwork tasks in one trip or to reduce the number of trips to the fieldwork site by performing more tasks in one trip and staying for a longer duration?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

How feasible do you consider the possibility to perform all your fieldwork tasks in one trip or to reduce the number of trips to the fieldwork site by performing more tasks in one trip for you and staying for a longer duration?

- ◯ Very unfeasible
- ◯ Unfeasible
- ◯ Somewhat unfeasible
- ◯ Somewhat feasible
- ◯ Feasible
- ◯ Very feasible
- ◯ Don't know / Prefer not to say

Please elaborate on the unfeasibility/feasibility of the possibility to perform all your fieldwork tasks in one trip or to reduce the number of trips to the fieldwork site by performing more tasks in one trip for you (optional):

4.5.5 Inviting guests virtually

Inviting guests virtually

Generally, how willing are you to invite guests virtually?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

You previously indicated that in 2022 you invited #v_475# guests to conferences and/or workshops.
Out of these, how many guests would you be willing to invite to participate virtually?

- ◯
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_475# guest to conferences and/or workshops.
Would you be willing to invite this guest to participate virtually?

- ◯ Yes
- ◯ No
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_476# guests for teaching.
Out of these, how many guests would you be willing to invite to participate virtually?

- ◯ _____
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_476# guest for teaching.
Would you be willing to invite this guest to participate virtually?

- ◯ Yes
- ◯ No
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_477# guests for examinations.
Out of these, how many guests would you be willing to invite to participate virtually?

- ◯ _____
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_477# guest for examinations.
Would you be willing to invite this guest to participate virtually?

- ◯ Yes
- ◯ No
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_478# guests for fieldwork and/or excursion.
Out of these, how many guests would you be willing to invite to participate virtually?

- ◯ _____
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_478# guest for fieldwork and/or excursions.
Would you be willing to invite this guest to participate virtually?

- ◯ Yes
- ◯ No
- ◯ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_479# guests for project meetings.
Out of these, how many guests would you be willing to invite to participate virtually?

- ○ _____
- ○ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_479# guest for project meetings.
Would you be willing to invite this guest to participate virtually?

- ○ Yes
- ○ No
- ○ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_480# guests for other reasons.
Out of these, how many guests would you be willing to invite to participate virtually?

- ○ _____
- ○ Don't know / Prefer not to say

You previously indicated that in 2022 you invited #v_480# guest for other reasons.
Would you be willing to invite this guest to participate virtually?

- ○ Yes
- ○ No
- ○ Don't know / Prefer not to say

Compared to inviting a guest to GIUZ in-person, how suitable do you consider virtual alternatives for guests' participation for the following purposes?

	Very unsuitable	Unsuitable	Somewhat unsuitable	Somewhat suitable	Suitable	Very suitable	Don't know / Prefer not to say
For conferences and/or workshops	⌄						
For teaching	⌄						
For examinations	⌄						
For fieldwork and/or excursions	⌄						
For project meetings	⌄						

You may add additional comments on the virtual attendance of guests here (optional):

4.5.6 Substituting stopover flights with direct flights

Substituting stopover flights with non-stop flights

Generally, how willing are you to substitute stopover flights with non-stop flights for your work at GIUZ?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don't know / Prefer not to say

Imagine the following scenario. You need to fly to another continent for your work at GIUZ. There are two different flights available from Zurich Airport. One is a non-stop and more expensive flight, the other flight has a stopover and is cheaper.
How much more would you be willing to pay for the non-stop flight compared to the stopover flight?

- ◯ I would always take the stopover flight
- ◯ 1-10%
- ◯ 11-20%
- ◯ 21-30%
- ◯ 31-40%
- ◯ 41-50%
- ◯ More than 50%
- ◯ Don’t know / Prefer not to say

Imagine the following scenario. You need to fly to another continent for your work at GIUZ. There are only stopover flights from Zurich Airport. Alternatively, you can reach Frankfurt Airport by train in 4 hours and from there take a non-stop flight to your destination.
How willing are you chose to travel to Frankfurt Airport by train and from there take a non-stop flight to reach your destination?

- ◯ Very unwilling
- ◯ Unwilling
- ◯ Somewhat unwilling
- ◯ Somewhat willing
- ◯ Willing
- ◯ Very willing
- ◯ Don’t know / Prefer not to say

You may add additional comments on the substitution of stopover flights with non-stop flights here (optional):

4.6 Concern about climate change

Please indicate how much you disagree or agree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree	Don't know / Prefer not to say
Climate change has severe consequences for humans and nature.							
Climate protection is important for our future.							
We must protect the climate's delicate equilibrium.							
I worry about the climate's state.							

4.7 Additional questions

Do you take any active actions to reduce or keep your academic air travel low?

- ◯ Yes
- ◯ No, but I would like to do so in the future
- ◯ No
- ◯ Not applicable / Prefer not to say

What active actions do you take to reduce or keep your academic air travel low?

Please select any that apply to you.

- ☐ Using virtual presence as an alternative to air travel
- ☐ Travelling by land-based transportation as an alternative to air travel
- ☐ Combining multiple travel purposes into one trip
- ☐ Favoring direct flights over stopover flights
- ☐ Other (please specify):
- ☐ Prefer not to say

Do you worry about any of the following as potential consequences if you reduce your academic air travel?

Please answer to this question regardless of whether you have reduced or intend to reduce your academic air travel. You may select more than one answer.

- [ ] Missing opportunities to receive feedback on your work.
- [ ] Not being perceived as an expert in your field.
- [ ] Missing out on important information about what is going on in your field.
- [ ] Missing opportunities to build personal relationships with colleagues from GIUZ.
- [ ] Missing opportunities to build personal relationships with people outside GIUZ.
- [ ] Violating the obligations defined in your job profile.
- [ ] Displeasing your supervisor.
- [ ] Reducing your chances to have a successful future career.
- [ ] Other (please specify):
- [ ] None of the above
- [ ] Prefer not to say

Within the past two months, how often have you spoken with other people at GIUZ (colleagues, students, ...) about the Air Miles Monitoring initiative and/or about the topic of greenhouse gas emissions from academic air travel?

- ◯ Never
- ◯ 1-2 times
- ◯ 3-5 times
- ◯ 6-10 times
- ◯ More than 10 times
- ◯ Don’t know / Prefer not to say

How important do you rate the following factors when planning air travel for your work at GIUZ?

Please select any that apply to you.

	Very unimportant	Unimportant	Somewhat unimportant	Somewhat important	Important	Very important	Not applicable / Prefer not to say
Price of flight ticket							
Trip time							
Trip distance							
Flight schedule (i.e., arrival/departure time)							
Loyalty to a specific airline							
Environmental ranking of the airline							
Environmental ranking of specific flights							
No stopovers							

4.8 Demographics

Which GIUZ division do you work at?

If several apply, please choose your primary affiliation.

- ◯ Physical Geography
- ◯ Human Geography
- ◯ Remote Sensing
- ◯ Geographic Information Science and Systems
- ◯ Support and Management
- ◯ Prefer not to say

Which position do you hold at GIUZ?

- ◯ PhD student
- ◯ Employee without PhD
- ◯ Employee with PhD
- ◯ Professor
- ◯ Other (please specify):
- ◯ Prefer not to say

Does your work at GIUZ involve researching or teaching climate change or sustainability?

- ◯ Yes, this is a major part of my work
- ◯ Yes, this is a minor part of my work
- ◯ No
- ◯ Prefer not to say

What is your academic age?

Academic age refers to the number of years you have been in the research field and performed active research (i.e., years since completion of your PhD).

- ◯
- ◯ Prefer not to say

How old are you?

- ◯
- ◯ Prefer not to say

Do you have children?

- ◯ Yes, children aged less than 18-years-old
- ◯ Yes, children aged 18-years-old or older
- ◯ No
- ◯ Prefer not to say

With what gender do you identify?

- ◯ Male
- ◯ Female
- ◯ Non-binary
- ◯ Other
- ◯ Prefer not to say

5 Final page

Thank you very much for your participation!

Your responses have been submitted, and you can close the window now without data loss.

The results of this survey will be published in Rocco Bagutti's Master Thesis. You will receive an e-mail with a link to the final version of this Thesis when it will be published (end of 2023).

In case of further questions about this survey, please contact Rocco Bagutti at rocco.bagutti@uzh.ch**.**

Thank you! The survey is now complete.

Personal declaration

I hereby declare that the submitted Thesis is the result of my own, independent work. All external sources are explicitly acknowledged in the Thesis.

Zurich, 30.09.2023

Rocco Bagutti