flyingless

Documentation | Accounting and monitoring tool for greenhouse gas emissions from air travel (GHG monitoring tool)

10. January 2025

List of abbreviations

ATR	Average temperature response
AU	Utilisation rate
CCD	Climb, cruise, decline
EQ	Equivalent factors
EWF	Emission weighting factor
GRC	Great circle distance
GWP	Global warming potential
IATA	International Air Transport Association
LTO	Landing and take-off phase
RFI	Radiative forcing index
SC	Seating category
GHG	Greenhouse gas
TREMOD AV	Transport Emission Model Aviation

1 The FlyingLess project

With the internationalisation of science and research, air travel by university members has also increased - scientists are among the frequent flyers.

The aim of the FlyingLess project is to support universities and research organisations in reducing air travel, which accounts for a significant proportion of their total greenhouse gas emissions. The project develops approaches to reduce air travel in the academic sector, which are implemented at various levels (research, teaching, training and administration).

A central element of FlyingLess is the development of an accounting tool to support research institutions in the accounting and monitoring of greenhouse gas emissions (GHG monitoring tool). This also involves standardising data collection and calculation so that results can be compared with each other. The tool was developed in dialogue with the project partners and offers various options for data input, taking into account the information availability of the respective institution. It automatically processes flight information and calculates GHG emissions per flight. The tool complies with the Greenhouse Gas Protocol Standard and the requirements of the European Sustainability Reporting Standards (ESRS).

2 General information and overview of the accounting process

The GHG monitoring tool is used by academic institutions to quantify their flight emissions resulting from their business trips. It also intended to enable the review of the reduction targets set. The focus is on accounting the GHG emissions associated with air travel. These are calculated in detail on the basis of individual flights and aggregated for various evaluations according to characteristics (e.g. reporting year, purpose of travel, organisational unit or flight distance classes). Group-specific reduction scenarios and measures to minimise GHG emissions can be introduced through targeted analyses by user groups. To this end, the institutions transfer their air travel information to a spreadsheet-based template (MS Excel file). Data is entered according to availability:

- Manual: paper-based booking or accounting information

- Digital: from accounting, booking or travel accounting system

As shown in Figure 1, the completed template is transferred to the monitoring tool to calculate the GHG emissions of each individual flight.

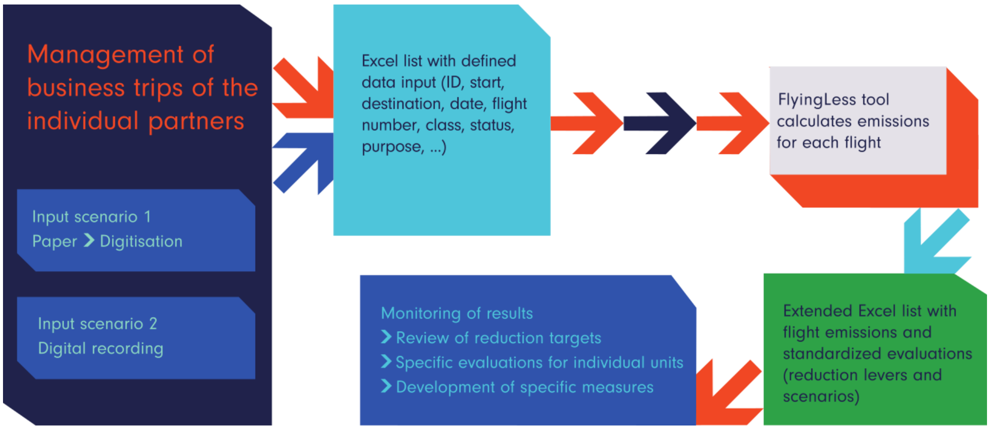

Figure 1: Procedure for accounting GHG emissions from air travel

The minimum information required to calculate the flight emissions are

1. Date of departure
2. Airport of departure (IATA codes[1], or city and country names)
3. Destination airport (IATA codes, or city and country names)
4. Flight number (optional)

The calculation using the IATA codes is more accurate than using place and country names. Further details, such as the comfort class or additional characteristics of the trip (e.g., organisational unit, purpose of the trip, etc.) make the emissions calculation more precise or enable detailed partial evaluations.

The use of the flight number theoretically enables automated data retrieval of flight information via an external data provider. This makes the emissions calculation more precise by providing detailed information on the aircraft used, the waypoints (departure and destination airports) and flight phases. However, the current state of research in the project has shown that this option is associated with considerable costs and maintenance effort. In addition, specific data on aircraft generate random results on a bandwidth for a given relation that the travelling person cannot influence, e.g. load factor or age of the aircraft. As FlyingLess aims to offer an open access tool and approved data basis, the calculation with standard values derived from TREMOD AV are used (for more details on the calculation method, see chapter 4). A complete list of all essential input fields can be found in the appendix.

Each flight must be entered individually. This means that outbound and return flights must be entered in separate lines. This also applies to part-haul flights with intermediate loads or intermediate destinations, provided that these can be found in the booking documents with the corresponding details (see list of minimum details above). Furthermore, a unique ID of

[1] The IATA (International Air Transport Association) assigns individual codes ("three-letter code") to commercially used airports worldwide. These can be used to identify departure and destination coordinates.

the person flying must be entered (anonymised personal code). This is used to determine air travel statistics per person within the institute (e.g. average flight kilometres or GHG emissions from flights per person and year) and can be transmitted either anonymised or pseudonymised. In both cases, the person flying remains unknown to the operator of the accounting tool. Furthermore, the ifeu insures not to pass on the data to third parties, apart from starting point and destination names without any further information. If no entries can be found in the airport database, they are transferred to a geocoding service in order to determine the geocoordinates. Only aggregated results from statistical analyses are evaluated and presented on the project website.

The result of the calculation is a list of flights and the associated flight emissions (in CO_2, equivalents) including the non-CO_2-induced climate effects that are taken into account by the RFI and EWF (see section 5.2). The results file (MS-Excel) also contains analyses according to travel characteristics and initial reduction scenarios for individual characteristic groups. These results are transmitted to the respective institution and used for general, anonymised evaluations within the project framework.

The input template (MS-Excel), in which the flights to be calculated are entered by the respective institution, can be uploaded via a web-interface on the homepage of the FlyingLess project (https://flyingless.de/thg-rechner) by interested parties after registration. Each registered user has their own separate area where they can upload the input data and download the results data after the calculation has been completed on the server. Besides this service also single flights by giving start and destination airport can be calculated directly without registration and login.

In the following sections, the system boundaries used for the accounting, details of the emissions calculation and the emission factors used are explained in more detail. Furthermore, the handling of incorrect or missing data in the flight data by the GHG monitoring tool is described. This is followed by notes on the presentation of the balance results and, finally, limitations and future discussion of the chosen method are listed.

3 System boundaries

The GHG emissions per flight are calculated as well-to-wing emissions. This means that the entire supply chain of transport energy is included, from the extraction and provision of the energy sources (here: jet fuel) to the conversion into kinetic drive energy or the on-board power supply.

In addition to CO_2 emissions, other relevant greenhouse gases such as N_2O (nitrous oxide) and CH_4 (methane) are also taken into account in order to determine the total GHG emissions (in CO_2eq.). Other greenhouse effects not induced by CO_2 are taken into account on the basis of their relative contribution compared to the GHG emissions in the corresponding flight phases (e.g., travelling altitude above 9,000 m) in the form of RFI or EWF factors[2]. A strict delimitation of the effectiveness of non-CO_2-induced greenhouse gas effects at flight altitudes above 9,000 m represents a compromise and is associated with greater uncertainties due to the complex conditions in the atmosphere. However, this delimitation accounts only in the calculation of the RFI result values. (see chapter 5). In

[2] RFI: Radiative Forcing Index; EWF: Emission Weighting Factor.

addition to the application of the RFI factors from a cruising altitude above 9,000 m, a result category independent of the cruising altitude for the RFI (factor 3) is also available in the result Excel sheet. Thus, in this case, the factor for non-CO_2-induced greenhouse effects is effective for the entire flight phase.

The GHG accounting is based on average emission and fuel consumption values for different distance classes. These are based on the fleet composition of the aircraft that take off or land in Germany.

Due to a lack of information for other countries, the German values are also used for flights in other regions of the world. This can result in deviations from the average GHG emissions per flight (and distance class) that actually apply there for national flights in other countries and international flights that do not have Germany as their departure or destination country. This assumption is considered negligible for the purpose of the GHG monitoring tool because, due to the scope of this project, it can be assumed that most flights either depart or arrive in Germany anyway.

Statistical surveys or research for fleet compositions with a different geographical reference are therefore considered to be of secondary importance for this project. The same applies to the load factors of the individual aircraft, which are used to determine the GHG emissions per passenger kilometre for the respective reference years.

Emissions from airport activities are not taken into account for the journey. Furthermore, the respective arrivals and departures to/from the airport are currently outside the scope of the GHG monitoring tool for air travel.

4 Calculation method

For the GHG-calculations, the geocoordinates are determined on the basis of the entries for departure and destination locations (city name and country) and/or the IATA code[3] of the corresponding airports. The emissions are calculated using average emission factors which depend on distance classes. These reflect the dependence of emissions on the flight distance in order to take into account the respective average aircraft fleet due to the different types of aircraft used in different distance classes.

4.1 Determining the flight distance

In a first step, the great circle distance (D_{GRC}) is calculated on the basis of the start and destination coordinates (lat_x, lon_x) of the corresponding airports and the earth's radius (r_{Earth}).

- $D_{GRC} = 2 \times r_{Earth} \times \arcsin\left(\sqrt{\sin^2\left(\frac{lat_2 - lat_1}{2}\right) + \cos(lat_1) \times \cos(lat_2) \times \sin^2\left(\frac{lon_2 - lon_1}{2}\right)}\right)$

or alternatively:

- $\omega = \arccos(\sin(lat_1) \times \sin(lat_2) + \cos(lat_1) \times \cos(lat_2) \times \cos(lon_2 - lon_1))$
  $D_{GRC} = \omega \times r_{Earth}$

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[3] Three-letter geocode designating many airports and metropolitan areas around the world, defined by the International Air Transport Association (IATA).

The great circle distance is then corrected in order to estimate the actual flight distance travelled (D_{real}). The distance surcharges depend on the great circle distance between the departure and destination airports (Knörr et al. 2012).

- $D_{real} = \begin{cases} D_{GRC} + 60 \text{ km} & , for\ D_{GRC} \leq 185{,}2 \text{ km} \\ (D_{GRC} - 185{,}2 \text{ km}) \times 1.04 + 245{,}2 \text{ km} & , for\ D_{GRC} > 185{,}2 \text{ km} \end{cases}$

4.2 GHG accounting using the fleet average by distance class

Flight emissions are calculated using derived mean values for GHG equivalents per passenger kilometre and distance class on the basis of TREMOD AV[4] (Knörr et al. 2012). These average values take into account both the fleet of aircraft in use and the degree of utilisation of the aircraft. The calculation also includes upstream chain emissions for the provision of fuel and does not include RFI or EWF factors:

- $EM_{LTO,total,FleetAvg} = \mathrm{ef}_{LTO}(D_{real})$
- $EM_{CCD,total,FleetAvg} = D_{real} \times ef_{CCD}(D_{real})$
- $EM_{Person,Flight,total} = \frac{EM_{LTO,total,FleetAvg} + EM_{CCD,total,FleetAvg}}{(AU_{Dist})} \times C(D_{GRC})$

In contrast to the calculation by aircraft type, the average GHG emissions for the LTO-phase[5] of the aircraft fleet used for each distance class $\boldsymbol{EM_{LTO,total,FleetAvg}}$ are calculated with emission data of the LTO-phase from TREMOD AV depending on the flight distance ($\boldsymbol{D_{real}}$). For the emissions of the flight phase ($\boldsymbol{EM_{CCD,total,FleetAvg}}$), the emission factor of the flight ($\boldsymbol{ef_{CCD}(D_{real})}$) is derived from TREMOD AV using the emission factors per distance class for the flight phase via interpolation between the distance averages of the classes.

The use of derived mean values has advantages over an aircraft-specific calculation from a statistical and accounting perspective of flights, as strong fluctuations in the occupancy rate, unusual taxi times or the random use of replacement aircraft cannot be influenced by the individual traveller. The overall accounting is hardly affected and the trend of emission-influencing travel behaviour is not distorted in the short term by singular effects caused by individual outlier flights.

4.3 Consideration of other non-CO_2-induced greenhouse effects in the flight phase

Emissions from combustion processes such as water vapour, NO_X and the formation of cirrus clouds in the higher layers of the atmosphere (stratosphere) are the main causes of further greenhouse gas effects. These are stated in the literature with different factors (in relation to the CO_2 emissions of a flight) in their impact as a greenhouse effect.

[4] TREMOD AV (Transport Emission Model Aviation): A model developed by the ifeu Institute to calculate German flight emissions.

[5] LTO: landing and take-off phases (including average taxi times).

These effects are taken into account in air traffic either in the form of the RFI (Radiative Forcing Index) or the EWF (Emission Weighting Factor) (Grassl, Bockhagen 2007). The factors essentially differ in terms of the time horizon considered for their impact on increasing the greenhouse effect of the atmosphere. Both approaches presented here (RFI and EWF) are taken into account in the GHG monitoring tool to determine the climate effects.

The **RFI** is an impact metric that provides a factor for determining the effects of non-CO_2 emissions relative to the CO_2 emissions of a flight. It is therefore a simple ratio between the radiative forcing of the non-CO_2 effects of aviation at a given point in time and that of CO_2 emissions from aviation, cumulated since 1950. In principle, this metric also includes the effects of all past flights and thus reflects the history of all influences of aviation on the radiation budget up to the present. However, the duration of the effects is also taken into account, the formation of cirrus clouds in past decades has little to no influence on the current RFI, but CO_2 emissions still have (Grassl und Bockhagen 2007).

The **EWF** basically corresponds to the Global Warming Potential (GWP), which includes further non-CO_2 emissions in the form of (additional) CO_2 equivalents for flight emissions and quantitatively assesses the (future) greenhouse effect over a defined time horizon (usually 100 years). Thus, this reflects the integral of the resulting radiative forcing (CO_2 and non-CO_2 effects) after the emissions have been emitted over the defined time horizon. In contrast to the RFI, historical emissions do not play a role, but rather the future development of radiative forcing over a certain period of time.
To determine weighting factors for non-CO_2 emissions on the basis of individual flights and their specific routes, Dahlmann et al. (2021) use the ATR (Average Temperature Response) over a time horizon of 100 years. This takes into account the lifetime of the various climate-impacting emission components and effects as well as the climate sensitivity parameter. As this methodology is the only one that makes it possible to calculate flight route emissions using a published set of parameters, it is used to determine the EWF and the weighting factors for non-CO_2 emissions.

To calculate the RFI, the proportion of CO_2 emissions ($EM_{CO2,CCD,direkt}$) emitted directly in the CCD phase above an altitude of 9,000 m by the propulsion units is determined on the basis of a flight distance-dependent function ($\mathrm{AF}(D_{real})$). The RFI factor is applied to this proportion and the additional emission effect is added to the total flight emissions. This results in the following calculation rule for the GHG emissions per person travelling and flight, including upstream chain emissions and altitude effects (non-CO_2 emissions) based on the RFI:

- $$EM_{Person,Flight,total} = \frac{EM_{LTO,total} + \left((\mathrm{RFI}-1)\times \mathrm{AF}(D_{real})+1\right)\times EM_{CO2,CCD,direkt} + EM_{CCD,VK}}{AU_{Flight}} \times SC_{Class}(D_{GRC})$$

$EM_{CCD,VK}$ represents the GHG emissions from the provision of energy sources for the CCD phase as well as the other equivalents for N_2O and CH_4 that are not included in the direct CO_2 emissions ($EM_{CO2,CCD,direkt}$).

In addition, the GHG monitoring tool also uses a calculation based on the EWF. In Dahlmann et al. (2021) constant, distance-dependent as well as route-dependent greenhouse gas equivalents (ATR100[6]) including non-CO_2 effects are derived. The latter are

[6] Change in the mean near-surface temperature over a time horizon of 100 years.

recommended in order to calculate an EWF for NO_X, H_2O and climate effects induced by cloud formation as accurately as possible. In this case, the distance dependencies with regard to flight altitude are already implicitly included ($\mathrm{AF}(D_{real}) = 1$). The following therefore applies when calculating the effects of non-CO_2 emissions using the EWF in the GHG monitoring tool:

- $EM_{Person,Flight,total} = \frac{EM_{LTO,total} + EWF \times EM_{CO2,CCD,direkt} + EM_{CCD,VK}}{AU_{Flight}} \times SC_{Class}(D_{GRC})$

For the calculation of the flight route-dependent EWF factor and the RFI factors used in the GHG monitoring tool, see section 5.2. For each flight, the climate impact is calculated using three different RFI factors (2,3,4), the flight route-dependent EWF and optionally a freely selectable weighting factor to take account of altitude effects. In addition, results using RFI factor 3 without any dependence on travel altitude are provided. This takes into account the ranges of these values found in the literature as well as the comparability with other calculation approaches.

5 Emission factors

5.1 CO_2, N_2O and CH_4 as direct engine emissions and as emissions during the provision of fuels

The initial data basis for the calculation is TREMOD 6.22[7] (Allekotte et al. 2020). This allows fleet average values of greenhouse gas equivalents for CO_2, N_2O and CH_4 of all flight phases to be determined by distance class, including emissions for the provision of fuels (well-to-wheel), as well as the associated aircraft utilisation rates for the respective reference years. The TREMOD data represents flights that either depart or arrive in Germany, whereby the selection of the average aircraft fleet was restricted to commercial flights from the 27 largest airports in Germany in order to determine the distance-dependent factors for the GHG monitoring tool. Due to the availability of the complete statistics, the updated emission factors are only available from the previous year. This method is independent from specific aircraft type information to determine representative emission factors.

5.2 RFI and EWF factor to account for non-CO_2 effects in higher atmospheric layers

According to (Jungbluth, Meili 2019), there are literature values for the RFI that show a factor of 1.0 to 8.5 in relation to CO_2 emissions at high altitudes (stratosphere). In addition to three constant RFI factors 2, 3 and 4, a freely selectable RFI is therefore also included in the results calculations for the GHG monitoring tool. The EWF based on the flight route is determined according to (Dahlmann et al. 2021) as follows on the basis of the mean latitude between the departure and destination airports (Lat_m) and the flight distance (D_{real}, unit 1,000 km). Separate equivalent factors (EQ) are derived for CO_2, H_2O and NO_X emissions as well as cirrus cloud formation ($Cirr$) based on individual parameter sets:

- $EQ_{CO2} = 1$
- $EQ_{NOx} = [2{,}3 \times \arctan(D_{real}) - 2{,}0] \times [c_{NOx} \times {Lat_m}^2 + d_{NOx} \times Lat_m + e_{NOx}]$

[7] The TREMOD version is changing annually and with each update of the emission factors the number of the underlying TREMOD version changes.

- $EQ_{H2O} = [0{,}2 \times \arctan(D_{real})] \times \left[b_{H2O} \times {Lat_m}^3 + c_{H2O} \times {Lat_m}^2 + d_{H2O} \times Lat_m + e_{H2O}\right]$
- $EQ_{Cirr} = \left[1{,}1 \times \arctan\left(\frac{D_{real}}{2}\right)\right] \times \left[a_{Cirr} \times {Lat_m}^4 + b_{Cirr} \times {Lat_m}^3 + c_{Cirr} \times {Lat_m}^2 + d_{Cirr} \times Lat_m + e_{Cirr}\right]$
- $EWF = EQ_{CO2} + EQ_{NOx} + EQ_{H2O} + EQ_{Cirr}$

The coefficients required to determine the flight path-dependent EWF for the respective subcomponents NO_X and H_2O as well as the cirrus cloud binding ($Cirr$) are shown in Table 1.

Table 1: Coefficients for calculating the flight route-dependent EWF factor.

	a	b	c	d	e
NO_X			1,6E-04	-1,6E-03	8,6E-01
H_2O		-7,6E-06	8,2E-04	1,4E-03	1,5E-01
Cirr	2,8E-07	1,9E-06	-1,2E-03	-7,7E-04	1,7E+00

5.3 Factors for taking into account the different space requirements of different seating categories (comfort classes)

The different comfort classes of aircraft seats (first class, business class, premium economy and economy class) require different proportions of space and therefore passenger transport capacity in an aircraft. In order to allocate the flight emissions between the four classes, an estimate of possible allocation factors (SC_{Class}) is made on the basis of information on seat sizes and proportions in different aircrafts. The data is based on a statistic from the travel platform Tripadvisor (Tripadvisor 2022). As both the class shares and the seat sizes per class differ between short-haul and long-haul flights due to the types of aircraft, a distinction is made in the factors between flights shorter than and greater than 1,500 km great circle distance (see Table 2).

Table 2: Average allocation factors based on the selected seat class for short and long-haul flights

	Short-haul	Long-haul
First class	1.3	2.6
Business class	1.3	2
Premium Economy class	1.1	1
Economy class	1	0.9

Especially in first and business class, the factors here differ significantly depending on the distance class. While both classes are allocated 1.3 times the emissions of an average person travelling on this flight for short-haul flights, first class is allocated 2.6 times and business class twice the emissions for long-haul flights.

5.4 Dealing with data gaps and incorrect entries

In the event of incorrect entries for the departure and destination airports, an attempt is made to find a suitable assignment for the coordinates based on similar values (i.e., airport names or names of the airport location) in the internal database. If this step is carried out, a corresponding message is displayed in the results sheet both in the overall results sheet and an extra sheet which contains information on the airport assignment that has been made. If the start and destination coordinates cannot be identified or are identical, the emissions are assessed and documented in the results sheet. If no seat category is specified or cannot be derived from the information provided, the "Economy Class" category is set for the flight. Any algorithmic allocation for imprecise entries is noted in the results sheet for the corresponding flight.

5.5 GHG accounting results

The GHG emissions (well-to-wing) of the flights are available in seven variants and differ in the consideration of the flight characteristics or route-dependent amplifications of the greenhouse effect caused by non-CO_2 effects (see Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

If all input data has been sufficiently completed, the results are grouped and aggregated according to the following characteristic categories in addition to a list of all flights and the respective GHG emissions:

- Anonymised personal code: Enables the determination of an average value per travelling person (and year)
- Financing
- Purpose of journey
- Status group or academic position
- Affiliations to organisational units
- Trip number: enables the calculation of an average value per trip (and year) if a trip consists of several flights.
- Seat/Comfort classes
- Distance classes: short (<1,500 km) and long haul (>= 1,500 km)

The group-based analysis is used to identify the largest groups of emitters and thus to develop target group-specific measures. Further, they are used to calculate reduction scenarios and monitor the success of the measures. The respective reduction rates of the scenarios can be adjusted in the results sheet to facilitate the scenario calculations by the research organisation.

6 Methodological limitations and need for further research

- **Uncertainties in TREMOD AV**
  In the project " Neubewertung der Unsicherheiten der mit den zur Berechnung der Luftschadstoffemissionen im Verkehrssektor verwendeten Parameter und Methoden“ on behalf of the Federal Environment Agency, the known uncertainties of the TREMOD-AV accounting model were quantified using Monte Carlo analysis. (Allekotte et al. 2023)
- **The RFI is actually not the right metric**
  The RFI is not the correct metric for assessing the non-CO_2 effects of a flight in terms of the future impact it is expected to have on the greenhouse effect of the atmosphere. The reason for this is that the RFI actually indicates the ratio of radiative forcing in a given year caused by all historical aviation emissions up to that year. Thus, the RFI has a backward-looking perspective that depends on past and

current emissions. Nevertheless, the RFI has become widely used, especially in the field of greenhouse gas emissions offsetting. The calculation of GHG emissions from aviation requires a forward-looking perspective with regard to the expected effects of current emissions. The EWF takes into account the current and future effects of aviation on the climate and is therefore better suited to assessing current emissions (Azar, Johansson 2012).
Currently, both factors have a similar high numerical value with great uncertainty. (Grassl, Brockhagen 2007). For this reason, and due to the historical use of the factor among stakeholders, the non-CO_2 effects continue to be reported as RFI values. Additionally, the EWF is calculated in the results sheet as an alternative to the RFI factors.

- **The limit of 9,000 m flight altitude to take into account the non-CO_2-induced climate effect in the case of the RFI stated represents a simplified compromise.**
  For this reason, an additional result category for the RFI factor 3 is provided, which takes into account the non-CO_2-induced climate effect regardless of the level of altitude.
- **The CO_2 emissions emitted as the basis for deriving the water vapour and NO_X emissions for quantifying the non-CO_2 effects in the case of the EWF are subject to major uncertainties.**

7 References

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8 Annex – Input fields of Excel template for calculation

Data field	Explanation
Anonymized person code	Anonymized or pseudonymized personal code that is to be assigned uniquely for each flying person. This can be any numeric or alphanumeric code for each flying person. If this is not assigned, no per person flight emissions can be determined as a statistical value. This value can be assigned for project purposes without a link to the personnel number or similar.
University	Unique name or abbreviation of the institution
Travel purpose	Purpose of the flight. Required for further analysis and allocation of emissions and, if necessary, for the development of measures.
Travel purpose (addition)	Purpose of the flight. Further information for own, not predefined purposes. Please complete with purpose information when indicating "Other" in the mandatory "Purpose of Trip" field.
Position/Status group	Position of the traveler. Required for further analysis and allocation of emissions and, if necessary, for the development of measures.
Organizational unit – level1	Here the flights can be assigned to different organizational units and subunits. E.G.: Section -> Department -> Working group The levels can be defined by each institution according to its own structure and desired evaluation possibilities. If necessary, the number of levels can be increased.
Organizational unit – level2	
Organizational unit – level3	
Journey code / Trip number	The trip number is to be assigned uniquely. Different legs, e.g. outbound and return flight of the same trip are to be assigned the same trip number. For round trips, this can also mean that several flights are combined into one trip.
Date of flight (DD.MM.YYYY)	The departure date is mandatory in order to assign the trip to a reference year or to be able to clearly assign it via the flight number.
Airport code (Departure)	IATA code of the start airport (3 letters) for unambiguous determination of the start coordinates.
If no airport code: City of departure	Specification of the departure city (e.g. Munich, Frankfurt am Main, etc.) possible, since a 100% breakdown cannot be guaranteed on the basis of existing code lists (IATA code). Furthermore, this serves as a check against accidental incorrect entries.
If no airport code: Country of departure	Indication of the country of departure (e.g. Germany, Switzerland, etc.) possible, as a 100% breakdown based on existing code lists (IATA code) cannot be guaranteed. Furthermore, this serves as a check against accidental incorrect entries.
Airport Code (arrival)	IATA code of the destination airport (3 letters) for unambiguous determination of the destination coordinates. See also variable "Airport code (start)".
If no airport code: City of arrival	Location of the arrival airport. See also variable "If no flight number or airport code: Departure city".
If no airport code: Country of arrival	Country of the arrival airport. See also variable "If no flight number or airport code: Departure country.
Seat Class: Economy (E) Premium Economy (P) Business (B) and First class (F)	The booked travel class is to be specified here. Primarily for further evaluations and statistics.
Funding	Type of financing for the flight or the associated project. Required for further analysis and allocation of emissions and, if necessary, for the development of measures.
Billing Date (DD.MM.YYYY)	The accounting date or period can be optionally assigned if the GHG balance is to be harmonized with accounting periods.
Costs	This specification is optional. However, this quantity could be helpful for the plausibility check of entries as well as for further analyses.
Airline (Code)	Airline code (IATA) for further checks and, if necessary, evaluations
Airline (if no airline code)	Name of the airline for further checks and, if necessary, evaluations

About FlyingLess

With the internationalization of science and research, the air travel of university members has increased – scientists are among the frequent flyers.

The aim of the FlyingLess project is to support universities and research organizations in reducing air travel, which accounts for a significant proportion of their total greenhouse gas emissions. FlyingLess develops approaches to reduce air travel in the academic sector, which are implemented at different levels (research, teaching and administration).

The project is being conducted in close collaboration with four pilot institutions - the EMBL (European Molecular Biology Laboratory) and the MPI Astronomy in Heidelberg as non-university research institutions, and the Universities of Konstanz and Potsdam as university institutions.

Further information can be found on the website www.flyingless.de.

The project is led by the ifeu institut Heidelberg in close cooperation with the TdLab Geography at the Institute of Geography of Heidelberg University.

The project is funded over 3 years within the framework of the National Climate Initiative (NKI) of the Federal Ministry for Economic Affairs and Climate Action.

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We would like to thank Susann Görlinger, Curdin Spirig (ZHAW) and Dr Julien Anet (ZHAW) for their critical discourse and for providing us with the necessary sources and documents.