S2 Appendix. Calculation of air travel distances and the corresponding GHG emissions

The questionnaire includes questions on air travel for professional reasons in 2019 through two distinct sets of questions. The first set, concerning the number of flights and total flight time (to pick among four possible ranges), was asked to all respondents. This information was not used here; instead, we used information generated by a second set of more detailed questions posed to half of the respondents in a random manner.

The latter set of questions consists of a table in which respondents were asked to enter all the airplane journeys taken in 2019 (up to a maximum of 5 journeys), specifying for each one the number of times the journey was taken, the city of departure and arrival, the number of days spent at the destination, the main reason and any secondary reason for the trip. This approach encouraged respondents to recount in detail their professional trips in 2019 rather than give an approximate total number. A list of the main French and international airports was provided to the respondents, helping them to select the cities (without forcing them to choose from the list) and serving to limit manual recoding and ambiguous names. The GPS coordinates of the corresponding airports were obtained from a list of world airports and the orthodromic distance between the place of departure and arrival was calculated using the haversine formula. The distances reported are thus theoretical, the real journeys necessarily being longer, notably for flights involving stopovers.

Limiting the number of journeys to 5 implies an under-estimation of flying on the part of the respondents with the most air miles. Each of these 5 journeys is defined by a combination of departure, arrival, time spent at destination, and reason, but the number of flights that could be reported per journey is unlimited. Only 4% of respondents in PhD-level positions reported a fifth journey in the table. Of this 4%, 60% reported more round-trip flights in the simplified question than in the table, for an average of 10.6 round trips, compared with 6.2. Overall, the under-estimation of air travel in the table therefore appears to be limited.

The calculation of GHG emissions generated by air travel is subject to uncertainty depending on the way in which the radiative forcing resulting from factors other than CO₂ (vapour trails, etc.) is considered. These factors are not taken into account by some GHG calculators, while the literature suggests that in all likelihood they double the emissions factors of flights [1]. Based on [2], we can select emissions factors of between 200 g CO₂/pasenger/km (for short-haul flights) and 300 g CO₂/pasenger/km (for long-haul flights). The detailed data on flights collected in the survey could be used to establish precise estimates of the emissions corresponding to each flight, but for the sake of simplicity we report distances, and only a rough estimate of the average emissions is provided here.

References
