IAS Working group on Carbon Footprint: Towards a carbon neutral science society (Executive Summary, Feb. 08, 2021)

*A. Streb, R. Lively, P. Llewellyn, A. Matsumoto, M. Mazzotti, R. Pini, B. Coasne**
benoit.coasne@univ-grenoble-alpes.fr

Context. FOA conferences are a cornerstone of our community but they are responsible for large CO_2 emissions. To rethink and reinvent our conferences as carbon neutral meetings, the IAS has appointed a working group in the aftermath of FOA13 in 2019. This working group acts as a think tank to propose actions to achieve carbon neutral FOA meetings. Here, we briefly report on our main outcomes and conclusions: (1) expected CO_2 emissions for FOA14 (Denver, 2022) are estimated using different sources to get accurate numbers related to accommodation, building, flights, etc.; (2) results of IAS survey on carbon footprint reduction/compensation; (3) possible actions – relevant to CO_2 reduction or compensation – for the upcoming FOA meeting but also beyond.

1. Environmental Impact of FOA

A first task consisted in estimating the expected CO_2 emissions for FOA14 (Denver, May 2022). Such estimates were established by crosschecking data from different sources to get accurate values for CO_2 emissions related to accommodation, catering, building, waste, flights and transport. It was assumed that the participant distribution per country in Denver will be similar to FOA13 in Baltimore (**Fig. 1**). The carbon footprint in CO_2 tons [for ~300 attendees] per emission source is shown in **Table 1**. Dedicated websites were used to obtain estimates that are representative for Denver. For local mobility, an average of 100 km travel by e.g. car or bus was considered reasonable for airport transfer from/to home/conference site. A more refined strategy was used for flight-related emissions, because of their large contribution to the carbon budget. For participants living in the USA, a direct flight from their city to Denver was considered. For participants leaving in a different country, long-haul flights from their capital city to Denver was considered. ► The data suggest CO_2 emissions of 2.6 CO_2 ton/participant with ~ 87% of the emissions attributed to flying and 8% due to accommodation.

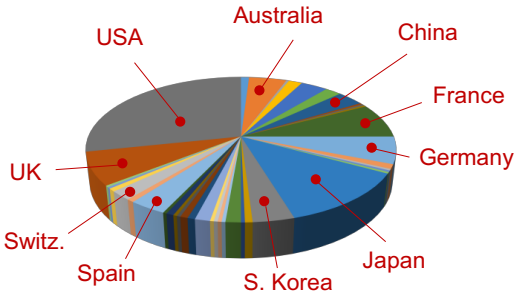

Fig. 1. FOA participants in Baltimore 2013 distributed per country. The main countries contributing to the overall ~300 participants are listed. For such a meeting organized in the United States, most participants come from USA, Europe, Japan, South Korea, and China.

If no CO_2 reduction actions are undertaken, ~78 USD/participant will be required to compensate for the emitted 2.6 CO_2 ton/participant. This number was estimated by cross-checking data from different organizations and by only retaining those that demonstrate high standard for efficient CO_2 compensation combined with additional sustainable development goals (as defined by the United Nations). In practice, even if other sources can be selected, the organization *myclimate.org* was considered reliable as it compensates through carbon offset projects which meet the highest standards (e.g. Gold Standard). ► Full CO_2 compensation only amounts to 78$, which is less than 10% of the typical FOA registration fees. For a participant, including this CO_2 compensation fee into their total expense – i.e. including traveling costs – represents an average increase below 2-3%.

Table 1. Expected overall CO_2 emissions for FOA14 in Denver in 2022. Detailed CO_2 emissions for accommodation, catering, transport, etc. are also shown. All data were estimated for 300 participants attending this 5 day conference hosted in a conference center ~3000 m^2.

Type	**Total in tons CO_2**
Accommodation	~ 60 (ave. Denver, 100 people share 1 room)
Catering + waste	~ 12 (catering 10, waste 2)
Energy (AC, heat.)	~ 12.7 (location dependent average)
Additional Mobility	~ 6 (100 km each person, in single car)
Transport	~ 10 (50 t of goods/materials over 50 km)
Flights	~ 680 (710 for 5 % business)
Total	**~ 781 tons CO_2**

2. IAS Survey on Carbon Footprint

An IAS survey was distributed in Spring 2020 to the extended IAS community. Survey data corresponding to answers from ~120 participants was analyzed in Nov. 2020. Two thirds of the participants are from academia (one third from industry), and 15% of the participants from academia are students/postdocs.

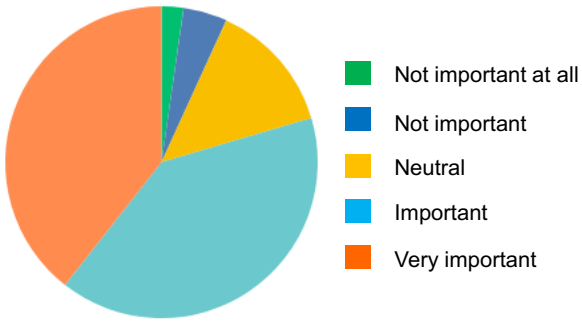

Fig. 2. Pie chart showing the answers to the question "how important to you is reducing FOA environmental footprint?"

► FOA carbon footprint. As shown in **Fig. 2**, ~80% of the survey participants consider important/very important to reduce FOA carbon footprint (only 7% consider it not important/not important at all). The answers are broadly distributed, but the participants estimate that the average emissions to attend FOA is ~3 t CO_2/participant – a value close to our estimate. Similarly, on average, the participants believe that flights largely contribute to overall CO_2 emissions – with a value close to that estimated from our carbon footprint assessment [87%].

► CO_2 emission reduction. About 65% of the participants are at least somewhat likely to attend a pre/post FOA school/workshop with an acceptable all-inclusive cost of ~75–175$/day. Moreover, ~50% of the participants are highly in favour of satellite FOA conferences that would occur in different places but with the same on-line common sessions. However, ~30% of the participants are against this option. If FOA were broadcasted on-line (on-site attendance combined with possible remote access), most participants indicate that 0-10 people around them would attend online (including them) with an average of 3.5 (median between 2-3). As for an acceptable on-line access fee, answers vary broadly from 10 to 400$ with an average of ~100-120$. In contrast, 8-10% of the participants indicate that they would not attend remotely. Participants are interested in sharing accommodation or taxi from/to the airport if a simple tool is made available (~85% for taxi, 30% for accommodation). Most participants support to have ≥ 3 meatless/cold meals and ~70% of the participants are in favour of less fancy gala/welcome reception (**Fig. 3**).

Meat less meals

0	1	2	3	4	5	6	7
10.00%	0.83%	8.33%	18.33%	14.17%	12.50%	1.67%	34.17%

Cold meals

0	1	2	3	4	5	6	7
9.17%	4.17%	10.83%	20.83%	20.00%	17.50%	2.50%	15.00%

Fig. 3. Answer distribution to the questions "How many meat-less meals would you find acceptable during the FOA conference?" (top) and "How many cold meals would you find acceptable during the FOA?" (bottom) [from 0 to 7 meals in total, including 5 lunches, welcome reception and conference dinner)]

► Compensation. About 66% of the participants are aware of carbon compensation by financially supporting emission reduction projects; 30% of the participants indicate that their employer is compensating (at least partially) for their flight/trip emissions; ~34% of the participants declare that they personally compensate such flight emissions at least partially. Regarding a registration fee increase to compensate the carbon footprint [~78$/participant], 50% prefer such increase to be optional while the other 50% prefer such increase to apply to every participant. Answers about a reasonable fee increase to achieve carbon neutral meetings vary broadly between a few 10$ to a few 100$. About 38% of the participants do not support the idea of a fee increase to compensate emissions.

3. Propositions for Upcoming and Future FOA Conferences

The IAS working group formulates the following recommendations. Some of these propositions – in italic below – can be or are being implemented for the upcoming FOA meeting.

Reduction of CO_2 emissions

- **Pre/post FOA events.** The survey data indicate that the IAS members would support and attend a pre/post FOA school or workshop. While this would not reduce the FOA carbon footprint, such joint events would better justify all travel-related CO_2 emissions.

- **Satellite conferences.** About 50% of the participants are in favour of satellite conferences. Typically, three conferences (the main FOA conference plus 2 satellites) would be held in parallel: one in the US, one in Pacific/Asia, and one in Europe. This would allow more people to attend whilst reducing travel and, hence, carbon emissions, cost and time.
- **Low local carbon footprint.** *The use of reusable materials combined with a few meat-free and/or cold meals would decrease the FOA carbon footprint. Similarly, a less fancy gala/welcome reception could be organized as it would be strongly supported by the community. These actions are more symbolic than effective, but they increase awareness to achieve carbon neutral conferences.*
- **Shared local transport/accommodation.** A simple on-line tool could be set-up to book shared taxi from/to the airport to/from the conference site but also on-site shared accommodation.

CO_2 compensation

- **Online access to FOA.** *On-line access to FOA through live streaming and/or recorded webinars could be provided at a reduced fee. Such extra income would be used to compensate carbon footprint. The FOA-14 chairs are currently exploring propositions to ensure that (1) FOA14 online access does not make the on-site FOA attendance drop, and (2) the income/outcome budget is balanced.*
- **Increased sponsoring.** Use IAS carbon footprint initiatives to foster industrial/academic sponsoring with the aim to compensate the FOA carbon footprint. A "Green sponsor level" could be created to identify partners supporting our carbon reduction/compensation actions. To ensure that this sponsoring is beyond normal sponsoring level, a FOA session dedicated to industrial carbon capture and storage could be included as a showroom for industrial partners. Oral presentations would be offered to partners who (1) already sponsor the conference, and (2) pay a fee to access this session.
- **Increased registration fees.** Increase registration fees (typically, cap at 10%). Considering the results from the IAS survey (50% against a general fee applying to everyone), it is suggested to leave this increased fee optional. We recall that CO_2 compensation to attend FOA only amounts to ~78$/participant (<10% of the FOA registration fee and only 2-3% of the total amount spent to attend FOA).

Beyond FOA conferences

As estimated in our study, CO_2 compensation for the upcoming FOA conference requires 23,400$. In order to control/follow compensation actions that will be undertaken, an IAS special committee could be appointed. The goal is not to act as a substitute of specific CO_2 compensation organizations, but to follow/coordinate the interactions with such partners and ensure that the CO_2 fund is used according to IAS standards/wishes. This CO_2 committee, which would gather academic experts plus industrial partners, would be in charge of selecting projects among those proposed by CO_2 compensation organizations.

Another important action that could be discussed concerns a possible raise in the IAS annual membership to help compensate FOA carbon footprint. Typically, a 10$ increase in the annual membership would provide a 30$ carbon compensation credit since FOA meetings are held every 3 years (assuming the number of IAS memberships roughly equals the number of FOA participants).