# An approach to less climate-impactful conferencing

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Abstract. Air travelling has a large and rapidly increasing impact on our global climate; as frequent conference goers, we all share an uncomfortable responsibility. We describe a modest attempt at reducing conference-related air travel while remaining true to the core benefits of scientific conferencing.

## The cost of air travel on our global climate

The allure of international travel will be familiar to most academics. Indeed, such travel presents a raft of benefits: the chance to deliver a talk at prestigious conferences; to meet with collaborators; and to network and develop one's professional reputation.

However, this travel comes at a considerable cost, not just to our budgets and to our lifestyles (including family life), but also to the global environment. For those who regularly travel long-distance, flights will generally be responsible for the largest proportion of their carbon footprint. For instance, a single return flight from London to New York contributes to almost a quarter of an average UK citizen's annual carbon emissions [2]. While air travel is not the only contributor to global warming, the emissions from this sector alone could exceed the constraints necessary to remain within the +2°C goal of the Paris accord [1].

For detailed information on the anthropogenic impacts on our global climate, one may consult the International Panel on Climate Change's synthesis report [IPCC14], written by some of the world's most authoritative experts on the subject. They write (paraphrasing [IPCC14, p.20]):

> Without additional efforts to reduce greenhouse gas emissions beyond those in place today, global emissions growth is expected to persist. In such a scenario, global mean surface temperature increases in 2100 range from 3.7°C to 4.8°C above the 1850–1900 average. They range from 2.5°C to 7.8°C when including climate uncertainty (5th to 95th percentile). Emissions scenarios leading to warming below 2°C over the 21st century relative to pre-industrial levels are characterized by 40 to 70% global anthropogenic emissions reductions by 2050 compared to 2010, and emissions levels near zero or below in 2100.

In short, in order to avoid ***catastrophic*** effects (cf. p.65 of [3]) of climate change on humanity, the global $CO_2$ emissions must be reduced by roughly 50% in the next 30 years. In view of the overwhelming evidence supporting these dire predictions of the future, it seems unwise to ignore this situation or declare an inability to affect it.

## What we did

We organised a 'double conference' with the following stated purposes:

(i) Lower the environmental impact (compared to other like events), by reducing the amount of flying.

(ii) Raise awareness about climate change, and the responsibility that academics all share as frequent travellers.

(iii) Spark the participants' imagination for the possibility of offering alternatives to the standard conference model, aided by present and forthcoming technologies.

In August 2018 we organised an international event entitled "Higher algebra and mathematical physics": https://www.mpim-bonn.mpg.de/HAMP. This event was a conference that was simultaneously held in two locations, one on each side of the Atlantic Ocean. One venue was the Perimeter Institute, in Waterloo, Canada; the other venue was the Max Planck Institute for Mathematics, in Bonn, Germany. The presentations and discussion sessions were live video streamed between the two institutes. The organisers, presenters, and other participants were adequately

distributed between the two locations, and all were encouraged to attend the location which was closer to their home institution.

A typical presentation was an hour long, followed by questions from the audience. There was a 'live' audience, who shared the venue with the presenter, and a 'virtual' audience who participated via video link from the other side of the Atlantic. At the live venue, a video of the virtual audience was visible to the presenter and live audience. At the virtual venue, a video of the presenter was projected life-size, and also a video of the live audience was visible via monitor or projector. Audience members at either venue were able to ask questions during the talk. Following the presentation, each venue would take turns soliciting questions for the presenter. With this concluded, video and audio would continue so that participants could ask the presenter further questions 'in-person'.

To our knowledge, this was the first implementation of such technologies for a mathematics conference. Teleconferencing is typically inadequate for spontaneous informal mathematical discussion (and it would not be a stretch to suggest that such discussion is the primary utility of a mathematics conference). To facilitate such discussion, we set up two "wormholes" between the conference sites. Each wormhole consisted of a pair of 80-inch touch-screen monitors, one at each venue, set up as digital whiteboards with shared whiteboard environments and audio-video connections. Conference participants were encouraged to arrange transatlantic meetings, either using the wormholes or their private video-calling accounts.

## What we learned

The participants of this conference were overall happy to be part of this experimental setup. They were generally forgiving of small technical glitches and provided useful feedback on how the technical setup could be refined in future.

We relied on state-of-the-art technology (notably, high-quality microphones that could pick up a presenter's voice, as well as sound from the audience) and on experienced technical teams who set up, tested, and controlled the technical equipment. It is our feeling that this double-conference format requires at least one person at each venue whose attention is entirely devoted to these technical aspects for the duration of the event as well as a couple days before for setting up the equipment. Current technology supports this double-conference format, but there is ample room for improvement, with prior set-up and testing being essential to the success of such an event in the future.

The organisers and technical support team communicated with each other through a chat forum to give constant feedback on adjusting aspects of the live stream. Having a large organising team was helpful for us to manage all the unforeseen tasks that accompanied the event. The wormholes were not as effective as we had hoped, due to technical problems and limited enthusiasm from participants. In the future, in order to spark increased use of these conference-wormholes, one could ask each speaker to hold an "office hour" after their talk at a pre-assigned wormhole.

Overall, we were very glad to have run this experiment, and two of us have already started organising a second double conference. As technology improves, we expect that such digital conferences will become an important tool in reducing the considerable carbon footprint of mathematicians' conference travels.

## Conclusion

We encourage all academics to be thoughtfully aware and adequately informed of the environmental costs of international travel. While we do not advocate ceasing all long-distance travels (thereby risking intellectual fragmentation), we implore our academic community to experiment and seek realistic alternatives to air travel while not unduly sacrificing the present benefits of such travel.

## REFERENCES

[1] Bows A., Anderson K., Upham P. *Aviation and Climate Change: Lessons for European Policy*. (2009) Routledge.
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[3] *Climate change 2014 Synthesis report.* International Panel on Climate Change (IPCC). www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf