

# Fly less to convey urgency

Last week, just days before the United Nations Climate Summit in New York, students across the globe protested in response to inaction over the greatest threat to humanity. Climate breakdown exists on a continuum of harm—it will get worse the hotter the planet gets. Limiting the catastrophe requires an effort at all scales of society.

Climate breakdown can't be fully understood without data, sophisticated analysis, and models. These tools of science are needed, for example, to formally attribute disasters such as hurricanes, floods, and wildfires to human-caused global heating, or to understand what humanity will face on a hotter planet. It is understandably difficult for the public and policymakers to directly consult the peer-reviewed literature and respond appropriately. This suggests that scientists have an ethical responsibility to alert the public.

In a perfect world, alerting the public could be done with summary reports on the science, such as those that the United Nations Intergovernmental Panel on Climate Change (IPCC) have produced since 1990. However, these reports have not led to meaningful action; greenhouse gas emissions continue to increase rapidly. Now, the climate crisis is so severe that many scientists are looking for other ways to persuade society to accelerate climate action.

Through my own experience as a scientist, I've found that facts, emotions, and personal actions are necessary for successful communication. When a scientist speaks only in the language of facts, the message gets through mostly to other scientists. Those without scientific training tend to look for emotional cues and reasons to trust scientists; without them, they may underestimate a scientist's level of concern. Scientists can bridge this gap by also speaking from the perspective of a concerned citizen and by taking personal actions that the public can relate to.

In 2010, I flew some 50,000 miles, most of them to scientific meetings. When I estimated my carbon emissions, I found that flying accounted for three-quarters

of the total. Over the next 2 years, I reduced my flying, which involved shifting the expectations of friends, family, and colleagues.

Hour for hour, it's hard to find a better way to heat the planet. Flying coach burns 0.2 to 0.3 kg of carbon dioxide (CO<sub>2</sub>) worth of jet fuel per passenger mile, roughly equivalent to driving (alone) a gasoline car that gets 40 to 50 miles per gallon. Add three passengers, and the car emissions go down to 0.06 kg of CO<sub>2</sub> per passenger mile. Short-term radiative forcing from ozone production, contrails,

and cirrus cloud formation further increases the climate impact of planes. Although aviation accounts for only 2% of global carbon emissions, flying less could be a powerful lever for cultural shift. In some sectors, including academia, flying reflects freedom and even success. If scientists fly less, it could communicate climate urgency more effectively.

Frequent flying is often justified by carbon offsets or by invoking the possibility of future carbon-free flight. However, battery energy densities are still an order of magnitude too low to support long-distance flights, and there is not enough biofuel to support aviation at the scale needed. Offset companies cannot guarantee that offsetting practices will permanently sequester an

equivalent amount of carbon and even if they could, people should be embracing those practices anyway, without negating them with flight emissions.

Not all scientists can eliminate flying, but it's time for the scientific community to find creative alternatives to the fly-in meeting. These could include regional meeting hubs connected by remote technology, asynchronous online-only conferences, or virtual reality conferences. Such efforts could lead to co-benefits such as smaller, specialized meetings and increased participation by students and low-income nations. Flying is tied to the scientific profession and flying less is an action that can be taken as a community, amplifying individual actions through the authority of its institutions and professional societies and sending a clear message of climate urgency to the public.

—Peter Kalmus



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# Science

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