guardian.co.uk

ENVIRONMENT BLOG

# The surprisingly complex truth about planes and climate change

A new study suggests that planes cause more warming than cars, while ships are cooling enough to counteract them both

Air travel causes more warming than cars, while shipping counteracts them both. Photograph: David Levene for the Guardian

We hear much about the environmental costs of air travel. As our recent Q&A explained, the problem is not just that planes burn a lot of fuel and therefore kick out plenty of $CO_2$ per passenger. Just as important are a host of other high-altitude impacts, including vapour trails and ozone production, that are usually estimated to cause as much warming as the $CO_2$ itself.

Hence we often hear that although air travel accounts for only a small fraction of global emissions (relatively few people can afford to fly), one transatlantic flight can add as much to your carbon footprint as a typical year's worth of driving.

Surely it couldn't get any worse, could it? Unfortunately for green-minded air travellers, it just did. Kind of.

The wrinkle, always vaguely understood by climate geeks but finally explored in depth in a recent scientific paper, is that the relative impact of different types of travel depends not just on practical factors such as engine efficiency and occupancy rates, but also on something altogether more abstract: the time frame you care about.

The reason this is so crucial is that the effects of different greenhouse gases play out in the atmosphere at a different speeds. $CO_2$, released by all fuel-burning vehicles, can remain in the air for centuries, causing a gentle warming effect. By contrast, most other gases and impacts – such as the vapour trails and tropospheric ozone produced by planes at altitude – cause much more potent but shorter-lived bursts of warming.

If you'll forgive an extension to the "frying the planet" metaphor, generating global warming with $CO_2$ is equivalent to slow-cooking the earth in a cast-iron skillet, whereas

cooking the planet with vapour trails would be more like flash-frying it in an extra-hot wok.

In order to tot up these differently paced warming impacts into a single carbon footprint number for a flight or any other activity, it's necessary to decide what time frame you're talking about. Conventional wisdom is to add up the total warming impact of all the different greenhouse gases over the period of a century to create a nice, round but ultimately arbitrary number.

If, by contrast, we shifted the focus to a much shorter time period – which arguably would make more sense, given that the next decade or so could turn out to be make-or-break in terms of avoiding climate tipping points – then the impact of vapour trails and other short-lived impacts look massively more significant.

At risk of over-stretching the frying-pans analogy, the flash-fry wok may be more likely to cause a disastrous kitchen fire than the slow-cook skillet, even if they both use the same amount of heat overall.

The new paper, published in the journal Environmental Science and Technology, finally pins some numbers on all this theory by examining the impact over different time periods of various different modes of transport. The results are illuminating.

According to the paper, if we focus just on the impact over the next five years, then planes currently account for more global warming than all the cars on the world's roads – a stark reversal of the usual comparison. Per passenger mile, things are even more marked: flying turns out to be on average *50 times* worse than driving in terms of a five-year warming impact.

If we shift to a 20-year time frame, things look completely different. The short-term impacts have largely died down and the plane looks considerably better – helped along by a quirk of atmospheric chemistry which sees nitrous oxide pollution from the aircraft engines causing cooling during this period by destroying methane in the air. The paper even suggests that for any time frame longer than 20 years, flying is typically greener per kilometre than driving (although when I phoned to check this, one of the authors of the report confirmed my suspicion that this isn't true in Europe, where fuel-efficient cars are more popular).

Of the various forms of transport examined by the researchers, shipping is the other one most markedly affected by short-term climate impacts. Here, however, everything is in reverse because the major short-term effect of shipping is sulfate aerosol pollution. While they remain in the air, these aerosol particles bounce sunlight away from the earth and therefore cause cooling rather than warming. The extent of this effect is amazing: if I'm understanding the numbers correctly, over a five-year time frame the world's ships cause enough cooling to offset the total warming caused by every car, plane and bus combined.

Even over a 20-year time frame, shipping pollution still contributes an overall cooling effect – as do electric trains, due to the aerosol pollution kicked out from coal-fired power stations. This throws up a tricky issue for policy makers and industry. If we clean up some kinds of air pollution for the benefit of environmental and human health, then we stand to significantly accelerate global warming in the near-term.

However the world deals with that particular conundrum, the new paper is a useful reminder that carbon footprints are more multi-dimensional than is usually understood. If we want to buy ourselves as much time as possible to avoid climate-tipping points, it may not just be *how much* warming something generates that matters, but *when* that warmth kicks in.

This issue isn't limited to transport, of course. Any activity that generates lots of methane, nitrous oxide or other non-$CO_2$ greenhouse gases will have a much faster warming effect than its carbon footprint, as traditionally expressed, might suggest. That would include meat and rice farming, landfill sites and fridge production, for example.

All of which is – for carbon geeks such as myself, at least – very interesting. What I'd like to know next is how much work has been done on analysing how near-term rates of global warming fit with the risk of overstepping climate-tipping points. Any pointers?

Previous
Blog home