



FLIGHT TURBULENCE

December, 2023

This summer I flew to Europe, to see the Matterhorn and Switzerland and then to explore Prague and Budapest with friends. Last winter I joined family in southern California. These were wonderful journeys, but I worried about contributing to climate change by flying; I experienced *flygskam* or flight shame. I decided to find out what my carbon emissions were and whether carbon credits could offset them.

What were my carbon emissions from flying?

Using online calculators, carbon emissions are approximately 0.2 to 0.5 tons CO₂ for short flights on one coast, 1ton coast to coast, and 2.5 tons West Coast to Europe, round trip per passenger in Economy class. My trips to southern California and Europe together generated about 3 tons of CO₂. I learned that emissions will be greater for multiple short hops than one longer non-stop over the same distance because take-off uses the most fuel during a flight. And if one flew First Class, the bigger seat would be allotted a bigger share of the airplane's emissions.

Is 3 tons of CO₂ emissions a lot?

Aviation alone accounts for 2.5% of *global* CO₂ emissions a year, or 3.5% if non-CO₂ warming effects are included.[1] *Per capita* CO₂ emissions in 2021 were 4.3 tons/year worldwide and 14.29 tons/year in the United States.[2] We Americans are richer, consume more, and emit more carbon. Aviation contributes a few percent of carbon emissions a year globally, but flying is a large part of emissions on an individual scale.

Would carbon offsets erase my emissions?

Purchasing carbon credits support projects that reduce or avoid or remove future greenhouse gas emissions, such as building hydropower, disbursing efficient cook stoves, preserving peatland, or planting trees. However, these voluntary offsets are unregulated and even certified projects have been challenged regarding actual reductions in greenhouse gases.[3] The cost to offset one ton of CO₂ emissions ranged from \$8.37 to \$31.45 in my limited online sample.[4] I did buy carbon offsets, knowing that they wouldn't get rid of the CO₂ my flights added to the atmosphere, but might help to lessen emissions going forward. There are lots of ways to support climate action; I could have donated to nonprofits working on decarbonization, sought organizations with matching interests, checked out local climate programs, etc.

So what? Why do carbon emissions matter?

Carbon emissions from flying stay in the atmosphere for hundreds of years, adding to our collective greenhouse gas emissions. Since heat trapping is proportional to the total carbon emissions, to limit global warming to a target level requires limiting cumulative emissions to a finite carbon ceiling. By current models, **all** remaining emissions would need to be limited to 250 gigatons of carbon for a 50-50 chance of limiting warming to 1.5°C above pre-industrial levels! For a 67% chance of limiting warming to below 2°C, the carbon budget would be 950 gigatons. Delay makes things worse. Total global emissions last year were 57.4 gigatons.[5] Our carbon budget is running out; we cannot add much more carbon to the atmosphere.

What to do...

This writing space is not for shaming or blaming. Some folks fly for work-related reasons, some to nurture social ties in this lonely age, and some are fulfilling dreams. There are overseas destinations that still call to me and when days are gray I wish for sun and the friends I miss, only a short airplane ride away. However, when I contemplate carbon emissions lasting for centuries, it is clearly better not to fly! My flying days are limited anyway, as I grow less willing to face crowds, exposure to disease, airplane delays, and increasing flight turbulence. There are other ways to travel and explore! I look forward to flight-free adventures.



Footnotes (my comments in italics)

1. Hannah Ritchie (2020) - "Climate change and flying: what share of global CO2 emissions come from aviation?" Published online at OurWorldInData.org. Retrieved from: '<https://ourworldindata.org/co2-emissions-from-aviation>' [Online Resource] *I like Hannah Ritchie's data-rich newsletter, "Sustainability by numbers."*
2. Wikipedia: List of countries by carbon dioxide emissions per capita (https://en.wikipedia.org/wiki/List_of_countries_by_carbon_dioxide_emissions_per_capita)
3. Can you really negate your carbon emissions? Carbon offsets, explained (<https://www.vox.com/2020/2/27/20994118/carbon-offset-climate-change-net-zero-neutral-emissions>)
In general, offsets should lead to real, verifiable, permanent or long-term carbon decreases that would not have happened otherwise (additional). They should be unique (not double counted), not lead to increased emissions elsewhere (leakage), and not harmful; social benefits are a plus.
4. Carbon credit providers accessed online (not endorsements):
 - Tradewater (<https://tradewater.us>) – refrigerant gases, methane from uncontrolled wells
 - Burn (<https://www.burnstoves.com/carbon-credits/>) – efficient cookstoves
 - Cool Effect (<https://www.cooleffect.org>) – based in Marin County; 501(c)3 so contributions (minus 9.87% fee) are tax deductible
 - myclimate (<https://www.myclimate.org/en/>) – up to 20% administrative expenses (but some offset providers didn't disclose expenses)
In comparison, Climeworks (<https://climeworks.com>) charges \$1400 to remove one ton of CO2 by direct air capture. Carbon sequestration and storage is expensive and not yet scalable.
5. UN environment programme, Emissions Gap Report 2023 (<https://www.unep.org>)

Additional resources

- A roadmap toward a sustainable aviation ecosystem, National Renewable Energy Laboratory (<https://www.nrel.gov/docs/fy22osti/83060.pdf>) – sustainable fuels, airports, aircraft
- We Stay on the Ground (<https://westayontheground.org/questions-and-answers/>) – go flight-free
- Stay Grounded (<https://stay-grounded.org>) – reduce air traffic