AVIATION GLOBAL CARBON EMISSIONS

Full story here!

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Talking about being "eco-responsible" is the trend. But since in our team, we are true students, we were already talking about the next summer holidays. In the middle of the discussion, we suddenly became worried about a specific aspect of the holidays: What role does aviation play in global carbon emissions?

Datasets

We used 80 million flights tracked from 2016 onwards, 7'700 different airports, 133 different aircraft types, and 45'200 aircraft registered to different countries worldwide. Getting access to this data is not easy since most information is private and not readily accessible to download. The aircraft type was scrapped from Wikipedia. The airport data was provided to use from OpenFlights.org. PlaneSpotters gracefully granted us access to their production database of aircraft registration. OpenSky gave us access to their historical database of ADS-B records that they started to collect in 2016.

80 million flights — OPENSKY

45'000 aircraft — PLANESPOTTERS.NET

7'700 airports — OpenFlights.org

133 aircraft

Data Cleaning

Out of the 80 million flights, some had unknown departure or arrival airports. The decision was taken to drop these flights, leaving us with 33 million usable flights. For aircraft, a lot of irrelevant data such as military, private, scrapped, destroyed, and written off aircraft had to be filtered out. The aircraft consumption data had duplicates that were manually verified and averaged to ensure accuracy in the data. And a manual dataset had to be created to link inconsistent naming of aircraft with regards to the names used on Wikipedia.

Analysis

To analyze our data, we split our story into four chapters. While the results are shown under "Results", here is the explanation of how we found them:

Chapter 1:

First off, we interested ourselves in the relation between the size and the carbon emissions of aircraft. Bigger planes fly bigger distances and hence we were looking for an ideal travel distance. We also wondered if more recent airplanes were less pollutant.

Chapter 2:

The results we found were interesting and led us to different types of traffic and different airlines. We computed the small and the big polluters amongst airlines.

Chapter 3:

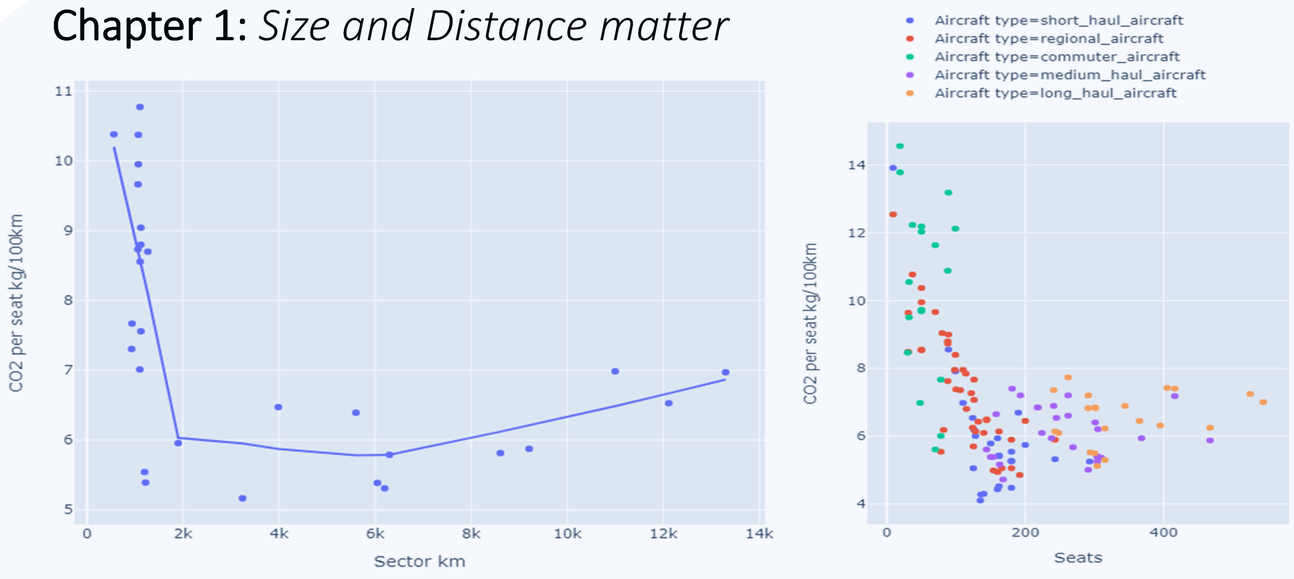
Full of confidence after the findings of the first two chapters, we explored the differences between countries. However, even if we found significant differences, we were not able to explain them with an interesting correlation such as the GPD.

Chapter 4:

Since worldwide data was not interesting enough and that we were planning to go on holiday from Switzerland, we looked at the routes flying from our home country.

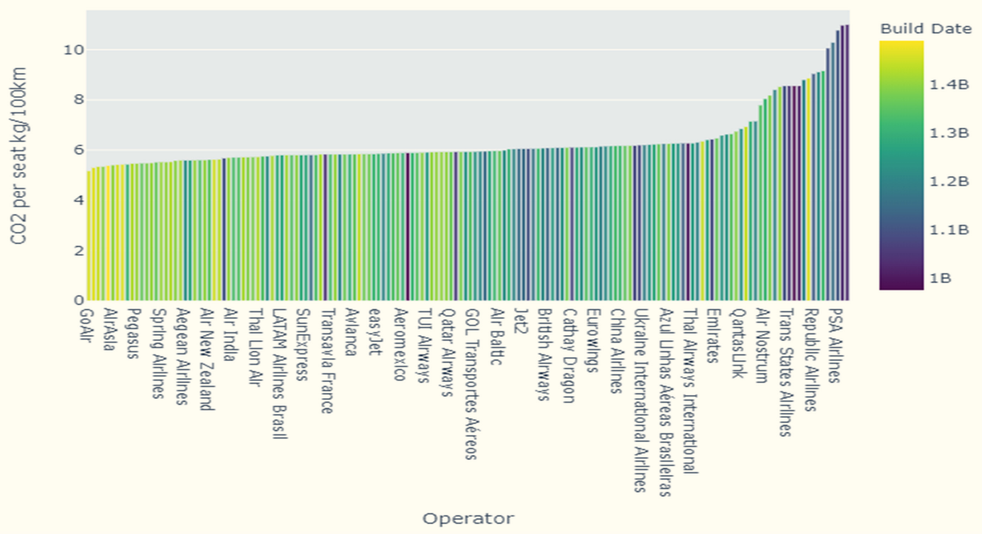
Results

Chapter 1: *Size and Distance matter*



As you can see on the left, the ideal sector of an aircraft is located between 2000km and 8000km. On the right, you can observe that aircrafts with less than 200 seats (mostly commuter aircraft) are the most pollutant. You can also see a correlation between those two graphs which confirms that bigger planes (i.e. with more seats) fly bigger distances.

Chapter 2: *More recent = more efficient*

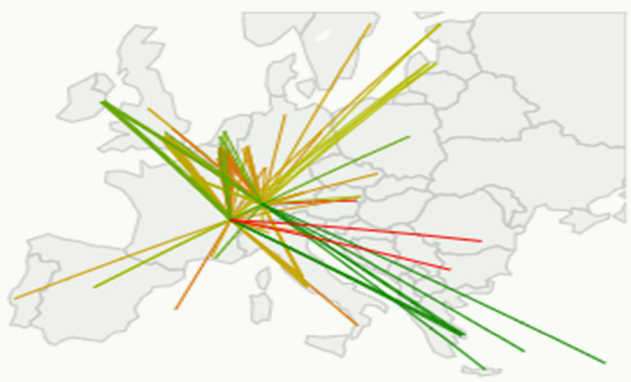


Interesting : the most pollutant airlines tend to have older planes!

Chapter 4:

Home Swiss Home

We found a significant difference between routes starting from Switzerland and going to the EU. Those results confirmed our findings from chapter 1: flights longer than 6000km and shorter than 2000km have higher CO2 emissions.



8.8 kg/100km
Average CO2 emissions by passenger driving in CH.

Boeing A220-300
Least pollutant widely-used aircraft

7.05 kg/100km
Average CO2 emissions by passenger flying Swiss

Bombardier CRJ-100
Most pollutant widely-used aircraft