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Global footprint of commercial aviation emissions

New research has estimated the global footprint of emissions from commercial aircraft. In 2006 nearly 190 million tonnes of fuel were burnt and 162 million tonnes of carbon from CO_2 were emitted. The vast majority of the fuel was burned in the Northern hemisphere and half the emissions were over the US, Europe and East Asia.

Monitoring and reporting emissions from aviation is an important part of EU policy on air quality and climate change[1]. The study analysed global aviation data[2] and described how aviation emissions differ between regions and over time. It calculated the amount of fuel burnt and emissions of CO_2, nitrogen oxides, sulfur components, and particulate matter, such as black carbon, using data from 2004 and 2006.

The results indicated that the global aircraft fleet burnt 188 million tonnes of fuel in 2006, which was an increase of 8 per cent from 2004. For both years, nearly all the fuel (about 93 per cent) was burnt in the northern hemisphere and nearly 70 per cent in the mid-latitudes of 30 to 60 N. Most of Europe falls within these latitudes.

These flights emitted 162 million tonnes of carbon from CO_2 in 2006, which represents about 2-3 per cent of global CO_2 emissions from human activity. 26 per cent of the emissions occurred within the US borders, 15 per cent within the OECD European region and 11 per cent within Eastern Asia. Although these three regions only account for 7 per cent of the global surface area, they receive over half of all aviation emissions. Interestingly, when considering emissions per unit area, the US falls just behind Europe which has a figure of 3730 kg of carbon from CO_2 per km^2. Japan has the highest emissions per unit area at 4694 kg of carbon from CO_2 per km^2.

The Arctic is another region of interest as total emissions were small but emissions per unit area were about one sixth of the 2006 global average. Over 95 per cent of emissions were at an altitude above 7 km where they have a longer residence time. In Europe, 65 per cent of emissions were above 7 km. Typical wind patterns tend to push emissions from the mid-latitude into the Arctic and then trap them there, which is significant for an area that is highly sensitive to climate change.

A seasonal peak in emissions in July and August was identified, and a weekly peak on Thursdays and Fridays. The study suggested that short-haul flights dominated in 2006 with 85 per cent of flights being under three hours. Long-haul flights lasting more than six hours only accounted for 4 per cent of flights, yet both short and long-haul flights produced roughly the same share of total emissions at just under 40 per cent each. The remaining percentage of emissions was from medium-haul flights.

The researchers suggested that the dominance of short-haul flights indicated potential for encouraging more travel by trains or buses by improving pricing and transportation systems.

While there are large uncertainties in relating aviation emissions to pollution and climate change, knowing the location and pattern of emissions is the first step to calculating potential impacts.

1. See: http://ec.europa.eu/environment/climat/aviation/mrv_en.htm
2. See: http://www.volpe.dot.gov/index.html

Source: Wilkerson, J.T., Jacobson, M.Z., Malwitz, A. *et al.* (2010) Analysis of emission data from global commercial aviation: 2004-2006. *Atmospheric Chemistry and Physics.* 10: 6391-6408.

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