Minimizing the Climate Impact of Aviation

A recent British study has analysed the most important factors influencing the warming effect on climate from condensation trails formed from the water vapour emitted by aircrafts at high altitude. The results of the study suggest that shifting air traffic from nighttime to daytime may help to minimize the climate effect of aircraft condensation trails, thus reducing the climate impact of aviation.

Aviation releases gases and particulates which alter the atmospheric composition, thus contributing to climate change. Although aviation's contribution is still small compared to other sources of human emissions, the rapid growth of air traffic is increasing the impact of aviation on climate. Even though there has been significant improvement in aircraft technology and operational efficiency, this has not been enough to neutralise the effect of increased traffic, and the growth in emissions is likely to continue in the next decades. If the present trend continues, it is expected that emissions from international flights from EU airports will increase by 150% by 2012 in comparison to 1990 levels. One of the effects of aircrafts is the emission of water vapour, which at high altitude often triggers the formation of condensation trails, i.e. line-shaped ice clouds that are also called "contrails", which tend to warm the Earth's surface by trapping outgoing heat emitted by the Earth and the atmosphere. Furthermore, such contrails may develop into cirrus clouds, which are suspected of having a significant warming effect, but this remains uncertain. It became necessary to improve the understanding of the resulting impact of contrails on climate.

Recently, British researchers have analysed the factors that influence most importantly the net warming effect of contrails, using a sophisticated radiative transfer model. In particular, the study aimed at understanding which parts of the diurnal and annual cycle of relevant parameters have the largest impact on this phenomenon. They considered, over daily and annual timescales, varying levels of air traffic, meteorological conditions, and solar insolation over a site in southeast England, located in the entrance region to the North Atlantic flight corridor.

The results show that flights during winter (December to February) are almost twice as likely to form contrails as are summer flights and contribute 50% to the annual mean warming effect attributable to this phenomenon, even if they account for only 22% of annual air traffic. Moreover, night flights (from 18:00 and 06:00), which account for only 25% of total air traffic, contribute 60 to 80% to the net warming effect attributable to contrails according to the model.

England already benefits from night-flying restrictions. In other parts of the world without such restrictions, the contribution of night flights to the annual warming effect attributable to contrails can be higher.

The authors argue that, according to the results, and considering the properties of contrails and their short lifetime, rescheduling flight times from night time to daytime could significantly change their warming effect.

On 27th September 2005, the European Commission adopted a Communication to reduce the climate change impact of aviation. The Communication recommends that aviation emissions should be included in the EU Emissions Trading Scheme and outlines a strategy that includes research into cleaner air transport, better air traffic management and the removal of legal barriers to taxing aircraft fuel. EC’s legislative proposal is expected towards the end of 2006.


Contact: n.stuber@reading.ac.uk

Theme(s): Climate change and energy

Additional Information: A project, co-funded by the EU LIFE programme (LIFE99 ENV/S/000631), was conducted in Sweden with the objective of evaluating, for the benefit of policy-makers, which measures could contribute to minimising the effects of aircraft emissions in the Nordic region. This was achieved by studying and modelling the response of the atmospheric system to a range of air traffic scenarios. For more information see the project summary and the project website

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