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# Jet contrails to be significant climate factor by 2050

WASHINGTON -- By the year 2050, increased flights by jet airplanes will impact global climate through the greater number of contrails they will produce, according to a new study in the July 1 issue of the journal, Geophysical Research Letters. Contrails are ice clouds created by jet engines and are short lived in dry air, but can persist for hours in moist air and become indistinguishable from natural cirrus clouds.

A research team of American and German scientists, headed by Patrick Minnis of the NASA Langley Research Center in Hampton, Virginia, reports that contrails cause a warming of the Earth's atmosphere, although their impact is currently small as compared to other greenhouse effects. They predict, however, that it may grow by a factor of six over the next 50 years. In 1992, for example, contrails added an estimated 0.02 watts of warming per square meter globally, about one percent of all manmade greenhouse effects.

Air traffic and, therefore, contrails, are not evenly distributed around the globe.They are concentrated over parts of the United States and Europe, where local warming reaches up to 0.7 watts per square meter, or 35 times the global average. The resulting temperature increase is not computed in this study, but is estimated to reach between 0.01 and 0.1 degrees Celsius (0.02 and 0.2 degrees Fahrenheit) over the northern temperate zones for current air traffic. In the future, increased air traffic will raise these values.

Large, linear contrails can be observed in satellite imagery. Although their total global coverage has not yet been determined, it is computed from traffic and weather data to amount to 0.1 percent. In the parts of Europe and eastern North America with the heaviest air traffic, however, contrails currently cover up to 3.8 percent and 5.5 percent of the sky, respectively.

Minnis and his colleagues report that global air traffic rose by over seven percent per year from 1994 to 1997, in terms of passenger miles flown. Growth is likely to continue, meaning contrails will play a larger role in future climates than they do today. Taking into account such factors as number of flights per day, fuel consumption, and altitudes flown, they conclude that by 2050, average contrail coverage over Europe will be four times higher than at present, or about 4.6 percent. In the United States, the increase will be 2.6 times current levels, or 3.7 percent coverage; and in Asia, the increase will be ten times current levels, or 1.2 percent.

The researchers emphasize that these are conservative estimates, which take into account only the thicker contrails that can be readily observed. Thinner contrails and contrails that have developed into natural-looking cirrus clouds also affect climate, but their impact cannot yet be predicted. Other factors that would play a role include natural cloud cover, overlapping of contrails, and size of the ice particles that form in them. They call for further research into the full extent of current contrail coverage and the specific effect of contrails in forcing climate change.

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Notes for science writers and public information officers:

1. You may obtain a copy of the paper, Patrick Minnis, Ulrich Schumann, David R. Doelling, Klaus M. Gierens, and David W. Fahey, "Global distribution of contrail radiative forcing," on request to Harvey Leifert <hleifert@agu.org>. Please include your fax number.
2. For further information on the science in this paper, you may contact the authors, whose postal and email addresses will be found at the end of the paper.

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