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Jet trails above fueling weather changes below, researchers say

By Ronald Kotulak
 Tribune science reporter
Published August 8, 2002

Fluffy rows of cirrus clouds created by the increasing number of jet contrails can sometimes fill half the sky and may significantly affect ground temperatures, according to a report in Thursday's issue of the British science journal *Nature*.

Using a unique opportunity to study the effect of contrails on temperature after all commercial jets were grounded for three days after the Sept. 11 terrorist attacks, a team of researchers found that the contrails spawned by jets lowered peak daytime temperatures and raised the lowest nighttime readings.

Such temperature changes could have a profound impact, affecting growing patterns of some crops and increasing the likelihood of larger insect populations, according to the researchers.

It may also be the clearest indication that human activity can alter the climate.

"We know for a fact that because of the contrails there are less clear days in the U.S. than there ever been," said David Travis, a University of Wisconsin climatologist who headed the study that found that human activity has much greater potential to change regional climate than it does to change the global climate."

The range between the daytime high and nighttime low temperature is called the diurnal temperature range and it has decreased by 3 degrees on average around the nation, and by 5 degrees in the Northeast and Northwest where air traffic is the heaviest, Travis said.

But whether the contrail effect changes the average 24-hour temperature is still under study. After three decades of records from 4,000 weather stations, scientists are trying to determine if the heating during the day or the cooling at night has a greater influence on the average daily temperature. The highs and lows seem to average out.



During the three-day grounding, the diurnal temperature increased by 3 to 5 degrees, the or made such a significant change in the last 30 years, Travis said.

Satellite images of the U.S. showed that the sky was clearer than usual during the three day

"During the three-day period when there were no commercial flights and only a few contrails planes, we got this sudden increase in the temperature range due to the fact that we sudden clearer skies across the country," Travis said.

The diurnal temperature range rose sharply on Sept. 11 and fell again on Sept. 14 when commercial flights resumed, he said.

The diurnal temperature range for Sept. 11-13 for the last 30 years across the U.S., prior to 9/11 was 30 to 35 degrees. But for the same period last year after the terrorist attacks, it rose to 38 degrees.

Cirrus clouds affect temperature by reflecting some sunlight back into space during the day reducing the amount of infrared heat escaping from the earth at night, Travis explained. Scientists long suspected that contrail clouds affect ground temperatures but there was little data from contrail-free skies with today's jet traffic. Satellite images of the Earth for Sept. 11 to 13 provide a view of the skies nearly free of contrails in 50 years.

"This result, if it is corroborated by additional studies, represents the first large-scale evidence of the effect of contrails on climate," said Patrick Minnis, a senior research scientist at NASA's Langley Research Center in Hampton, Va.

Minnis used satellite images to study the individual growth of contrail clouds during the air traffic task that was previously impossible because the numerous contrails that crossed paths blurred the findings.

Studying satellite images of lone contrails from military craft on Sept. 12, Minnis was able to determine that the cirrus clouds formed from these contrails lasted an average of six to eight hours.

Six to eight contrails can grow to form a cloud cover the size of Massachusetts, he said. They now make up 4 to 6 percent of the cloud cover on any given day, a huge increase from the 1 percent previously estimated.

On a typical day, an estimated 13,000 planes crisscross the nation at altitudes greater than the elevation at which cirrus clouds begin to form, Minnis said. As a result, contrails are more common between airports than they are around airports.

Cirrus clouds form in the upper atmosphere when there is sufficient moisture and temperatures are 40 degrees below zero.

Contrails are formed from jet engine exhaust when particles from burnt fuel and water vapor are flash-frozen into tiny droplets, serve as nuclei to which moisture already in the atmosphere can attach and grow into clouds.

Jets frequently fly at altitudes where there is not enough moisture to form clouds naturally, but there is enough moisture to sustain cloud growth once the initial cloud is formed from a contrail, Minnis said.

Unlike the warming from greenhouse gases, which are thought to have a global impact, contrail clouds act regionally over areas with the most flights, Travis said. How contrail clouds fit into the global warming scenario is unclear, but their ability to moderate extreme temperatures will complicate the issue.

Also complicating the global warming issue is a recent report by the General Accounting Office estimating that jet engine emissions may account for about 3 percent of greenhouse gases.

"Our winters have not been as dramatically cold in recent years as they have been historically," Minnis said. "Some of what has been attributed to global warming may be due to contrails that throw a blanket of clouds to warm the nights."

Reducing the extremes of day and night temperatures could have a subtle impact on ecosystems, Minnis said. It may, for instance, increase insect populations that thrive better in moderate temperatures.

Some crops could also be affected. Cranberries and citrus orchards need a certain number and warm days to ripen properly, Travis said.

Travis said he has mixed feelings about contrails. On the one hand they have been a prime research interest for the last 10 years. On the other hand they almost spoiled a recent vacat Pacific Northwest.

"There were so many contrails in the sky we weren't having any nice days," he said. "The cc making the days kind of gloomy and overcast. There aren't as many sunny days as we had were kids."

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