Hot on the Contrails of Weather

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Scientists have long suspected that airplane condensation trails -- the wispy, white tails found in the wake of high-flying jets -- form larger cloud banks that substantially alter the atmosphere's heat balance.

These jet-generated clouds, called contrails, may in turn play an important role in shaping our weather.

However, testing this proposition has been tricky. Scientists can't just ground all the planes across, say, North America and then study the before-and-after data.

But, for three days starting last Sept. 11, meteorological researchers were presented with just such an opportunity when the FAA grounded commercial flights nationwide for three days following the terrorist air attacks.

And now it has emerged that the American climate was indeed noticeably different during those three days without air travel.

A team of climatologists presented their work Tuesday, showing that temperatures in the United States fluctuated by 1.2 degrees Celsius more when airplanes were grounded than

when normal flight patterns prevailed. That is, planes in the sky dampen the variability between day and nighttime temperatures. More air travel, the researchers suggest, brings less meteorological difference between noon and midnight.

"We actually found a much greater change in temperature range for parts of the country that normally get the greatest contrail coverage," said David J. Travis, of the University of Wisconsin in Whitewater. His team presented their results at an American Meteorological Society conference in Portland, Oregon.

Large contrails, he said, only form when the cruising-altitude atmosphere is both sufficiently moist and sufficiently cool (somewhere in the range of minus 40 to minus 65 degrees Celsius). The skies above the Southwest are typically too dry, and the skies above the deep South are too hot for extended contrail coverage.

These factors plus the varying density of air traffic over different parts of the country combine to make the skies in the Midwest and Northeast -- and, to a lesser extent, the Pacific Northwest -- particularly laden with contrails.

In such contrail-heavy portions of the country, Travis' team found that during Sept. 11-13, the difference between day and night temperatures increased even more. The Midwest and Northeast experienced a "contrail effect" of 3 degrees Celsius, more than twice the national average.

And as anyone who follows global-warming forecasts knows, it only takes climatic changes of fractions of a degree Celsius to yield widespread results.

Yet, Travis added that the new data does not suggest that contrails offset or enhance global warming. Other research

has suggested contrails have a global-warming effect. But Travis' data addresses variability between day and night temperatures, not an overall warming or cooling trend.

Conclusions are more certain on the regional scale, he added. As air traffic increases over some regions of the world, the increased density of contrails will likely bring even smaller differences between daytime and nighttime temperatures, and that will alter the local environment.

Cranberry bogs and citrus orchards, for instance, require a combination of cool nights and warm days for optimum yield. And in the spring, sugar maples don't produce sap if daily (diurnal) temperatures don't fluctuate enough.

Furthermore, he said, some insects are particularly sensitive to changes in diurnal variations. And changes in insect populations can in turn have some unexpected aftershocks.

Patrick Minnis of NASA's Langley Research Center in Hampton, Virginia, said Travis' results confirm previous statistical studies Travis had published on climate variability and contrails.

On Monday, Minnis presented research that also examines contrails using the unique window that Sept. 11 provided. However, instead of studying the lack of airborne jets during the FAA's three-day moratorium, Minnis considered the few aircraft that were in the skies -- military jets and transport planes.

In a usually packed air corridor around Washington, D.C., Minnis followed satellite images of a lone contrail drifting through the mid-Atlantic states on Sept. 12. The three days of grounded air travel provided him a unique opportunity to model the evolution of single contrails where normally scores

or hundreds would be found.

He witnessed six contrails, each no wider than an airplane wing, evolve in a matter of hours into cloud banks that covered 20,000 square kilometers.

"This is a once-in-a-lifetime opportunity to measure these contrail effects," Travis said. "Or, at least, we can only hope it's once in a lifetime."