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Those Hazy Jet Trails May Heat Up The Debate About Global Warming

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BOSTON -- Patrick Minnis studies satellite images of aircraft contrails and thinks of climate change. Those pretty patterns in the sky may not be as benign as they look. They may be inducing enough extra cloudiness over heavily traveled Northern Hemisphere regions to significantly warm the ground below.

"When we look up at the sky or down from a satellite, it's possible we are viewing a cloud that would not have been there if it hadn't been for a jet aircraft," Dr. Minnis says. Sketchy contrail statistics gleaned from satellite images had suggested jet trails would be climatically insignificant. Minnis says "we know better than that [now]."

TRAILERS: Researchers have found that contrails, like these over Arizona's Saguaro National Monument, can cause far greater cirrus cloud coverage than previously thought. (BOB HARBISON/STAFF)

Satellite analysts had not connected sharply defined contrails seen in some images with cirrus clouds seen subsequently in other images covering other areas.

Minnis - an atmospheric scientist at the NASA Langley Research Center in Hampton, Va. - has made that connection. He took part in a National Aeronautics and Space Administration (NASA) field experiment in May 1996.

Infrared images taken every 15 minutes by the GOES-8 weather satellite enabled him to track distinctive contrails for six hours or more.

At a meeting of the American Geophysical Union in Baltimore last May, Minnis told how he followed a 100-kilometer-long, oval contrail made by a NASA DC-8 research aircraft. The contrail formed cirrus - covering 4,000 square kilometers (1,500 square miles) at its peak.

A Figure 8 contrail apparently produced over south Texas or Mexico by an unknown aircraft grew to a size of 20,000 square kilometers as it drifted over the Gulf of Mexico.

Minnis calls such observations solid evidence that contrails can cause cirrus coverage far beyond that of the young contrails that are easily identified.

Brian Toon, who is with the University of Colorado at Boulder, and is project scientist for the field study, notes that this points up the need to assess the area of the earth covered by contrails and figure out what's happening to the climate.

Howard Wesoky, who oversees the research from NASA's Washington headquarters, points out that the effect is more likely to be regional than global.

Recent research has found what Minnis calls a strong correlation between contrail frequency and fuel usage over the United States. In 1992, 93 percent of aircraft fuel was burned in the Northern Hemisphere - 70 percent of it between 60 and 30 degrees north latitude. The 1992 statistics could indicate where the climate impact will lie. It could be anything from a mild nighttime warming to a climatic big deal.

Minnis notes, for example, that average cloudiness over the United States has increased 5 percent in the three decades since jet travel began to intensify. He explained that, if the increase is all due to contrails - a big if - we're looking at a potential warming from the contrails that would amount to one-third to two-thirds as much warming as we already have from the buildup of atmospheric carbon dioxide during the past century.

No one knows how much of the increased cloudiness to pin on contrail cirrus. But any significant fraction that is due to contrails would be of climatic concern.

Clouds can cool the planet by reflecting sunshine back into space, or warm it by trapping outgoing heat. Contrails form cirrus clouds with the type of structures and at levels in the upper atmosphere that make them climate warmers. Scientists need to get into the detailed cloud physics and chemistry of contrails as well as follow them by satellite to find out what's going on. That was the point of NASA's 1996 field study with the unwieldy name Subsonic Aircraft Contrail and Cloud Effects Study (SUCCESS). It combined Minnis's satellite tracking with research in which a chase plane dogged behind a DC-8 sniffing everything that came out of the DC-8 engine exhaust.

Chemist Richard Miake-Lye of Aerodyne Research Inc. in Cambridge, Mass., says the team had expected soot to dominate. Instead, they found a tremendous number of sulfate particles formed from sulfuric acid droplets.

He added that they are convinced the sulfate aerosol helps water condense to form contrails. However, it was hard to separate out the aerosol effect from natural cloud seeding. "There was so much natural debris - rock dust and organic matter - in the ambient air we really couldn't see a [contrail seeding] signal from the aircraft," says project scientist Toon.

The main result of the field study is a sharper list of questions about the chemical and climatic impact of contrails on the atmosphere. It shows that the research is certainly worth pursuing, Minnis says.

Are contrails a serious environmental hazard that aviation planners must try to mitigate? With more than 62 million commercial and military flights across the United States annually and even denser air traffic over Europe, that's a hemisphere-wide - if not global - concern.
