Airplanes make clouds brighter

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Credit: University of Hertfordshire

Clouds may have a net warming or cooling effect on climate, depending on their thickness and altitude. Artificially formed clouds called contrails form due to aircraft effluent, in a cloudless sky, contrails are thought to have minimal effect on climate. But what happens when the sky is already cloudy?

In a new study published in the journal *Nature Communications*,

scientists from the University of Hertfordshire and Stockholm University show that contrails that are formed within existing high clouds increase the reflectivity of these clouds, i.e. their ability to reflect light.

The researchers hope that their discovery offers important insights into the influence of aviation on climate.

"Normal contrails are the stripes you sometimes see behind high-flying aircraft. Lots of times these contrails disappear fairly quickly. Other times they stick around for a while, and even spread out, sometimes considerably. There has been a lot of work done to find out how these form, and what kind of climatic effect they have - which is estimated to be rather small. Figuring out what kind of effects airplanes have while flying through clouds that are already present in the atmosphere has been much more difficult," says Kevin Noone, Professor at the Department of Environmental Science and Analytical Chemistry at Stockholm University.

Contrails and existing clouds

"Though contrails and their effect on climate have been studied for quite a while now, we have not yet investigated what happens when they form in already existing clouds. This is partly because the imaging sensors conventionally used for this kind of research are not able to resolve what is going on inside the clouds. We were excited to see that overcoming this limitation would immediately lead to a new discovery," adds Matthias Tesche, Lecturer in Physics at the University of Hertfordshire.

Increased optical thickness

The researchers used a combination of flight tracking data and satellites

equipped with sensitive lasers for detecting small changes in cloud optical thickness, i.e. the degree to which a cloud prevents light passing through it. When they looked at flight corridors from Honolulu to Los Angeles, Seattle and San Francisco, they found a significant increase in the optical thickness of the clouds close to the flight tracks compared to those further away. In other words, clouds inside flight corridors were more reflective or "brighter."

"Such effects only occur in certain latitude bands, so aircraft flying on polar routes in the Northern Hemisphere and close to the Equator are unlikely to produce these sorts of clouds. The most important areas are in the Northern and Southern mid-latitudes. Work is in progress to calculate the climatic effects of the changes we've observed," says Professor Noone.

Provided by University of Hertfordshire