Airplane Contrails and Global Warming

According to a recent study, the airplanes contrails contribute more to global warming than the CO_2 emitted by an aircraft.

- Moreover, the contrails' impact on climate change will triple by 2050 than it was in 2006 because of following reasons:
    - Modern planes flying slightly higher than their predecessors, which is likely to lead to more contrail cloud formation over the tropics.
    - Increase in air traffic.
    - Improvements in fuel efficiency.
- The study also suggested that the impact on the atmosphere due to contrail cirrus clouds will be stronger over Northern America and Europe which are the busiest air traffic areas on the globe.
    - However, the impact will also increase in Asia as the air travel is also growing in the region.
- The warming effect of cirrus clouds is also short-lived, and because it occurs in the upper atmosphere, it's not clear how much of a difference it actually makes for temperatures at Earth's surface.

Contrails

- The hot, humid exhaust from jet engines mixes with the atmosphere, which at high altitude is of much lower vapor pressure and temperature than the exhaust gas.
- The water vapor contained in the jet exhaust condenses and may freeze, and this mixing process forms clouds.
- Most of these contrail cirrus clouds dissipate quickly, but under the right conditions they can remain for hours, and when that happens they warm the atmosphere by absorbing thermal radiation emitted by the Earth.

Impacts

- Jet engine exhaust contains carbon dioxide, oxides of sulfur and nitrogen, unburned fuel, soot and metal particles, as well as water vapor.
    - The soot provides condensation sites for water vapor. Any particles present in the air provide additional sites.
- Depending on a plane's altitude, and the temperature and humidity of the atmosphere, contrails may vary in their thickness, extent and duration.
- The nature and persistence of jet contrails can be used to predict the weather.
    - A thin, short-lived contrail indicates low-humidity air at high altitude, a sign of fair weather, whereas a thick, long-lasting contrail reflects humid air at high altitudes and can be an early indicator of a storm.

Significance

- Aviation already has a sizable influence on the climate.
    - In 2005, air traffic contributed about 5 percent of humans' influence on climate change.
- Air traffic roughly doubles every 15 years. And contrails are the aviation industry's biggest climate influencer, even more than CO_2 emissions from planes.
    - But policies to lower aviation's influence on climate change focus on CO_2 emissions, all but ignoring the impact of contrails.
- The study suggests that contrails are a major factor that climate policies should take into account.
    - It is important to recognise the significant impact of non-CO_2 emissions, such as contrail cirrus, on climate and to take those effects into consideration when setting up emission trading systems or schemes like the CORSIA Agreement.

Solution

- Cleaner aircraft emissions would solve the issue, as the reduction of the number of soot particles emitted by aircraft engines decreases the number of ice crystals in contrails and that means climate impact of contrail cirrus will also be reduced.
    - However, soot would have to be decreased a lot to have a significant effect–even if it was reduced by 90 percent, the contrail cirrus clouds will produce more warming in 2050 than they did in 2006.
- Therefore, the best option for reducing this effect and aviation's carbon footprint is to fly less.