4.244 Should we control aircraft NOx emissions?.

Early Career Scientist

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Abstract:

Aviation emissions of nitrogen oxides (NO_x) alter the chemistry of the atmosphere, perturbing the greenhouse gases ozone and methane, resulting in positive and negative radiative forcing (RF) effects, respectively. We examine the changes in the tropospheric composition and the net RF from aviation NO_x emissions for 30% reductions in the present-day (2006) ozone precursor emissions (NO_x, CO, NMVOC) and for a future (2050) range of RCP scenarios together with ICAO CAEP aviation emission projections using the global chemistry transport model MOZART-3.

Any of the reduction in surface anthropogenic emissions results in the decrease, ranging from -8% to -20%, of the global aircraft net NO_x RF, where CO and NO_x emissions lead to the smallest and greatest decreases, respectively. Moreover, the surface NO_x emissions are 70% more efficient in affecting aviation net NO_x RF than aircraft NO_x emissions; any 1% reduction of background anthropogenic NO_x emissions decreases aircraft net NO_x RF by 0.9%. Thus, the ongoing efforts in cutting ground-level air pollution serve not only the air quality improvements but it is also beneficial for reducing the climate impact of aviation NO_x emissions.

Conversely, any reduction of aircraft NO_x emission *increases* the global aviation net NO_x climate impact. The global net NO_x RF in 2050 is ~23% smaller than RF in 2006, per any 1 Tg of emitted N, despite the fact that the ~200% increase of aircraft NO_x emissions is predicted. It is rather counterintuitive to suggest to *increase* aircraft NO_x emissions in order to reduce aviation net NO_x climate impact. As technology trade-offs exist: improving the fuel performance of engines at the cost of NO_x or concentrate on combustor modification at the cost of CO_2, this study suggests that efforts that will lead to better fuel efficiency might turn out to be a better option for the climate.