

## Climate change and aviation turbulence

*By Dr Paul Williams and Dr Manoj Joshi*

New research indicates that climate change will create a more turbulent atmosphere, causing transatlantic flights to get bumpier by the middle of this century. The research, published this week in the journal *Nature Climate Change*, is the first study to examine the impacts of climate change on aviation turbulence. The study finds that the average strength of turbulence will increase by 10-40%, and the proportion of the atmosphere containing significant turbulence at any time will increase by 40-170%.

In addition to flights becoming more uncomfortable, the number of passengers and cabin crew injured may increase. Another possible consequence is that journey times may lengthen, as planes are diverted to avoid patches of turbulence that are stronger and more frequent. This could make delays at airports more common, increase fuel consumption and emissions of atmospheric pollutants, and push up ticket prices.

The research uses supercomputer climate simulations to compare pre-industrial turbulence with a future in which the concentration of carbon dioxide in the atmosphere is doubled. The research focuses on clear-air turbulence in winter at typical cruise altitudes within the transatlantic flight corridor. Aviation is partly responsible for changing the climate, but these findings show for the first time how climate change could affect aviation.

At present, commercial aircraft encounter moderate turbulence tens of thousands of times each year worldwide. These encounters injure hundreds of passengers (occasionally fatally), cost airlines tens of millions of dollars, and cause structural damage to planes. Clear-air turbulence is especially difficult to avoid, because it cannot be seen by pilots or detected by satellites or on-board radar. As a result, planes currently spend 3% of their cruise time in light turbulence and 1% in moderate turbulence, but the new study predicts that these figures will increase significantly.

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