



NCAS Science Highlight

Climate change and bumpier flights

[Paul Williams](#)¹ and [Manoj Joshi](#)²

¹University of Reading, ²University of East Anglia

What are the new findings?

Atmospheric turbulence is a major problem for aviation. It causes uncomfortable flights and injures hundreds of air travellers every year. Extreme turbulence, although rare, can even damage planes and cause fatalities.

Our study finds that turbulence at cruising altitudes on transatlantic flights could become stronger and twice as common by mid-century. The reason is that climate change is modifying the winds aloft, destabilising the atmosphere and making it easier for turbulence to break out.

Why are these findings important?

Air travellers can expect to see more of the 'fasten seatbelt' sign. Flight diversions around turbulence could become more frequent, increasing journey times, fuel consumption, and atmospheric emissions. The societal cost of turbulence, currently about \$100m annually, could also rise.

Aviation is partly responsible for changing the climate, but our findings show for the first time how climate change could affect aviation.

How did we discover this?

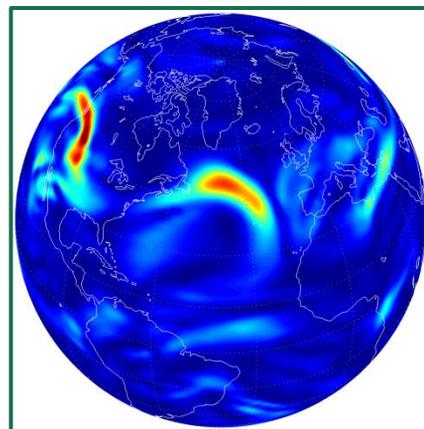
We compared two supercomputer simulations, with low and high amounts of CO₂. We calculated turbulence using 21 different mathematical formulations, which allowed us to estimate the uncertainty in our results.

We focused on clear-air turbulence in winter. This is especially problematic to airliners, because clear-air turbulence is invisible to pilots and satellites, and winter is when it peaks.

This research was funded by the Royal Society through the University Research Fellowship scheme (UF080256).



Paul Williams is a Royal Society University Research Fellow, specialising in small-scale processes and numerical modelling.



Above: Patches of turbulence on a hypothetical winter day in the 2050s, calculated from supercomputer simulations.

Find out more:

- See [Paul Williams' webpage](#)
- Email p.d.williams@reading.ac.uk
- Take a look at the [journal article](#) Williams and Joshi (2013), Nature Climate Change, doi: 10.1038/nclimate1866.

[Return to NCAS Climate public engagement website](#)

Tell us what you think

- How clearly was this article written?
- How interesting or useful was it?
- Do you have any other comments?

Please let us know:

climate-feedback@ncas.ac.uk