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## Examining Clear-Air Turbulence (CAT) climatologies and trends in ERA5 reanalysis (1979-2020)

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Although a previous study has created a global 2PVU diagnosed CAT climatology and North Atlantic trend analysis, one does not exist for a constant pressure surface on which aircraft typically cruise. Other previous work has shown a tripling in frequency of diagnosed CAT in climate model simulations with climate change. However, the question of whether an increase in global diagnosed CAT can already be seen in reanalysis since 1979, has not yet been addressed.

Here, we calculate 21 CAT diagnostics from ERA5 to produce a global 197hPa climatology of moderate/severe CAT exceedance frequencies for the period 1979-2020. Linear regressions are then performed to calculate trends in the frequency of diagnosed CAT over this period.

The results of the 197hPa climatology show three features of interest. Firstly, there appear to be roughly two distinct regimes of diagnosed CAT: a midlatitude regime and a tropical one. Secondly, diagnosed CAT appears to be more frequent over the oceans than the land and finally, mountain ranges appear to be hotspots of diagnosed CAT. The most significant result from the trend analysis is that North America and the North Atlantic have seen a substantial increase in the frequency of diagnosed CAT since 1979, far more than any other region worldwide.

The diagnosed CAT climatologies produced here are of general scientific interest to those researching turbulence theory or geophysical fluid dynamics. The result of the trend analysis will be of substantial interest and use to the aviation industry and aviation turbulence forecasters in long term planning and aviation safety.