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Enhancing confidence in the climatological distribution of aviation turbulence through a careful reevaluation of AMDAR turbulence report statistics

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The continually growing archive of automated turbulence reports from commercial aircraft strengthens the robustness of climatological studies on observation-based atmospheric turbulence occurrences. EDR, defined as the cube root of the eddy dissipation rate, has become the standardized measure for turbulence intensity across aircraft. The shift from using a combination of like EDR, derived equivalent vertical gust, and pilot reports to a single comparable measure has simplified turbulence assessment. Still, biases can arise due to factors such as:

- Uncertainties in the downlink/reporting frequencies of the anonymized archived data.
- Irregular coverage of different flight altitudes.
- Varying impact of the less turbulent lower stratosphere on the surveyed atmospheric volume.

We present a multi-year analysis of the geographic and vertical occurrence frequency distribution in the northern hemispheric UTLS, while taking into account the identified sources of bias. The vertical occurrence frequency distribution determines the tropopause as a natural reference layer for such an analysis. The quasi-horizontal analysis relative to the tropopause over the contiguous USA as one of the busiest aviation regions shows a dominating zonal gradient in occurrence frequencies, with a more complex multipole signal in the seasonality.

In a subsequent step, we present preliminary results on the effectiveness of a set of well-established turbulence diagnostics in mesoscale-resolved regions of inertial instability within the ERA5 reanalysis. The goal is to explore potential missing causal links between the occurrence of atmospheric turbulence and the response of atmospheric flow to these instabilities."