



In situ turbulence measurements from commercial aircraft

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The statistical properties of turbulence at upper-levels in the atmosphere (upper troposphere and lower stratosphere or UTLS) are still not very well-known, partly because of the lack of adequate routine observations. This is in spite of the use that such observations would have in better quantifying dissipation rates in the atmosphere due to turbulence, but also for the practical value this information would have in alerting aircraft of potentially hazardous conditions, either in real-time or for climatological route planning. To address this, in the U.S. a program has been underway over the last few years to outfit commercial aircraft with a software package that automatically estimates and reports atmospheric turbulence intensity levels (as $\varepsilon^{1/3}$ where ε is the eddy dissipation rate) during each minute of flight. The reporting frequency is variable depending on the airline, but some reports are routinely made once per minute while others report only when the turbulence level exceeds some threshold or "trigger". The amount of turbulence data gathered is unprecedented - as of Jan 2013 there are ~ 200 aircraft outfitted with this system, contributing to well over 140 million archived records of $\varepsilon^{1/3}$ mostly at cruise levels of commercial aircraft, i.e. in the UTLS.

In this talk the results of some statistical analyses of these $\varepsilon^{1/3}$ values will be presented, including vertical distributions, horizontal distributions, turbulence patch lengths and depths, and probability distribution functions (PDFs). These analyses are restricted to the U.S. for now, but as this program is expanded to international carriers, such data will begin to become available over other areas of the globe, including the North Atlantic and Europe.