Comparison of weather-balloon observations of in-cloud and clear-air turbulence with model predictions

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Turbulence costs the airline industry millions of dollars each year and injures many passengers. There are still difficulties in the numerical prediction of turbulence, especially Clear Air Turbulence (CAT), which is particularly damaging because planes cannot detect it in advance. The aim of this work is to confront atmospheric turbulence theories with measurements made using adapted RS92 radiosondes, which carry motion detectors based on Hall Effect devices sensing the Earth's magnetic field. The radiosondes also carry solar radiation sensors, allowing in-cloud turbulence and CAT to be distinguished. The Richardson number and Thorpe lengths scale can also be deduced from the ascent profile. Initial results show increased turbulence near jet regions at the tropopause and near radiative cooling regions at cloud tops. Examples will be shown, including methods used to evaluate the measurements made by the magnetometer sensors, and a comparison of the measured turbulence with turbulence diagnostics commonly used by aviation forecasters. The results from these balloon flights will be used to validate CAT models and also to provide an insight into other atmospheric processes including in-cloud turbulence and turbulence in the lower stratosphere.