



In-situ sensing of atmospheric turbulence

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Atmospheric turbulence is a relevant parametrisation factor in climate models and has significant impact on aviation. Precise and repeatable measurements can help to improve these parametrisations as well as turbulence forecasts. LITOS (Leibniz-Institute Turbulence Observations in the Stratosphere) and HYFLITS (Hypersonic Flight In the Turbulent Stratosphere) are balloon-borne instruments both capable of measuring atmospheric turbulence from the boundary layer to the lower stratosphere. They rely on different measurement principles. While LITOS resolves the Taylor microscale, HYFLITS uses the power spectral density of velocity fluctuations in the inertial subrange to infer turbulent kinetic energy dissipation rates. We used both independent instruments for co-located, simultaneous measurements.

First results from a campaign in November 2018 show good agreement between both measurements. We found weak to moderate turbulence located in distinct, thin layers. The individual requirements for both methods (high measurement resolution for LITOS and external calibration for HYFLITS) are pointed out. Furthermore a detailed intercomparison between the results from both instruments is shown. Another focus will be on general aspects of measuring turbulence on balloons such as avoiding the balloon's wake. For a standard balloon configuration we find a wake encounter probability of 30 %. Accordingly, we avoid this effect by using descending balloons. The good agreement between these independent instruments and the avoidance of wake-related issues enables high-confidence turbulence estimations with 20 m vertical resolution in the troposphere and stratosphere.