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In-situ turbulence observations in the stratospheric wind and temperature field with LITOS

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Although stably stratified, turbulence occurs in the stratosphere due to breaking gravity waves. This leads to energy dissipation which modifies the energy transfer from the troposphere to the mesosphere. Stratospheric turbulence is also important for vertical mixing of trace species. In order to derive turbulent parameters accurately very small scales on the order of centimeters and below have to be resolved. This can only be performed applying in-situ techniques. Our balloon-borne in-situ measurement system LITOS (Leibniz Institute Turbulence Observations in the Stratosphere) utilizes constant temperature anemometer (CTA) and constant current anemometer (CCA) for simultaneous observation of small scale fluctuations of wind and temperature with high vertical resolution ($\sim$1 mm). The CTA consists of a small, thin (5 µm) wire kept at constant temperature; its principle of operation is based on the cooling effect of the air flow around the wire. The CCA is a thin (3.8 µm) wire which is basically operated as a resistance thermometer. Three flights in different configurations have been carried out at Kiruna, Sweden (67°N, 21°E) within the BEXUS programme in 2008, 2009 and 2011. The balloons reached altitudes of typically 27 km. To our knowledge, during the flights in 2009 and 2011 the first simultaneous turbulence measurements of winds and temperatures in the stratosphere were performed. Turbulent layers with a vertical thickness in the order of several 10 m have been observed. Results for energy dissipation rates computed directly from the spectrum of wind or temperature fluctuations will be presented. We will compare measurements from different flights for both wind and temperature fluctuations and consider a potential dependence on background conditions.