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Measuring turbulence and gravity waves on a balloon in the UTLS region

Jens Söder (1), Michael Gerding (1), Henrike Wilms (2), Johannes Wagner (2), and Franz-Josef Lübken (1)

(1) Leibniz-Institute of Atmospheric Physics e.V. at the University Rostock, Kühlungsborn, Germany (soeder@iap-kborn.de), (2) German Aerospace Center (DLR), Institute of Atmospheric Physics (IPA), Wessling, Germany

The breakdown of atmospheric gravity waves is associated with turbulence. As this process involves scales below one meter, in-situ measurements are important for its understanding. Our balloon-borne instrument LITOS (Leibniz-Institute Turbulence Observations in the Stratosphere) infers kinetic energy dissipation rates by resolving the inner scale of turbulence. Here we focus on a particular event during a research flight in Northern Scandinavia, where we observed turbulence at a local wind minimum in the lower stratosphere. Contrary to a regular critical level, the background wind did not reach zero and the dominating gravity wave was not fully extinguished.
The detailed investigation of the process is aided by a combination of high resolution in-situ measurements together with 3d WRF simulations and idealised 2d large eddy simulations using EULAG. A particular focus will be on general aspects of balloon-borne wave and turbulence measurements, like the ambiguity of horizontal and vertical wave scales and influences of subcritical and supercritical flow around the balloon. Our combination of measurement and modelling results enhance the general understanding of wave breakdown processes, while the technical aspects provide insights into general characteristics of balloon borne measurements of atmospheric dynamics.