

## Vertical velocity spectra from global to gravity wave scales near the tropopause

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Vertical motions are fundamental for cloud formation, gravity waves, turbulence, and many aspects of weather prediction. Compared to spectra of horizontal velocity, the horizontal spectrum of vertical velocity ( $w$ ) is less well known. In this presentation, we suggest a hypothesis leading to a simple model relating  $w$ -spectra and spectra of horizontal velocities from global to gravity waves and turbulence scales. The model is tested by comparisons to published global high-resolution numerical simulation results and to aircraft measurements in the upper troposphere and lower stratosphere in two recent field campaigns. The general agreement between the measured and the modeled spectra supports the validity of both, the model and the measurements. In many cases the power slopes of the measured mesoscale spectra are steeper than  $-5/3$ , in particular near mountains. The results suggest that energy exchange between horizontal and vertical motions is far more important for the spectra than small-scale energy dissipation. 80% of  $w$ -variance near the tropopause occurs at scales between 1 and 80 km. The spectral characteristics should be sensitive to how vertical velocity is treated in high-resolution numerical weather prediction models. This should be tested.