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Derivation of gravity wave intrinsic parameters and vertical wavelength using a single scanning OH(3-1) airglow spectrometer

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For the derivation of information about the direction of energy transport by gravity waves, knowledge of the wave vector and the period is a precondition. An approach to derive zonal, meridional and vertical wavelengths as well as periods of gravity waves based on only one OH(3-1) spectrometer addressing one vibrational-rotational transition is presented here.
Measurements by a OH* spectrometer allow the analysis of gravity wave periods, but spatial information cannot necessarily be deduced. Using a scanning OH-spectrometer at Oberpfaffenhofen (48.09°N, 11.28°E), Germany, we additionally derive horizontal wavelengths at the mesopause which are typical for gravity waves (ca. 1–10 h, 100–1000s km).
Based on the approximation of the dispersion relation vertical wavelengths can be calculated, if horizontal wind information are available. The mesopause wind measurements nearest to Oberpfaffenhofen are conducted by a meteor radar ca. 380 km away of Oberpfaffenhofen at Collm (51.30°N, 13.02°E), Germany.
The vertical wavelengths based on the spectrometer-radar data combination are compared to vertical wavelengths derived from collocated detrended TIMED-SABER measurements. They only show a mean difference of 2.5 km or 21% and range mostly between 5 km and 19–20 km.
We conclude that the presented combination of measurements provides a good estimate of the vertical wavelengths on average.