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On the propagation direction of gravity waves in the strato- and mesosphere

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Observing gravity waves in the middle atmosphere is crucial for understanding their propagation and effect on the dynamics in the strato- and mesosphere. Temperature measurements, for example by lidar, are often used to calculate the gravity wave potential energy density (GWPED) in the middle atmosphere and to study the seasonal variation of gravity waves. We have extended this procedure by performing Doppler-wind measurements by lidar to study gravity waves in the altitude range from 30 to 70 km where no other remote sensing method allows to study such waves in detail.

In this work we use the phase relation between both zonal and meridional wind components, and temperature. The main challenge for this method is the identification of quasi monochromatic waves in an altitude range where usually several waves are present. We applied a new algorithm that isolates a dominating wave from continuous measurements during day and night. Measurements of more than 24 hour duration are analyzed to resolve inertia gravity waves.

We show results obtained at the ALOMAR research station in northern Norway (69N, 16E) resolving the seasonal cycle of GWPED and compare those to lower latitude observations at Kühlungsborn (54N) and satellite observations. Furthermore we study gravity wave propagation sorted for up- and downward propagating waves for summer and winter conditions to investigate different wave propagation and generation scenarios.