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Combination of lidar and model data for studying deep gravity wave propagation

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An approach to complete temperature measurements of the Esrange lidar's Rayleigh channel below 30 km with mesoscale simulation results obtained with the advanced version of the Weather Research and Forecasting (WRF – ARW) model is presented. The mesoscale simulations are validated against mean temperature profiles obtained with the Esrange lidar's rotational Raman channel and against radiosonde launched at Esrange during December 2013.

With the combined data set a gravity wave analysis is performed for all Esrange lidar measurements during November/December 2013. Several distinct cases during this period are presented in detail in order to show the capabilities of this method. Especially wave breaking which often happens in the lower stratosphere can be studied in more detail. Furthermore it can be easily distinguished between cases during which middle atmospheric gravity waves were excited in the troposphere close to Esrange and cases during which gravity wave activity in the middle atmosphere was not directly linked to the Scandinavian mountain ridge. Thus, by complementing lidar temperature measurements with mesoscale simulation results, gravity wave propagation can be studied throughout the entire altitude range from the troposphere into the mesosphere.