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Inertia gravity waves in the upper troposphere during the MaCWAVE winter campaign: collocated radar observations and modelling studies

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An experimental and modelling study was carried out to investigate a strong gravity wave event in the upper troposphere/lower stratosphere near the Scandinavian mountain ridge. Continuous VHF radar measurements during the MaCWAVE campaign in January 2003 were performed at the Norwegian Andøya Rocket Range near Andenes and the Swedish Rocket Range near Kiruna. The investigations show the appearance of mountain waves and jet-induced inertia gravity waves. Wavelet transform has been used to examine temporal and spatial dependencies of the inertia gravity waves in the upper troposphere. The estimation of the inertia gravity wave characteristics is based on the Stokes spectra analyses and evaluation of the dispersion and polarisation equations for each radar location. The inertia gravity wave packet has characteristic horizontal wavelengths of 200 km and moves upstream and downward in the upper troposphere. The contribution of inertia gravity waves to the vertical flux of horizontal momentum is estimated in relation to the total and mountain wave induced momentum fluxes. During periods and heights of the strongest inertia gravity wave activity, the derived vertical flux of the horizontal momentum corresponds to the obtained parameters of the jet-induced inertia gravity wave. Detailed gravity wave investigations based on PSU/NCAR Mesoscale Model MM5 data have been used for comparison with experimentally obtained results. The case study of model data indicates the appearance of the inertia gravity wave generated by a jet streak near the tropopause region and mountain waves. The experimental radar observations and modelling results agree fairly well.