

First OH Airglow Observation of Mesospheric Gravity Waves Over European Russia Region

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Abstract

©2018. American Geophysical Union. All Rights Reserved. For the first time, we perform a study of mesospheric gravity waves (GWs) for four different seasons of 1 year in the latitudinal band from 45°N to 75°N using an OH all-sky airglow imager over Kazan (55.8°N, 49.2°E), Russia, during the period of August 2015 to July 2016. Our observational study fills a huge airglow imaging observation gap in Europe and Russia region. In total, 125 GW events and 28 ripple events were determined by OH airglow images in 98 clear nights. The observed GWs showed a strong preference of propagation toward northeast in all seasons, which was significantly different from airglow imager observations at other latitudes that the propagation directions were seasonal dependent. The middle atmosphere wind field is used to explain the lack of low phase speed GWs since these GWs were falling into the blocking region due to the filtering effects. Deep tropospheric convections derived from the European Centre for Medium-Range Weather Forecasts reanalysis data are determined near Caucasus Mountains region, which suggests that the convections are the dominant source of the GWs in spring, summer, and autumn seasons. This finding extends our knowledge that convection might also be an important source of GWs in the higher latitudes. In winter the generation mechanism of the GWs are considered to be jet stream systems. In addition, the occurrence frequency of ripple is much lower than other stations. This study provides some constraints on the range of GW parameters in GW parameterization in general circulation models in Europe and Russia region.

<http://dx.doi.org/10.1002/2017JA025081>

Keywords

airglow, mesospheric gravity wave, seasonal variations, sources

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