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Thermospheric Gravity Wave Activity near Summer Solstice 2014 Based on Analysis of Tromsø Dynasonde Data

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Propagation conditions for thermospheric gravity waves in the Polar Regions are characterized by combination of several unique factors including interactions with the Auroral activity and the polar vortex. Tropospheric sources of the acoustic gravity waves (AGWs), such as wind disturbances caused by mountain relief, are likely to be complemented by energy and momentum depositions associated with fluxes of energetic particles from above. We apply recently developed Dynasonde techniques to study peculiarities of the gravity wave characteristics over Northern Scandinavia. A week-long (adjacent to the summer 2014 Solstice) data series for this study has been obtained with the Dynasonde system at the EISCAT's Tromsø Observatory operating continuously with sounding session periodicity equal to 2 min. A component of Dynasonde data analysis software, the inversion procedure NeXtYZ, has been used to attribute plasma density, plasma contour tilts, and line-of-sight Doppler values to the altitudes in real space with 1 km resolution. The temporal and spatial resolution allows visualization of the phase fronts of the traveling ionospheric disturbances (TIDs) and measuring the full set of parameters (both vertical and horizontal) of TID activity in the upper atmosphere between the base of the E layer and the maximum of F layer, where the ionospheric plasma can reflect the radar's signal. We verify the nature of the activity for selected spectral peaks by substituting the TID parameters into the dispersion relation describing acoustic-gravity waves. Application of the Lomb-Scargle periodogram technique to the tilt data provides useful insight into the dynamics of spectral composition of the TIDs, which we compare to results of a similar analysis obtained for mid-latitude (Wallops Island, VA) Dynasonde location. Interference of wave packets and multi-path propagation are more frequent in polar thermosphere compared to mid-latitude situation. Backtracking of selected waves to their apparent source locations using a ray tracing technique with background atmospheric parameters taken from the Whole Atmosphere Model (WAM) developed at the NOAA/SWPC reveals mostly continental ground-level sources. Correlation between measured spectral amplitudes of the wave activity at 200 km altitude and attenuation of AGWs estimated from WAM parameters is tested as a quantitative measure of AGWs originating in the troposphere and propagating in specific direction.