

Measuring Waves Generated by Solar Terminator with Dynasonde Techniques

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Solar terminator represents a unique source of atmospheric waves possessing of near-ideal coherent properties: its geometry and magnitude of the impact changes very little from day to day. This feature has been used in [Forbes et al., GRL, 2008] to obtain "snapshots" of terminator waves in the neutral atmosphere at the altitude 400 km by averaging CHAMP accelerometer data over relatively long sequences of the satellite passes. The results were represented in the geographic latitude vs local time coordinates. We apply a similar approach averaging time series of Wallops Island, VA Dynasonde Doppler data to obtain "snapshots" of terminator waves in the ionosphere in the true altitude vs local "terminator time" coordinates. The averaging is performed independently for every month of the yearlong observation period from May 2013 to April 2014. The altitude range covered is 90 km to 400 km with 2 km resolution, representing the entire bottom-side ionosphere. Individual local time segments used for the averaging were 12 hours long and all centered at the times of the sunrise or sunset terminator passing at every specific altitude. This procedure effectively suppresses all kinds of incoherent wave activity and allows one to reveal the perturbation phenomenon mainly caused by the solar terminator. This is an important advantage of this technique compared to multiple "terminator wave" studies based on simple time coincidence. Both sunrise and sunset terminator waves are easily visualized in all of the monthly images. Our results confirm observations of [Forbes et al., GRL, 2008] of the wave structures existing on both sides of the terminator. The phase fronts of the sunset terminator wave are propagating downward indicating upward movement of the terminator-related disturbance and of the wave energy generated by it. The phase fronts of the sunrise terminator waves are propagating upward indicating downward movement of the terminator-related disturbance and of the wave energy generated by it. Spectral analysis of the local time sequences reveals characteristic peaks in the terminator-related wave activity corresponding to the periods 40-60 min and 2 hours. We also analyze statistics of their horizontal wavelengths.