Simultaneous OI 630 nm imaging observations of thermospheric gravity waves and associated revival of fossil depletions around midnight near the EIA crest

Navin Parihar et al.

Abstract

We report the F-region airglow imaging of fossil plasma depletions around midnight that revived afresh under the persisting thermospheric gravity wave (GW) activity. An all-sky imager recorded these events in OI 630 nm imaging over Ranchi (23.3º N, 85.3º E, m lat. ~19º N), India, on 16 April 2012. Northward propagating and east-west aligned GWs (λ ~210 km, υ ~64 m/s, and τ ~0.91 h) were seen around midnight. Persisting for ~2 hours, this GW activity revived two co-existing and eastward drifting fossil depletions, DP1 and DP2. GWs-driven revival was prominently seen in depletion DP1, wherein its apex height grew from ~600 km to >800 km, and the level of intensity depletion increased from ~17% to 50%. Present study is novel in the sense that simultaneous observations of thermospheric GWs activity and associated evolution of depletion in OI 630 nm airglow imaging, and that too around local midnight, have not been reported earlier. Current understanding is that GW phase fronts aligned parallel to the geomagnetic field lines and eastward propagating are more effective in seeding Rayleigh-Taylor (RT) instability. Here, GW fronts were east-west aligned (i.e. perpendicular to the geomagnetic field lines) and propagated northward, yet they revived fossil depletions.

Reference:

Parihar, N., Padincharapad, S., Singh, A. K., Mahavarkar, P., and Dimri, A. P.: Simultaneous OI 630 nm imaging observations of thermospheric gravity waves and associated revival of fossil depletions around midnight near the equatorial ionization anomaly (EIA) crest, Ann. Geophys., 42, 131–143, https://doi.org/10.5194/angeo-42-131-2024, 2024.