Scientists reveal energy exchange between troposphere and ionosphere in Congo Basin

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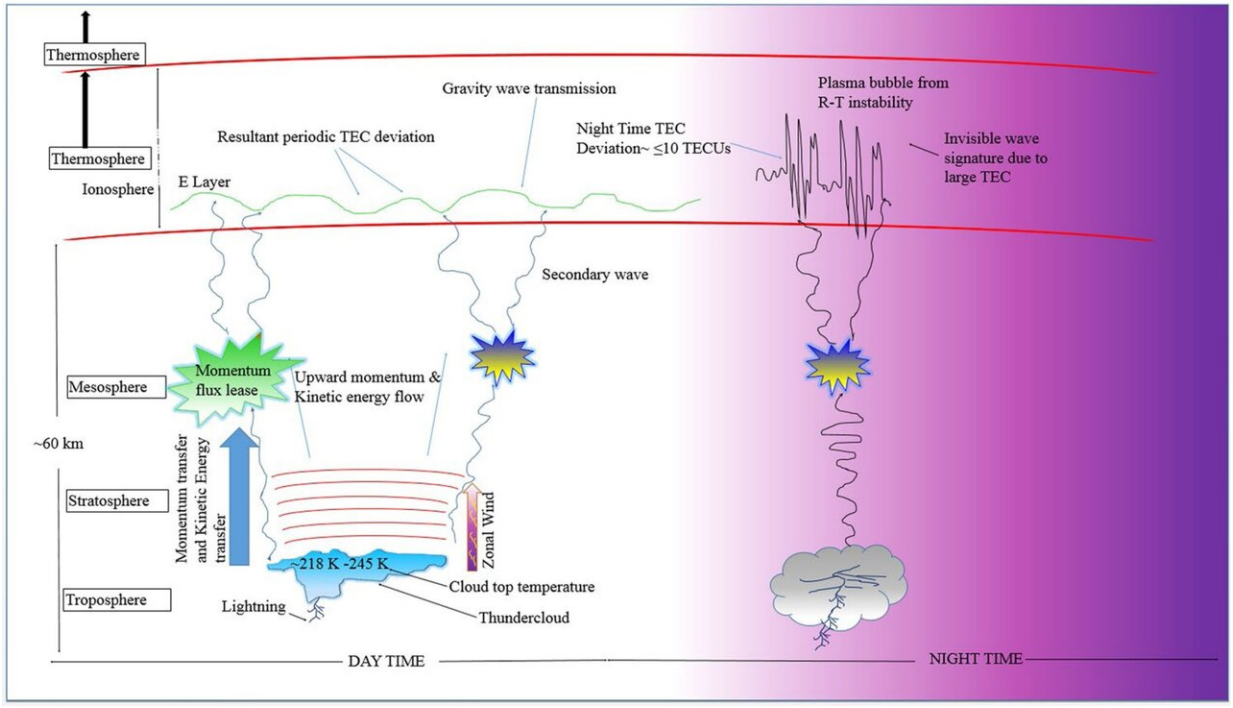

An illustration of the atmospheric wave dynamics from convective processes and ionospheric responses. Credit: Babalola Ogunsua

The Earth's ionosphere, extending about 80 to 1,000 km above the Earth's surface, connects outer space and the middle atmosphere. It's an important part and key layer in the whole Sun-Earth system.

However, the understanding of the equatorial ionospheric responses to thunderstorms remains a mystery due to the peculiarities in the dynamics of the ionosphere over this region.

A recently published study in *Scientific Reports* focuses on the Congo Basin, located in the equatorial region, where lightning and severe thunderstorms are considered to be the most active in the world.

In the study, Dr. Babalola Ogunsua, a postdoctoral fellow from Nigeria with Prof. QIE Xiushu's research group from the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences traced the thunderstorm effect through ground-based World Wide Lightning Location Network (WWLLN) observations, in combination with the ionospheric total electron content (TEC) measured from the communication path between the Global Positioning System (GPS) and the GPS receiver station in the West Africa-Congo basin.

The researchers found solid evidence of tropospheric thunderstorm impact on the ionospheric electron content. Ogunsua said, "We found that changes in the ionospheric electron content resulting from thunderstorms propagated from the location of the thunderstorm to a specific direction, with high peaks of the total electron content deviation, and the gravity waves induced by thunderstorms oscillated between 16 and 76 minutes."

"The dynamics of the equatorial ionosphere are suppressed by the impact of thunderstorm activity during the day with visible gravity wave effects, and the effect of the gravity wave is negligible at night due to the plasma bubbles and large scale TEC deviation," said Prof. QIE.

This study provides a better understanding of the equatorial ionosphere in terms of its responses to extreme tropospheric events, with additional information for improved modeling of the equatorial ionosphere.

More information: B. O. Ogunsua et al. Significant Day-time Ionospheric Perturbation by Thunderstorms along the West African and Congo Sector of Equatorial Region, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-65315-3