# The variation of the ionospheric electron density associated with active lightning

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Existing literature studies show that the thunderstorm generated in the troposphere is capable to disturb the ionospheric electron density by gravity waves generated in deep convections, or the change of the quasi-electrostatic field associated with sprites, or the direct heating of the electromagnetic pulses. The contribution of the above processes can be investigated by the variation of the ionospheric electron density above the thunderstorm regions at or after the lightning active time above thunderstorms. Unfortunately, the occurrence of lightning is unpredictable and irregular. Hence, it is difficult to study this variation by a direct and programmed measurement on the electron density above thunderstorms.

In this work, the long-term lightning activity monitored by the world-wide lightning location network (WWLLN) and the electron density profiles observed by COSMIC are employed to explore the electron density variation above the thunderstorms at their active time. The lightning active periods and regions were identified from 2006 to 2017 globally. Furthermore, the corresponding electron density profiles were extracted from the COSMIC database to exams the discrepancy respected to the density profiles at quiet time. Therefore, the variations of the ionospheric electron density caused by lightning can be assessed quantitatively in time, space and height. The results of this study indicate the elevation of the electron density by dense lightning activity is statistically significant, and the response time is less than 30 minutes. The diurnal vibration of the lightning and electron density elevation is also investigated and presented in this paper.

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