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Observations of plasma bubbles reaching midlatitudes and after sunrise during the Mother's Day geomagnetic storm (10—12 May 2024)

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Plasma bubbles are pockets of abrupt significant depletions in background plasma variations. These depletions are ubiquitous in the nighttime F-region and topside ionosphere at equatorial and low latitudes. There are sometimes ionospheric irregularities of various scales within the bubbles, which may cause ionospheric scintillation. The scintillation can have substantial impact on radio signals traversing through the ionosphere, with signal cycle slips in global navigation satellite systems (GNSS) being an example of such impact. General occurrence features, plasma density structures, and generation mechanisms of plasma bubbles are known, particularly during quiet conditions [e.g., 1, 2]. However, when there is a significant increase in the input of solar wind energy to the magnetosphere and ionosphere during geomagnetic storms, the features of plasma bubbles may change. For example, due to intensified pre-reversal enhancement equatorial plasma bubbles can ascend to higher apex altitudes thereby reaching midlatitude regions [e.g., 3, 4, 5]. Also, although rare plasma bubbles have been detected during daytime, and are thought to be fossil bubbles, i.e., related to plasma bubbles of the previous night [e.g., 6, 7]. This study presents an investigation of the time evolution of equatorial plasma bubbles during the Mother's Day geomagnetic storm (10—12 May 2024). Swarm plasma density measurements and total electron content (TEC) over the Asian sector (longitude 90-170 E) are used in this study. Results show that plasma bubbles were suppressed prior to the storm commencement (10 May) but were observed to extend beyond 35° magnetic latitudes in the south and northern hemispheres and after sunrise during the recovery phase of the storm (11—12 May). We will explore the poleward expansion of the postsunset plasma bubbles as well as the origin of the daytime plasma bubbles.

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