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Neutral density depletions attributed to plasma bubbles

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Abstract. Neutral density measurements in the equatorial thermosphere by the accelerometer of the San Marco V satellite in 1988 indicate from time to time sudden density depletions of 10-20 s. As the occurrence of such events maximizes between 1700 and 0300 hours local solar time, we interpret them as manifestations of the crossings of plasma bubbles by the satellite.

1. Introduction

Neutral density measurements by the accelerometer on board the Italian San Marco V satellite [*Arduini et al.*, 1992] indicate from time to time sudden density depletions of 10-20 s in the equatorial atmosphere [*Illés-Almár et al.*, 1997], (Figure 1). Considering the velocity of the satellite, in the height interval from 130 to 600 km, this time corresponds to a range of 100-200 km along the orbit. The occurrence of such events has a maximum between 1700 and 0300 hours local solar time (Figure 2).

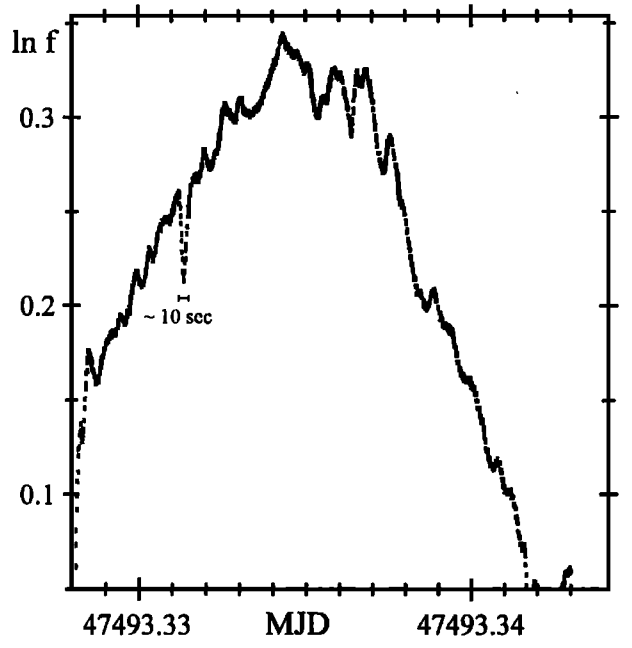

Figure 1. Example of San Marco V density residuals, with respect to MSIS'86 model, versus time ($f = \rho^{obs}/\rho^{model}$).

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2. Conclusion

Not precluding the possibility of other explanations as well, we interpret the depletions of the neutral density as manifestations of the crossing of plasma bubbles by the San Marco V satellite in the equatorial ionosphere because of the above characteristics of the phenomenon: the linear size corresponds to the size of plasma bubbles, and their occurrence starts mainly at sunset, similar to the frequency of plasma bubbles. Though the ion density in a bubble is up to 3 orders of magnitude smaller than the background plasma density, there is a larger difference between the vertical velocity of the plasma and that of the neutral gas. The ion drag depends mainly on the ion density, the ion-neutral collision frequency, and the difference between the velocity of the neutral gas and the drift velocity of the plasma. Taking these conditions into account, the upwelling of the plasma inside the plasma bubble can take the neutral gas with it, also causing a depletion of the neutral density inside the bubble.

A detailed description of the analyses will be published later.

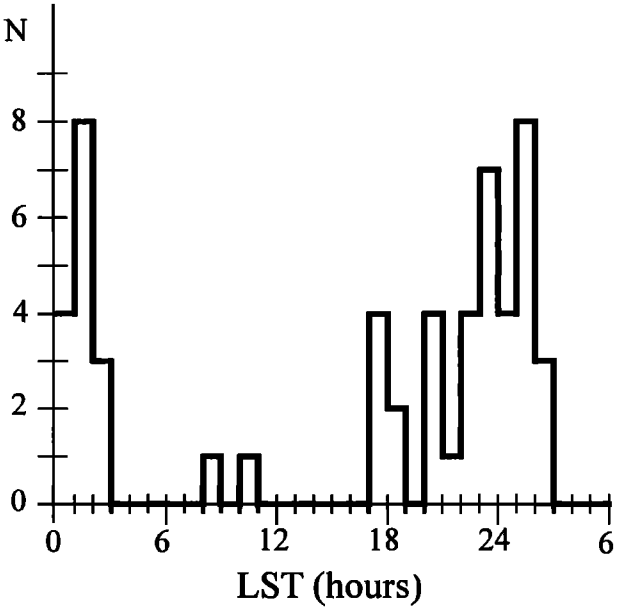

Figure 2. Distribution of 39 neutral density depletion events as a function of local solar time.

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