Geophysical Research Abstracts,
Vol. 10, EGU2008-A-00199, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-00199
EGU General Assembly 2008

Topside ionosphere irregularities: He^+ density depletions (bubbles)

L. Sidorova

Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation, Troitsk, Moscow region, Russia (lsid@izmiran.ru / Fax: +7 495-3340124)

The present study deals with plasma density depletions, observed as subtroughs in He^+ density during a high solar activity. There are the indications that plasma bubbles, produced by Rayleigh-Taylor instability at the bottomside of ionosphere, could rise up to the topside ionosphere and plasmasphere. Maryama and Matuura (1984), using ISS-b satellite data (high solar activity period, 1978-79), have seen the plasma bubbles in Ne density over equator at 1100 km altitudes in 46 cases in 1700 passes. That is $\sim$3% only. However, there is distinctly another picture in He^+ density depletions (subtroughs) according to ISS-b data for the same period. He^+ density subtroughs occur in the topside ionosphere over equatorial and low-latitudinal regions (L$\sim$1.3-3) in 11% of the cases (Karpachev, Sidorova, 2002; Sidorova, 2004). The detailed statistical study of the He+ density subtrough peculiarities was done. The subtrough depth (depletion value) as function of local time (evening–night hours) was compared with the vertical plasma drift velocity variations, obtained for the same periods from AE-E satellite and IS radar (Jicamarca) data. Striking similarity in development dynamics was revealed for the different seasons. It was noted also that the He^+ density subtroughs are mostly observed in the evening-night sector (18-05 LT) from October till May. It was like to the peculiarities of the equatorial spread-F (ESF), usually associated with plasma bubble. The monthly mean He+ density subtrough occurrence probability, plotted in local time versus month, was compared with the similar plots for ESF occurrence probability, derived by Abdu and colleagues (2000) from ground-based ionograms obtained over Brazilian regions for the same years. The comparison shows good enough correlation (R=0.67). Moreover, it was revealed that there are many cases

of the He^+ density subtrough observations on the OGO-4 (1968 - solar maximum, 20th cycle), the OGO-6 (1969 - solar maximum, 20th cycle) and DE-2 (1981 - solar maximum, 21th cycle) data. It was concluded, that the He^+ density depletions should be considered as originating from equatorial plasma bubbles phenomena, or as possible fossil bubble signatures (Sidorova, 2007). It was also concluded that the He^+ density depletions are rather typical phenomena for the topside ionosphere for high solar activity epoch. The possible reasons of the He+ density depletions occurrence as function of solar activity are discussed.

REFERENCE

Abdu, M.A., J.H.A. Sobral, I.S. Batista, Equatorial spread F statistics in the american longitudes: some problems relevant to ESF description in the IRI scheme, Adv. Space Res., 25, 113-124, 2000.

Karpachev, A.T. and L.N. Sidorova, Occurrence probability of the light ion trough and subtrough in Íå+ density on season and local time, Adv. Space Res. 29, 999-1008, 2002.

Maryama, T. and N. Matuura, Longitudinal Variability of Annual Changes in Activity of Equatorial Spread F and Plasma Bubbles, Journal of Geophysical Research, Vol.89, N A12, P.P. 10,903-10,912, December 1, 1984.

Sidorova, L.N., He+ density topside modeling based on ISS-b satellite data, Adv. Space Res., 33, 850-854, 2004.

Sidorova, L.N. Plasma bubble phenomenon in the topside ionosphere. Adv. Space Res., Special issue (COSPAR), 39, 1284-1291, 2007. doi: 10.1016/j.asr.2007.03.067, 2007.