Geophysical Research Abstracts, Vol. 7, 00653, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00653
© European Geosciences Union 2005

Solar activity influence as seen in the GPS radio occultation data

A.G. Pavelyev[1,3], J. Wickert[2], Y.A. Liou[3], T. Schmidt[2], A.A. Pavelyev[1]

[1]Institute of Radio Engineering and Electronics of Russian Academy of Sciences, (IRE RAS), Fryazino, Vvedenskogo sq. 1, 141190 Moscow region, Russia. E-mail *pvlv@ms.ire.rssi.ru* Fax: +7 095 203 8414

[2]GeoForschungsZentrum Potsdam (GFZ-Potsdam), Telegrafenberg, 14473 Potsdam Germany. E-mail: *wickert@gfz-potsdam.de* Phone: +49- 331-288-1168; Fax: +49-331-288-1169.

[2]Center for Space and Remote Sensing Research, National Central University, Chung-Li 320, Taiwan.
E-mail: *yueian@csrsr.ncu.edu.tw*. Tel: (03) 4227151 ext 7631. Fax: (03) 4254908

Since 1995, the global positioning system (GPS) has been exploited by the means of the radio occultation (RO) method to study the Earth ionosphere and atmosphere. Several satellite missions have been launched with GPS occultation receivers including OERSTED, SUNSAT, CHAMP, SAC-C, and GRACE. The temporal interval of the GPS RO database occupies now about six years of observations, which allows studying the seasonal and geographical dependence of the ionospheric phenomena on a global scale. These phenomena may be important and (sometimes) dangerous for communications, space flights and other areas of human activity. Analysis reveals five types of the ionospheric influence on the RO signals: quiet, isolated regular spikes, quasi-periodical modulation, isolated diffractive and noisy patterns. This classification is based mainly on the amplitude variations because the amplitude response is more sensitive to the sharp gradients in the ionospheric plasma perturbations than the phase path excess of the RO signal. The amplitude variations are sensitive to small-scale ($\sim$1 km), medium-scale ($\sim$10 km), and large-scale (100-500 km) electron density structures, and can be used to reveal dependence of the intense ionospheric plasma perturbations on the solar and magnetospheric activity and geographical position. Analysis of the CHAMP RO data revealed dependence of the amplitude variations on long-term variation of the solar activity, the sharp changes in the DST and Kp indexes and on the local time thus indicating a variety of mechanisms responsible for creation of the

plasma structures in the ionosphere. Maps of the seasonal, geographical and temporal distributions of the CHAMP RO events with high S_4 index values observed during the years 2001-2003 indicated their dependence on solar activity and intimated the presence of two mechanisms of ionization: (1) ionization owing to the fast electron moving in downward direction from the magnetosphere in the polar regions and (2) solar radiation. As follows from this analysis the GPS signals in the trans-ionospheric links can be used for investigating the influence of solar activity on the lower ionosphere and detecting the relations between processes in the atmosphere and mesosphere with global coverage.