

Effects of jet engines of Progress ships in the ionosphere according to Japanese GPS-receivers network GEONET

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For several years, using the tools of the Institute of Solar-Terrestrial Physics Siberian Branch Russian Academy of Sciences, experiments were carried out to record parameters of ionospheric effects that appeared as a result of the inclusion of jet engines "Progress" transport cargo ships. In particular, the data of the total electron content registered by the Siberian SibNet network of GPS/ GLONASS receivers were used. Negative perturbations in the variations of the total electron content were recorded [Ishin A.B., Voeykov S.V., Perevalova N.P. Complex analysis of ionospheric response to operation of Progress cargo spacecraft from GNSS data in the Baikal region. Solar-terrestrial physics. 2017. Vol. 3, No. 4, P. 83–92.] However, a small number of observation stations and insufficient network density did not allow for a detailed study of the disturbances dynamics in space and time.

In addition to the recently constructed SibNet network, there are regional networks of GPS/ GLONASS receivers. Some of them operate continuously and have a sufficient density of stations and a sufficient number of them to carry out more detailed experiments.

In this study, data from the Japanese GEONET network of GPS stations were used as source data. On the one hand, the registration of ionospheric parameters in the GEONET network occurs only once every 30 seconds, on the other hand, this network has a much higher density than the previously used SibNet. For analysis, we took the event of work of the jet engines of Progress transport-cargo ship on May 4, 2006. Part of the trajectory with the engines turned on was 180 kilometers from Hokkaido island. During the experiment, slight background variations of the total electron content were observed. This level of variation was associated with a low level of geomagnetic activity. We were able to detect a decrease in the total electronic content by 0.06 TECU in the exposure area. The rate of change of the total electron content, estimated by derivative, is 5 times greater than the background values. This effect is observed on rays passing at a distance of up to 50 kilometers from the area of impact. In the future, the regeneration of the total electron content to background values within 3-5 minutes is observed.