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Ionospheric disturbances caused by the Sumatra earthquake on 26 December 2004

E. I. Astafyeva (1), E. L. Afraimovich (1), Yu. Ya. Ruzhin (2)

(1) Institute of Solar-Terrestrial Physics, Irkutsk, Russian Federation (elliada@iszf.irk.ru / Phone: +7 3952 564554); (2) IZMIRAN, Troitsk, Moscow region, Russian Federation

By using data from GPS receivers network it is shown that ionosphere response to the earthquake on 26 December 2004 reveals as ionosphere disturbances (ID) of different origin. It can be classified as “primary” and “delayed” responses.

About 10-15 minutes after the earthquake N-form shock-acoustic wave was observed in total electron content (TEC) variations at the nearest to the earthquake epicenter GPS receivers. The “primary” wave with a time period of about of 300-500 s propagated with a velocity about 1000 m/s. “Primary” wave forms due to acoustic waves from the epicenter penetrate upward into the atmosphere.

For detecting the “delayed” waves we used data of GPS receivers located from -20º to 50º of latitude and from 60º to 145º of longitude. For the Sumatra earthquake the “delayed” response represented as intensive quasi-periodical TEC variations with a time period of about of 15 min and with duration of order of 1-2 hours. The ID propagated with a velocity about 250 m/s. Such variations were detected 2-7 hours after the main shock at distances from 1000 to 5000 km out of the earthquake epicenter, both on the northwest and on the northeast from the epicenter. Thus, detected ID is supposed to be a spherical-form wave propagated outward a source. A seismic air wave, which was generated by sudden vertical displacement of the Earth’s surface near the epicenter, appears to be the source of the “delayed” wave we detected. It should be noted that there were no significant fluctuations of H-component of geomagnetic field all the day. No other possible sources of this type of TEC variations, like meteoevents, rocket launches or explosions were noticed. Furthermore, after 12 UT on 26 December 2004 TEC variations didn’t contain quasi-periodic fluctuations similar to the intensive ones that we observed 2-7 hours after the earthquake.