Geomagnetic Pi3 range pulsations on the ground, inside and outside of the magnetosphere during the Bastille magnetic storm (July 15, 2000)

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The magnetic storm of July 15, 2000 was a very large one, caused by coronal mass ejection (CME), which had occurred one day before (July 14) and was called because of this date “Bastille Day Event”. The front edge of this magnetic cloud was characterised by untypically large and variable values of IMF (up to 70 nT), negative values of Bz IMF (up to -60 nT), and solar wind speed (up to 1000 km/s). Our analysis was based on 1-min sampled digital geomagnetic measurements on 78 globally distributed stations of INTERMAGNET, including 7 French observatories as well as the Scandinavian magnetometer chain (IMAGE) and Russian observatory Irkutsk. The dynamic spectral and wavelet analysis of geomagnetic pulsations from all listed above ground stations, the geosynchronous GOES 10 satellite inside of the magnetosphere and GEOTAIL spacecraft, located before magnetosphere at X ~20 Re, has been carried out.
The analysis showed that the strong IMF and ion density variations in the turbulent region before the leading edge of the interplanetary magnetic cloud triggered the magnetic substorm and geomagnetic pulsations in the polar cap near the footprint of the border between the close and open field lines. The dynamic spectra of the magnetic fluctuations inside and outside of the magnetosphere before the leading edge of the magnetic cloud passage were rather similar, particularly in Bz and By components. Similar pulsations were detected on the ground near footprint of GOES 10. We suppose that ground pulsations, observed at polar latitudes, can be result of the direct penetration of the interplanetary hydromagnetic wave into the polar cap. Another possibility can be attributed to the wave generation at ionosphere altitudes by the oscillations of the electron precipitation in the substorm related field aligned currents.