Characteristics of the magnetic variations at geosynchronous orbit and on the ground associated with SSC on 15 July, 2000

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A strong interplanetary shock buffeted the magnetopause on 15 July, 2000. The magnetosphere was suddenly compressed by the sudden increasing of the solar wind dynamic pressure and a Storm Sudden Commencement (SSC) was globally observed on the ground stations and at the geosynchronous orbit. During the compression of the magnetosphere, GOES 8, 10 and 11 were located at 9 LT, 5 LT and 7 LT, respectively, and observed the sudden increasing of the HP component of the magnetic fields at 14:37:20, 14:37:41 and 14:37:32, respectively. Such a time delay means the propagation of the compressional wave launched from the magnetopause by the buffeting of the interplanetary shock.

On the other hand, GOES 8 and 11 detected the southward magnetic fields after the first passing of the compressional waves. This indicated that the magnetopause was strongly compressed and shrank to inside of the geosynchronous orbit. At first, the GOES 8 observed the southward magnetic field, then GOES 11 observed the same signature. However during GOES 11 observed the southward magnetic field, magnetic field at GOES 11 had already turned to northward. It indicates that the compression of the magnetosphere occurred with the much complicated deformation of the magnetopause.

On the ground, the sudden increasing of the H component magnetic fields globally occurred at 14:38 UT at low-latitude CPMN stations. It is consistent with a general feature of the SSC (Araki, 1994). At high-latitude CPMN stations, a small increasing of the H-component magnetic field (~150nT) occurred at CHD (MLT=0 hr), then a decreasing of the H-component magnetic field started at 14:38:30. On the other hand, the same H-component increasing was observed at IMAGE chain stations (MLT=17 hr). In general, the high-latitude magnetic variations associated with the SSC was thought to be generated by the twin-vortex ionospheric current system (Araki, 1994). In this case, the magnetic variations due to the twin-vortex ionospheric current should show opposite sense variations between the morning and afternoon sectors. In the present event, the fact that the increasing of the H-component magnetic variations at all local-times is not consistent with the general feature of the ground magnetic variation of the SSC.

We discuss the possible mechanism of the magnetic variations observed at the geosynchronous orbit and ground, that is, (1) the strong deformation of the magnetopause occurred at near the subsolar point by the buffeting of the interplanetary shock and propagated to the night side, (2) at the same time the comporessional waves was launched from the cusp region of the magnetosphere and caused the increasing of the H-component magnetic field at ground high-latitudes.