0.0.1 The Space Weather Effect of Interplanetary Shock Parameters

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The ring current is the key element in the magnetic storms in the near-Earth space, which absorbs and stores geomagnetic storm energy and then releases it slowly over subsequent days and weeks. Understanding the structure and property of the ring current can lead to more accurate predictions of the space environment of the inner magnetosphere for the ongoing rapid development of human activities. When a sudden increase in the solar wind dynamic pressure following an interplanetary shock (IPS) compresses the Earth magnetosphere, the inner magnetospheric currents significantly intensify, especially, the ring current. However, how the interplanetary shock triggers the magnetic storm and how it affects the intensification and the decay of the ring current are not fully understood. For this purpose, we statistically study how critical parameters of an IPS, such as, the orientation and the strength of the IPS, correlate with the geomagnetic indices, such as, Dst, SYM and ASY, which relate to the disturbances in the ring current.

In order to investigate the effectiveness of an IPS on the near Earth space environment, we apply Gaussian wavelet transform method to the solar wind plasma and the interplanetary magnetic field data from WIND and ACE satellites, to determine the critical parameters of the IPS. We have successfully identified more than 300 IPSs from the archives of WIND and ACE measurements. The initial results have shows that (1) Gaussian wavelet transform method has good responses to the changing features of interplanetary shocks; (2) The lag time from an IPS passage (L1) to the intensification of the ring current is a critical parameter; (3) The shock speeds have some correlation with storm intensities; and (4) The shock front normal angleθ_{BN}, being a good indicator of geo-effectiveness of an IPS, has good correlation with Dst index. The correlations of IPS parameters with ASY and SYM indices are also investigated.