Geosynchronous magnetic field variations associated with the passage of interplanetary shocks or solar wind discontinuities

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Previous studies reported that geosynchronous magnetopause crossings (GMCs) are more frequently observed in the prenoon sector than in the postnoon sector. Since the GMCs indicate that the magnetopause is compressed to within geosynchronous orbit, the previous studies suggested that the magnetopause is strongly asymmetric with respect to local noon during extreme solar wind conditions. Motivated by this suggestion, we investigate geosynchronous magnetic field variations when sudden commencements (SC)/sudden impulses (SI), which are associated with the passage of interplanetary shocks or solar wind discontinuities, occur on the ground. From a statistical analysis of the geosynchronous magnetic field response to SC/SI events from 1997 to 2005, we find that the magnetic field enhancement in the prenoon sector is larger than that in the postnoon sector over dayside local times. This asymmetry of the geosynchronous magnetic field amplitude with respect to local noon cannot be explained by the solar wind aberration effect due to the motion of the Earth around the Sun. Using solar wind data and ground magnetic field data, we examine what causes the asymmetry.