Towards an Empirical Model of Geomagnetic Storm Prediction Based on Solar Information

Yong-Jae Moon, Kyung-Suk Cho, Rok-Soon Kim,
Seoung-Mi Kang, Khan-Hyuk Kim, Yeon-Han Kim,
Su-Chan Bong, and Young-Deuk Park
Korea Astronomy and Space Science Institute

Recently, we have examined the physical characteristics of geoeffective halo CMEs that produced geomagnetic storms. First, we investigated the CME geoeffectiveness depending on its location and speed using SOHO/LASCO halo CMEs from 1997 to 2003. Second, we examined the relationship between several CME physical parameters and geomagnetic storms for very fast halo CMEs. In particular, we suggest a new earthward direction parameter that can be directly estimated from coronagraph observations. This new parameter is applied to all halo CMEs. Third, we examined the relationship between the field orientation in a CME source region and a geomagnetic storm using a coronal flux rope model as well as its dependence on ICME classification (magnetic cloud or ejecta). Major results are as follows. (1) We present the probability map of geoeffective CMEs depending on each physical parameter (location, speed, direction) and its combinations. (2) The CME direction has a much better correlation with the Dst index than other parameters for very fast halo CMEs and is much more important for fast CMEs than for slow CMEs. (3) The relationship between the field orientation and the geomagnetic storm for magnetic cloud is much better than that for ejecta. Finally, we discuss future plans to set up an empirical model of geomagnetic storm prediction based on solar information.