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Solar wind parameters dependence of energy coupling between solar wind and magnetosphere during northward interplanetary magnetic field

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We statistically study the solar wind parameter dependence of the magnetospheric activities during northward interplanetary magnetic fields (IMFs) events (Bz $>$ 10 nT, last over 3 hours). It was found that the energy coupling between solar wind and magnetosphere during northward IMFs was mainly controlled by solar wind velocity and IMF clock angle (θ). A northward IMF coupling function was derived based on the dimensional analysis and quantitative analysis of the IMF and the geomagnetic indices. This coupling function can combine the influences of both IMF θ and solar wind velocity and well describe the energy input from the solar wind into the magnetosphere during northward IMF events. In addition, it was shown that when θ is greater than $\sim 50^o$, the energy input increases remarkably as θ increases. Most importantly, our coupling function can measure the relative importance between the viscous interaction and the By reconnection in controlling the energy input into the magnetosphere during northward IMFs. The viscous interaction will overweigh the By reconnection in the northward IMF events with θ less than 70^o. In contrast, for those northward IMF events with θ greater than 70^o, the By reconnection may be more important than the viscous interaction.