New insights for Solar wind-magnetosphere coupling function

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The interaction between the solar wind and the earth's magnetosphere could be represented using different linear and non-linear coupling functions. Such coupling functions are built using a combination of solar wind parameters such as the solar wind velocity, density and dynamic pressure but also the configuration of the interplanetary magnetic field (IMF). One function defined by Newell et al. (2007) shows a remarkable correlation when compared to ground-based indices, such as the PC, AE or SYM-H indices which are indicating the magnetosphere response. Recently, Maggiolo et al. (2017) have showed that the magnetospheric response to the solar wind parameters and to the IMF is time-lagged, with characteristic time delays going from 5 min (pc and ae vs the solar wind pressure) to several hours (SYM-H index vs IMF magnitude). Furthermore, the intercorrelation between solar wind parameters and their own autocorrelation time was shown to impact significantly such correlation analysis. Interpreting the correlation between solar wind parameters or derived coupling functions and geomagnetic indices is thus far from being straightforward. In that context, we investigate the correlation between the different coupling function used by Newell et al. (2007) and the geomagnetic indices for different time lag following the method developed by Maggiolo et al. (2017). We identify the correlation peak of those coupling functions with a set of geomagnetic indices and the associated response time.