On the origins of an explicit IMF By dependence on solar wind - magnetosphere coupling

Jone Peter Reistad¹, Anders Ohma¹, Karl Magnus Laundal¹, Therese Moretto¹, Steve Milan², and Nikolai Østgaard¹
¹University of Bergen, Birkeland Centre for Space Science, Department of Physics and Technology, Bergen, Norway
(jone.reistad@uib.no)
²Department of Physics and Astronomy, University of Leicester, Leicester, UK

Presently, all empirical coupling functions quantifying the solar wind - magnetosphere energy- or magnetic flux conversion, assume that the coupling is independent of the sign of the dawn-dusk component (By) of the Interplanetary Magnetic Field (IMF). In this paper we present observations strongly suggesting an explicit IMF By effect on the solar wind - magnetosphere coupling. When the Earth's dipole is tilted in the direction corresponding to northern winter, positive IMF By is found to on average lead to a larger polar cap than when IMF By is negative during otherwise similar conditions. This explicit IMF By effect is found to reverse when the Earth's dipole is inclined in the opposite direction (northern summer), and is consistently observed from both hemispheres using the Active Magnetosphere and Planetary Electrodynamics Response Experiment (AMPERE) to infer the size of the region 1/2 current system. Two interpretations are presented: 1) The dayside reconnection rate is affected by the combination of dipole tilt and IMF By sign in a manner explaining the observations 2) The combination of dipole tilt and IMF By sign affect the global conditions for maintaining a given nightside reconnection rate. The observations as well as idealized magnetohydrodynamic (MHD) model runs are analyzed and discussed in light of the two different interpretations in order to enhance our understanding of this explicit IMF By effect.