Lack of Ring Current Response to Large Y-Component Interplanetary Magnetic Field

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The interplanetary magnetic field (IMF) couples with the magnetosphere-ionosphere system through dayside merging and night side reconnection, and the IMF can affect the viscous interaction as well. These processes generate the transpolar potential and cause plasma convection in the magnetosphere and ionosphere, with larger IMF values producing generally greater coupling. Enhanced plasma convection in the inner magnetosphere can lead to the formation of an enhanced ring current, which is the hallmark of a geomagnetic storm. As with IMF Bz, the transpolar potential increases then saturates as IMF By increases, thus one might expect the ring current to respond to large values of IMF By. We use the LFM global simulation, the CRCM, and data to quantify the ring current responses to increases in IMF By. We find the ring current does not respond to increases in IMF By even though the ionosphere does, with large IMF By producing greater convection and Joule heating. This indicates a decoupling of the plasma convection and energy deposition in the ionosphere from convection and energy deposition in the inner magnetosphere. We will present these findings and discuss how they relate to current paradigms about solar wind-magnetosphere coupling.

Keywords: Ring Current; Geomagnetic Storm; Magnetospheric Convection.