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Howthe IMF By induces a By component in the closed magnetosphere and how it leads to asymmetric currents and convection patterns in the two hemispheres

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We describe the effects of the interplanetary magnetic field (IMF) B_y component on the coupling between the solar wind and magnetosphere-ionosphere system using AMPERE observations and MHD simulations. We show how B_y is induced on closed magnetospheric field lines on both the dayside and nightside. The magnetosphere imposes asymmetric forces on the ionosphere, and the effects on the ionospheric flow are characterized by distorted convection cell patterns, often referred to as “banana” and “orange” cell patterns. The flux asymmetrically added to the lobes results in a nonuniform induced B_y in the closed magnetosphere. We present a mechanism that predicts asymmetric Birkeland currents at conjugate foot points. Asymmetric Birkeland currents are created as a consequence of y directed tension contained in the return flow. Associated with these currents, we expect aurora and fast localized ionospheric azimuthal flows present in one hemisphere but not necessarily in the other. We present a statistical study where we show that these processes should occur on timescales of about 30 minutes after the IMF B_y has arrived at the magnetopause. We also present an event with simultaneous global imaging of the aurora and SuperDARN measurements from both hemisphere. The event is interpreted as an example of the of the proposed asymmetric current mechanism.