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How the IMF By induces a By-component on closed field lines during northward IMF Bz

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We describe how the IMF B_y-component induces a local By-component on closed field lines during northward IMF B_z. The mechanism is the result of high-latitude reconnection on the dayside when IMF B_y is non-zero. We describe the dynamical process, in which tension on newly reconnected field lines redistribute the open flux asymmetrically between the two hemispheres, which leads to asymmetric energy flow into the lobes. The resulting shear flows change the magnetic field, thereby inducing a B_y-component on closed field lines. We use a global magnetohydrodynamics model to illustrate the mechanism. The magnetosphere imposes asymmetric forces on the ionosphere, and the effects on the ionospheric flows are characterized by a departure from a symmetric two-cell configuration to the growth of one of the lobe cells, while the other will contract. We also present the associated timescales of the local B_y-component to a change in the IMF B_y, by both theoretical arguments and by a superposed epoch analysis between magnetic field measurements from GOES and a list of IMF B_y reversals. We find that the magnetosphere responds within 10 minutes and reconfigures within 40 minutes.