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Mapping the open/closed boundary in Jupiter's polar cap with a 2-D equatorial magnetic field model

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How much of Jupiter's polar cap is open to the solar wind? Where do the auroral active, dark, and swirl regions map within (or outside) the magnetosphere? With a good global magnetic field model, one could map field lines from the equator to the ionosphere and answer these and similar questions. However, such a model does not exist for Jupiter, so we have taken a different approach in mapping magnetospheric sources to auroral features. Rather than following along a model field, we map equatorial field lines to the ionosphere by requiring that the magnetic flux in some specified region at the equator equal the magnetic flux in the area to which it maps in the ionosphere (flux conservation). The equatorial flux is calculated by using a two-dimensional fit to the north-south component of the measured magnetic field at the equator. This fit accounts for changes with radial distance and local time. To estimate the internal Jovian field in the ionosphere we use a version of the VIP4 model [Connerney et al., 1998] with magnetic anomaly [Grodent et al., 2008] that has been modified to include the effects of the current sheet [Khurana, 1997]. Equating the fluxes in this way allows us to link a given position in the magnetosphere to a position in the ionosphere and to gain insight into the source of different auroral features. We will discuss the results of our mapping in the northern and southern hemispheres, particularly the locations that map to beyond the dayside magnetopause and are likely regions of open flux. We will also compare our calculations to the available auroral observations.