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Maps of precipitation by source region, binned by IMF, with inertial convection streamlines

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We present maps of ionospheric precipitation regions, based on 11 years of DMSP particle data, binned by the interplanetary magnetic field (IMF), with superposed SuperDARN convection streamlines gathered under similar conditions. The convection patterns are transformed into an inertial coordinate system. The maps, which include the both the nightside and dayside, are created in a fully auto-mated fashion, with, for example, the cusp centered at its centroid latitude for each half hour bin of MLT, with a latitudinal width equal to the statistical difference between the poleward and equatorward edges. The mantle asymmetry about noon does not fit the pattern expected from simple theoretical considerations (namely that the mantle should be thicker postnoon for positive By in the northern hemisphere). The mantle is appreciably thicker prenoon than postnoon, especially for positive By, but also even for negative By. This asymmetry matches the SuperDARN convection flows, in which, irrespective of the sign of By, most of the conversion of closed field lines to open occurs prenoon. Quantitatively expressed, for southward IMF, the potential encompassed by flux crossing the open-closed boundary prenoon (0600-1200 MLT) exceeds that for postnoon (1200-1800 MLT) by 30 kV to 15 kV for By $>$ 3 nT, and by 30 kV to 20 kV for By $<$ -3 nT. The mantle shape thus matches convection pattern variations. Only about 25-35% of the dayside open-closed field line conversion occurs within the particle cusp, with the lower number appropriate to northward IMF. Most closed-to-open field line conversion occurs away from noon. Merging is thus active throughout the frontside magnetosphere. Field lines which merge well away from noon do not experience enough particle inflow against the solar wind velocity to produce anything more than a weak, de-energized (mantle) precipitation. The boundary between the dusk cell and dawn cells consistently coincides with one edge of the cusp. IMF By also controls

where most of the nightside reconnection occurs. For positive Bz and By, $>$ 3 nT, 31 kV reconnects from 1800-2400 MLT, but only 14 kV reconnects from 0000-06000 MLT. The convection reversal boundary (CRB) consistently coincides with the nightside open-closed particle boundary (OCB). On the dayside, the CRB lies equatorward (poleward) of the OCB in the postnoon (prenoon) sector for By,$<$0 (By,$>$0). This shift is consistent with the effects of an interhemispheric current produced by the partial penetration of the IMF By, into the frontside magnetosphere.