Bimodal Solar Wind-Magnetosphere-Ionosphere Coupling

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Regarding its coupling to the solar wind, the magnetosphere-ionosphere system appears to be schizophrenic. That is, it seems to manifest two modes with contradictory qualities, modes that alternate depending on solar wind conditions. Normal conditions elicit the normal mode (aka the solar wind-dominated mode). But extreme conditions bring out the un-normal mode (aka the ionosphere-dominated mode). The greatest difference between the two modes concerns the mechanism of momentum coupling between the solar wind and the terrestrial system. In the usual case the solar wind pushes on the magnetosphere via magnetic coupling to the geo-dipole. In the unusual case the solar wind drags on the ionosphere via field-aligned currents and sets a neutral flywheel in motion. Related to this fundamental difference are other consequences: the magnetosphere-confining Chapman-Ferraro current system fades away to be replaced by the region 1 currents system which links the now dominant ionosphere to the whole of geospace out to and including the bow shock. Dst no longer responds to the ram pressure of the solar wind. The electrical potential across the polar cap stops growing as solar wind driving strengthens and, instead, becomes bound to ionospheric conductance. The plasmasphere is stripped away, most likely to feed (by global circulation) an intensifying ring current. The outer magnetosphere begins a series of slow, macroscale convulsions. Huge parallel potentials possibly develop in the magnetosphere's outer regions, reacting against the ionosphere's domination. Compared to the solar wind-dominated magnetosphere, the ionosphere-dominated magnetosphere is comparatively unknown and, so, provides opportunities for significantly advancing our understanding of the coupled solar wind-magnetosphere-ionosphere system.