Alfvénic Density Holes and Ionospheric Upwelling

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The Ionospheric Alfvén Resonator (IAR) is an electromagnetic cavity bounded by the conducting ionosphere from below and by a steep gradient in the Alfvén-wave refractive index near 1 R_E altitude. We know from previous studies that a resonant feedback instability amplifies spontaneously generated IAR oscillations in regions where downward currents flow between the magnetosphere and ionosphere (Streltsov and Lotko, 2004). The ensuing turbulence is commonly observed by polar-orbiting satellites like FAST and Dynamics Explorer. More recent studies sponsored by the Heliophysics Theory Program (see figure) predict that the ponderomotive force of the small-scale IAR oscillations transports ionospheric plasma upward, creating a large-scale, bottomside density cavity. The upwelled plasma enhances the topside source of outflowing heavy ions that circulate through the plasmasheet and intensify the stormtime ring current (Lotko, 2007). Multiscale interactivity of the magnetosphere-ionosphere system is clearly evident in this process.

