Sub-Auroral Ion Drifts as a Source of Mid-Latitude Plasma Density Irregularities

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Ionospheric irregularities cause scintillations of electromagnetic signals that can severely affect navigation and transionospheric communication, in particular during space storms. At midlatitudes, such space weather events are caused mainly by subauroral electric field structures (SAID/SAPS) [1, 2]. SAID/SAPS –related shear flows and plasma density troughs point to interchange and Kelvin-Helmholtz type instabilities as a possible source of plasma irregularities. A model of nonlinear development of these instabilities based on the two-fluid hydrodynamic description with inclusion of finite Larmor radius effects will be presented. A numerical code in C language to solve the derived nonlinear equations for analysis of interchange and flow velocity shear instabilities in the ionosphere was developed. This code was used to analyze competition between interchange and Kelvin Helmholtz instabilities in the equatorial region [3]. The high-resolution simulations with continuous density and velocity profiles will be driven by the ambient conditions corresponding to the in situ Defence Military Satellite Program (DMSP) satellite low-resolution data [2] during UHF/GPS L-band subauroral scintillation events.

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[2] Mishin, E., and N. Blaunstein (2008), Irregularities within subauroral polarization stream-related troughs and GPS radio interference at midlatitudes. In: T. Fuller-Rowell et al. (eds), AGU Geophysical Monograph 181, MidLatitude Ionospheric Dynamics and Disturbances, pp. 291-295, doi:10.1029/181GM26, Washington, DC, USA.

[3] V. Sotnikov, T. Kim, E. Mishin, T. Genoni, D. Rose, I. Paraschiv, Development of a Flow Velocity Shear Instability in the Presence of Finite Larmor Radius Effects, AGU Fall Meeting, San Francisco, 15 – 19 December, 2014.