PLASMA INSTABILITIES IN IONOSPHERIC DENSITY GRADIENTS FROM 120-200 KM ALTITUDE

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Abstract Submission Form

2006 National Radio Science Meeting

Abstract: dyrud12097

Date Received: September 15, 2005

We present recent plasma simulations showing the effects and evolution of gradient drift type instabilities at a broad range of ionospheric altitudes (from 120-200 km) and parameter regimes. This work is motivated by several recent observations such as those by the Sondrestrom Radar which observed narrow field aligned filaments of enhanced density extending from approximately 100-200 km altitude (Semeter et al., JGR 2005). These density gradients are approximately 10-200 km wide in the transverse to B direction, and have a peak density as high as 10 times that of the background ionospheric density. Additionally, these simulations likely apply to various HF backscatter regimes, including those of ionospheric patches and or the structuring responsible for cusp backscatter (Moen et al., JGR 2002). To examine the stability of such density gradients when immersed within plasma convection, we conducted a number of 2-D (plane perpendicular to the magnetic field) hybrid plasma simulations of enhanced density columns. We will present results from these simulations at various altitudes from 120-200 km, and discuss the implications. These simulations show a relatively rapid development (of the order of seconds) of gradient drift type instability waves. For parameters near 200 km altitude, and convection velocity of 600 m/s plasma columns are unstable to waves with a wavelength of about 10-20 m. For gradients near 115 km, we see the development of strong polarization fields and rapid structuring at 5-10 meter wavelengths. All of the instabilities simulated are strongly non-linear, due to the background gradients, and will influence the evolution of the medium scale plasma through processes such as a greatly enhanced anomalous diffusion.

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2. H - Waves in Plasma

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4. I - Invited Paper, Program chair: Meers Oppenheim

5. No special instructions