WHY AND HOW DO E REGION IRREGULARITIES EVOLVE LARGER ASPECT ANGLES, OR NOT?

St.-Maurice Jean-Pierre
ISAS U of Saskatchewan,116 Science Place,Saskatoon,Saskatchewan,Canada

Abstract:

The aspect angle of E region irregularities seems to play an important role in the nonlinear and nonlocal evolution of the structures. However, this topic has proven extremely difficult to study both theoretically and observationally. In this presentation I will go over some theoretical notions that have been worked on and describe the progress in thinking that has been accomplished over the past few years. I will show that while the notion of a diffusion in wave vector space has not had too much success, linearly unstable modes can acquire large aspect angles through a variety of other means. In particular, the evolution of decameter structures is controlled by nonlocal processes that force the aspect angle to change with time until the modes become stable again. In the process, mode conversion can also occur to trigger purely decaying modes or heavily damped ion-acoustic modes with large aspect angles; the kind of mode that will be produced will depend on the altitude at which the conversion occurs. In addition, when the Farley-Buneman modes are strongly excited at high latitudes (electric fields in excess of 40 mV/m), the 2-D nonlinear evolution of m-size structures predicted by a recently developed fluid blob theory can be shown to break down to trigger large aspect angle modes in the final stages of its evolution. The large aspect angles in turn trigger strong electron heating through the resulting parallel electric fields. Finally, even at high latitudes, nothing precludes m-size modes to either spend a substantial part of their evolution at zero aspect angles, which might be the reason for the presence of so-called type IV modes at high latitudes. Alternatively, some modes might never develop large aspect angles, as can be shown to probably happen at equatorial latitudes. In the latter case, the persistence of very small aspect angles leads to saturation at super-adiabatic phase speeds, that is to say, isothermal theory can be shown not to apply, at least not in the lower parts of the equatorial electrojet.