Large Scale wave structure and its actual role in modifying the RT instability

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Observations made from Sriharikota, India, clearly suggests that the low latitude E region Pedersen conductivity plays an important role in explaining the day-to-day variability of the Pre-Reversal Enhancement (PRE) of zonal electric field and equatorial spread F (ESF). Detailed analysis of the Ionosonde observations clearly suggest that the formation and disruption of sporadic E (Es), which can modify the field line integrated Pedersen conductivity of the E region in the evening hours, is a secular process not being controlled by the mapping of sheared F region vertical electric field. Ionosonde observation of the F layer height also indicates the presence of a spatial wave in the iso-electron density level, commonly referred to as Large Scale Wave Structure (LSWS). Detailed analysis based on long term observations clearly shows that the LSWS in the equatorial F region can be generated by the spatial modulation of the low latitude Es. Model computation also indicates that zonal modulation of low latitude Es is capable of generating zonal modulation in the F layer height. It is found that the modulation of the F layer height, linked with the low latitude Es, assists the onset of ESF by modifying both, growth rate of the collisional Rayleigh-Taylor (RT) instability and also its efficiency. A new mechanism for the generation of the LSWS is being proposed. Actual role of the LSWS in modifying the RT instability (considering that the scale of LSWS is much larger than that of an individual bubble) will also be discussed in details. Prospects of simulation of LSWS and its impact on RT instability using open source physics based model (like SAMI2+, SAMI3 etc.) will also be presented.