New aspects of low latitude E and F region plasma irregularities revealed from radar observations in India.

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Abstract

While significant progress has been made to understand the low latitude E and F region electron density irregularities, there remain several aspects of these which need further investigations. Much of the understanding on the irregularities has come through the radar observations. Further, most of the observations related to low latitudes have been limited to the magnetic equator and mostly made at radar frequency close to 50 MHz. So the radar observations made at different frequency and at different latitudes other than the equator are yet to be fully known. In this context, radar observations made in the recent past at the equator using a newly built 18 MHz radar and at low latitude (6.3 ^{o} dip latitude) using the Gadanki MST radar would be of interest. Observations made at 18 MHz show strong anisotropy of the 8.3 m electrojet irregularities in contrast to that observed at ~3 m. Further simultaneous observations made at 2.7 m and 8.3 m electrojet irregularities reveal interesting aspects of the turbulent processes in the electrojet. As far as low latitude processes are concerned, the Gadanki radar results clearly show that they are quite different than that of the electrojet both in terms of local time and seasonal behavior and also the detailed characteristic in terms of structures and turbulence activities. Low altitude descending thin irregularity layers occurring both during day and night and high altitude quasi-periodic structures are common phenomena unlike that at the electrojet. Further, new structures, quite similar to equatorial large scale gradient drift waves, occurring below 98 km and echoes descending down to altitudes as low as 85 km are of significant interest in terms of their generation mechanisms. There are also midnight descending intermediate structures that are of interest in terms of their generation mechanisms. The F region irregularities associated with the equatorial spread F also show remarkably different features than that of the equator. While the bottomside band structures are uncommon as expected, multiple plume structures are very common and are in contrast to that of the equator. Further, there are evidences of strong coupling of these structures in deciding the fate of the E region instability process at low latitudes. While much is yet to be learnt on the above aspects, this talk will be intended to cover the new aspects uncovered in the recent radar observations from India and the related physical processes