FIRST EVIDENCE OF BEAM BROADENING EFFECT DOMINATING DOPPLER SPECTRA OF FIELD-ALIGNED IRREGULARITIES IN SPORADIC E REGION

Chu, Y.H.[1] , Wang, C.Y.[2]
[1]Institute of Space Science, National Central University
[2]Department of Physics, Chinese Cultural University

With the interferometry technique implemented at the 52 MHz Chung-Li VHF radar, for the first time we present the observational evidence showing that the observed Doppler spectral widths of the field-aligned irregularities in the sporadic E region may be dominated by the beam broadening effect. Statistics indicates that the ratio of the beam broadening spectral width to the observed Doppler spectral width for the data investigated in this research is in the range 0.1 0.6. In a special case, however, the ratio can be as large as more than 0.8. After removing the beam broadening spectral width from observed spectral width, we obtain that the magnitude of the spectral width caused by the random fluctuation of the plasma irregularities is in the range 1 7 m/s comparable to that induced by the neutral turbulences in Es region. We also examine the power law relation between the observed Doppler spectral width and the drift velocity of the irregularities, showing that the estimated power value is only about 0.289 which is much smaller than the value of 4/3 predicted by the theory of non-linear turbulence energy cascade process. This result is in excellent agreement with that obtained by a stochastic model that simulates the observed Doppler spectral width in terms of the combination of the spectral width caused by neutral-induced plasma irregularities and the beam broadening spectral width. Therefore, it appears very likely that the mechanism involved in the generation of the 3-meter field-aligned irregularities for the present case seems to be the neutral turbulences that induce the plasma irregularities responsible for the radar returns, instead of the non-linear turbulence energy cascade process from primary plasma wave associated with the gradient drift instability.

Abstract Submission Form

2004 National Radio Science Meeting

Abstract: chu4099

Date Received: September 24, 2004

1. (a)
Yen-Hsyang Chu
Institute of Space Science
National Central University
Chung-Li, Taiwan
320 R.O.C.(TAIWAN)
yhchu@jupiter.ss.ncu.edu.tw
(b) 886-3-422-8374
(c) 886-3-422-4394

2. G - Ionospheric Radio and Propagation

3. (a)

4. C - Contributed Paper

5. No special instructions