Aspect angle measurements of irregularities in the equatorial *E* region above Jicamarca

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We have revisited, refined, and extended the 50 MHz radar aspect angle measurements made at the Jicamarca Radio Observatory in Peru by Kudeki and Farley in 1985, taking advantage of the now considerably upgraded facilities of the Observatory. We study here (1) both type 2 and type 1 echoes in the electrojet region, (2) early evening echoes from somewhat above the electrojet, and (3) daytime "150 km" echoes in the ~145 to 170 km altitude region. Our electrojet data (a) confirm the results of the earlier study for weakly driven type 2 conditions, namely that the aspect angle $\theta_{rms}(\omega) = \langle(\theta-\langle\theta\rangle_\omega)^2\rangle^{½}$ (where $\langle\rangle$ implies expected value or a time average and θ is measured from perpendicular to **B)**, decreases from about 0.3º at 99 km to slightly less than 0.2º at 108 km; and (b) provide much more information about the aspect angles of type 1 echoes and the apparent nonlinear interaction between type 1 waves and slower waves. Type 1 waves, with phase velocities near the ion-acoustic velocity, have aspect angles decreasing from about 0.15º near 104 km to about 0.10º near 110 km. Furthermore, there is strong evidence that horizontally travelling type 1 waves can nonlinearly couple to slow, vertically travelling waves with aspect angles sometimes larger than 0.5º. These waves, which we will call type 1C (for coupled), are not unstable gradient-drift waves, even though the phase velocities are similar. In the early evening we often observe echoes in the 125-135 km region with aspect angles of 0.05º or even less. During the daytime the relatively weak "150 km" echoes have even smaller aspect angles that are about at the limit of our measurement resolution. At the end of the talk we discuss ideas that may advance our understanding of the nonlinear aspects of electrojet irregularities, particularly of type 1 waves.

Counter electrojet features in the Brazilian sector: Simultaneous observation on radar, digital sounder and magnetometers data

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Counter electrojet events have been detected in Brazil with the RESCO radar and two set of fluxgate magnetometer. RESCO radar is a 50 MHz backscatter coherent radar installed in 1998 at São Luís (SLZ, 2.33° S, 44.60° W), an equatorial site. The magnetometers are fluxgate-type installed at SLZ and Eusébio (EUS, 03.89° S, 38.44º W). In addition, electron density profile is routinely monitored at the radar site by a digital sounder. Several cases of westward morning electrojet and its inversion to the normal eastward equatorial electrojet (EEJ) have been observed as seen in magnetometers signatures of the EEJ strength obtained from the difference between the horizontal component of magnetic field at SLZ station and the same component at the low latitude magnetic station, EUS. Moreover, some cases of counter electrojet (CEJ) have been detected. In the present work, we show some characteristics of normal EEJ inversion in the morning hours and CEJ events observed in Brazil with the magnetometers as well as

with the RESCO radar. Electron density profiles are used to infer the presence of sporadic layers and to provide the current status of the ionospheric ionizations level. The spectral characteristics and power intensity of the backscattered echoes are examined.

Irregularities in the low- and mid-latitude *E* region: A historical perspective

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Recent investigations of E region irregularities in the low- and mid-latitude E region have focused on the electrodynamics associated with larger-scale structures, in particular, wind shear and sporadic E in the nighttime ionosphere. Small-scale irregularities responsible for radar backscatter appear explainable in terms of the gradient-drift instability, operating locally without effects of field line mapping. A brief review will be presented that outlines the historical flow of research, the findings, and the status of our understanding. In particular, earlier findings are revisited to determine whether interpretation, at the time of discovery, remains reasonable, or whether a new interpretation emerges when viewed in light of current thinking. Topics of interest include Hall polarization, a sporadic-E layer instability, the effects of electrical coupling between the E and F regions, and neutral dynamics and the Kelvin-Helmholtz instability.

Quasi-periodic variation of the sporadic E layer reflection

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Sometimes, the sporadic E layer (Es) is described as patchy, meaning that on these occasions the radio waves are either penetrating the layer or reflected by a high electron density patch. In July 2006, an unusual one hop propagation mode 1Es has been observed at midlatitude using the Nostradamus HF radar. The event lasted about 40 minutes and during this time interval the Es reflection had a patchy character but with an unusual quasi-periodic behaviour. Most of the time the quasi-period was close to 10 sec but for a few seconds, a shorter 2 sec quasi-periodic reflection was also observed, superimposed on the slower 10 sec reflection. A simple model based on a periodic variation of the Es critical frequency is developed to explain the characteristics of these observations. The simulations agree well with our observations if the FoEs variation is sufficiently large but for now it is not clear how such a variation could be created.

Some intriguing features of QP echoes revealed by Gadanki radar observations and a mechanism that explains them

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Quasi-Periodic (QP) occurrence of E-region echoes has been a subject of intense scientific investigation since they indicate the potential role of neutral dynamics in the manifestation of plasma irregularities.