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Estimation of spectral parameters from oblique Equatorial Electrojet echoes using a double skewed Gaussian model at the Jicamarca Radio Observatory

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Coherent echoes from the equatorial electrojet (EEJ) region are detected in Perú at the Jicamarca Radio Observatory by using an array of 16 Yagi antennas with a main beam pointed obliquely to the west with a 35 deg elevation. The spectrum of these observations are composed of two types of echoes (Type I and Type II) from which we can estimate their main spectral parameters such as Doppler shift and spectral width independently for each type. Previously, the method applied to obtain these parameters was a standard fitting approach based on a double Gaussian model. However, in some cases, the shape of the spectral measurements are not symmetric. Based on simulations, we determined that the skewed shape of the oblique EEJ spectrum comes from the fact that the measured spectrum is the result of the sum of spectral contributions coming from different heights, with different Doppler shifts and spectral widths weighted by the antenna beam shape. The overall result is an asymmetric spectrum with a peak that does not coincide with the average Doppler shift. Thus, in order to account for this effect, we have implemented a double skewed Gaussian distribution model to fit the oblique EEJ measurements and estimate their spectral parameters. In this work, we present the results obtained in the simulation showing the skewed shape of the spectrum. Based on our simulations, we have also proved that the shift of the skewed Gaussian model can be interpreted as the Doppler Shift. In addition, an example of the new fitting procedure is shown in comparison with the classical Gaussian fitting where it can be seen the better agreement between data and the double skewed Gaussian model. Moreover, these new results will change zonal wind estimations in the EEJ region that uses EEJ Type II Doppler shifts as input.