ESTIMATING DAYTIME VERTICAL EXB DRIFT VELOCITIES FROM EQUATORIAL MAGNETOMETER OBSERVATIONS USING A MULTILAYER NEURAL NETWORK

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A recent study has quantitatively established the relationship between the vertical daytime ExB drift velocity in the ionospheric F region and the DH values measured by two magnetometers in the South American (west coast) longitude sector. Magnetometer H component observations from Jicamarca (0.8 N. dip lat.) and Piura (6.8 N. dip lat.) in Peru and daytime, vertical ExB drift velocities measured by the Jicamarca Unattended Long-term Ionosphere and Atmosphere (JULIA) radar have been used to establish this relationship. The magnetometer observations and the JULIA 150 km echo ExB drift measurements were obtained for the period between August, 2001 and September, 2003. A multilayer feed-forward neural network has been designed and trained in order to estimate the quantitative relationship between the vertical daytime ExB drift velocities in the equatorial F-region and the ground based magnetometer observations. We have found that a neural network approach performs better in capturing the non-linear relationship between the input and the output values than the classical least-squares method. An independent data set of vertical ExB drift velocities obtained from Jicamarca Incoherent Scatter Radar (ISR) observations has been used to validate the neural network approach. The RMS error in ExB drift is approximately 3 m/sec. It is thought that the greatest source of remaining error comes from not knowing the E region, zonal neutral wind velocities on a day-to-day basis. A possible proxy for these winds is the vertical component of the magnetic field (Z), since it is believed that zonal neutral winds will affect the Z component at Piura more than at Jicamarca. For this study we add the DZ observations between the Jicamarca and Piura magnetometers as inputs to the neural network in addition to the inputs previously used. The results of this new study will be presented and discussed with an emphasis on how they can be used to infer the day-to-day variability in zonal neutral wind velocities.

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2. G - Ionospheric Radio and Propagation

3. (a) Data Assimilation

4. C - Contributed Paper

5. No special instructions