SPECIFYING ERROR BARS FOR PROFILES DERIVED FROM IONOGRAMS

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Electron density profiles supplied to Kalman filter based data assimilation models, such as the Utah State University Global Assimilation of Ionospheric Measurements (USU-GAIM) model, must be accompanied by error bars so that they can be weighted appropriately with other data sources. Profiles deduced from ground-based vertical incidence ionograms have fundamental limitations due to the lack of observations below some frequency fmin (the starting problem), and the lack of echoes from altitudes within the E-F valley (the valley problem). If the ionograms are scaled automatically, issues of correct echo identification must also be addressed.

Techniques have been developed at AFRL to scan autoscaled ionograms to determine which scaled h(f) traces are acceptable, and then to use the true-height analysis program POLAN to derive the corresponding electron density profiles. Empirical models of the underlying and valley ionization developed by J. E. Titheridge are used to resolve the starting and valley problems.

POLAN is run four times, with upper and lower estimates of the true height at a plasma frequency of 0.5 MHz, and upper and lower estimates of the E-F valley width. In one run, the last scaled frequency is taken to be foF2, and in another run the value of foF2 is obtained (by POLAN) using a least-squares fit to a Chapman layer

The uncertainties in the plasma frequency at a fixed altitude are found to be largest just above the top of the E-F valley. Large uncertainties also arise at the peak of the layer if the scaled trace does not possess sufficient upwards curvature to define the peak adequately.

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3. (a) Radio and Radar Techniques

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5. No special instructions