HF Radar Measurement Techniques in the Thermosphere-Ionosphere using Dynasonde methods

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The advanced capabilities of the Vertical Incidence Pulsed Ionosphere Radar (VIPIR) radar operating in the MF and HF bands (0.5-25 MHz) allow rapid and high quality measurement of the ionosphere, enabling the discovery of mesoscale plasma structure and study of the associated physics. High signal to noise ratios, robust analog signal performance and pulse shaping provide a large pool of radar resources to the user. Pulse-to-pulse frequency aglity and flexible operating schemes allow the design of measurement modes to optimize radar resouces toward specific observational goals. Amplitude and phase calibrations allow for increased precision and accuracy of the resulting data.

Dynasonde observation principles for ionospheric radio sounding take advantage of the precise phase and frequency agility properties of the VIPIR. Unique capabilities of the Dynasonde technique allow measuring echo ranges and angles of arrival with high precision and with high time resolution. The inversion algorithm NeXtYZ, which is a part of the Dynasonde data analysis package, uses this information to restore parameters of a three-dimensional plasma density distribution over the sounder location, including its vertical cross-section (vertical profile) and tilts of constant electron density surfaces as functions of the true altitude. Manually guided analysis allows for the correction of automatic data analysis. Such analysis is possible for US stations in Boulder, Wallops and San Juan, as well as Istanbul and the EISCAT instruments.