

# **3-D Inversion of Ionosonde Data for Ionospheric Electron Density: New Developments and Benefits for Assimilative Modeling**

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## **Abstract**

Modern phase-based digital ionosondes have capabilities to measure accurately both the group time of propagation and the directions of arrival for each ionogram echo. Inversion algorithm NeXtYZ uses this information to recover locally both true vertical profile and horizontal gradients of ionospheric plasma density. For the first time in ionospheric sounding practice this algorithm provides justifiable profile uncertainties that characterize specific ionogram and obey Gaussian statistics. Horizontal gradients not only describe the plasma density distribution directly but also quantify energetics and dynamics of the ionosphere and thermosphere through characterization of the gravity waves and of the neutral wind.