A combined reconstruction algorithm for computerized ionospheric tomography

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Abstract: Ionospheric electron density profiles inverted by tomographic reconstruction of GPS derived total electron content (TEC) measurements has the potential to become a tool to quantify ionospheric variability and investigate ionospheric dynamics. The problem of reconstructing ionospheric electron density from GPS receiver to satellite TEC measurements are formulated as an ill-posed discrete linear inverse problem. A combined reconstruction algorithm of computerized ionospheric tomography (CIT) is proposed in this paper. In this algorithm, Tikhonov regularization theory (TRT) is exploited to solve the ill-posed problem and its estimate from GPS observation data is input as the initial guess of simultaneous iterative reconstruction algorithm (SIRT). The combined algorithm offer a more reasonable method to choose initial guess of SIRT and the use of SIRT algorithm is to improve the quality of the final reconstructed imaging. Numerical experiments from the actual GPS observation data are used to validate the reliability of the method, the reconstructed results show that the new algorithm works reasonably and effectively with CIT, the overall reconstruction error reduces significantly compared to the reconstruction error of SIRT only or TRT only.