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A hybrid reconstruction algorithm for three-dimensional ionospheric tomography

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In this paper a hybrid reconstruction algorithm (HRA) is presented to solve the ill-posed inverse problem associate with three-dimension ionospheric stochastic tomography. In this new method, the ionospheric electron density (IED) can be inverted by using two steps: 1) truncated singular value decomposition (TSVD) method, whose estimation is independent on any initial guess, is first used to resolve the ill-posed problem of tomography system; 2) Taking into account the "coarse" of its solution, an iterative improvement of the solution is implemented by utilizing the conventional algebraic reconstruction algorithm. The HRA therefore offers a more reasonable approach to choose an initial approximate for the ART and improve the quality of the final reconstructed image. A simulated experiment demonstrates that the HRA method is superior to the TSVD or the ART alone for the tomographic inversion of IED. Finally, The HRA is used to perform GPS-based tomography of the IED at mid-latitude and low-latitude region.