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A hybrid reconstruction algorithm for three-dimensional ionospheric tomography

Yunbin Yuan (1), Debao Wen (1,2), Jikun Ou (1)

(1) Institute of Geodesy and Geophysics, Chinese Academy of Sciences, 340 Xudong Street, Wuhan, China, 430077, (2) Graduate School of Chinese Academy of Sciences, Beijing, 100039, China (iontomography@hotmail.com)

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.