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Development and validation of three-dimensional ionospheric tomography by neural network

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Earthquake related ionospheric disturbances have been reported by many researchers. We especially pay attention to the pre-seismic ionospheric disturbances to mitigate earthquake disasters. In order to clarify the mechanism of earthquake-related ionospheric disturbances, three-dimensional ionospheric tomography is effective. Various techniques for ionospheric tomography algorithm have been proposed. Meanwhile, the algorithm using sparse data is necessary to investigate low-density GPS receiver area for this earthquake research.
In this aim, we adopted "Neural Network with Residual Minimization Training" by Ma et al.[2005]. It doesn't depend on the model in this technique, and a flexible reconstruction is possible according to function approximation ability of neural network. Moreover, ionosonde and Low-Earth-Orbit data can be easily taken as constrain conditions and the increase of precision is expected. Ma et al. have demonstrated good results for a few specific conditions but they did not provide the general performance in the case of disturbed periods and the estimation of plasmaspheric electron density.
In this paper, we will present the results of evaluation of the "Neural Network with Residual Minimization Training" technique and it's improvement for the practical use.