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Ionospheric Tomography and Prediction based on GNSS Augmentation Network

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High resolution regional ionospheric tomography will provide fine structure of plasma parameters, which is not only important for space weather motioning and ionospheric induced propagation effects. With global navigation satellite service (GNSS) and large amount of ground-based reference stations, it becomes possible to achieve large scale ionospheric tomography. However, ionospheric tomography in disturbed ionosphere is still challenging compared with quite time, which becomes demanding since the solar activity starts to enter into a new active period. With rapid progress of machine learning, it is important to adopt new techniques to advance ionospheric tomography. This work summarizes our attempt to achieve ionospheric tomography with machine learning based on GNSS Augmentation network.

First of all, we proposed two data-driven sparse tomography methods by combing model data with measurement to achieve high spatial and temporal resolution [1, 2]. The Slant Total Electron Content (STEC) are extracted by the un-differential and un-combined precise point position (PPP). Secondly, the PPP/SSA-based method has been adopted to calculate ionospheric TIDs and velocity. Thirdly, a three-layer neutral network perception is used to predict the electron density for a short time period (20 minutes). Finally, we would like to discuss possibilities of ionospheric anomaly and irregularities by combing GNSS tomography with synthetic aperture radar (SAR). Results of these methods have been tested based on CORS data over North America and in China.

References

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