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Inferring the Value of Phase Scintillation Index from TEC Measurements Using Machine Learning Techniques

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1 Extended Abstract

The ionospheric studies community has been benefiting from GNSS-based ionospheric scintillation monitoring (ISM) receivers for decades. The opportunistic use of GNSS signals has opened the door to extensive research resulting from the unprecedented increase in the amount of ionospheric scintillation measurements. However, being receivers deployed only for the purpose of ionospheric monitoring, the number of these monitors is geographically limited and concentrated around the magnetic equator and poles where the demand for scientific data is higher.

On the other hand, the IGS network which has wider geographic distribution compared to ISM receivers, has been exploited by ionospheric studies community for continuous Total Electron Content (TEC) measurements for the last decades. However, these receivers do not provide the scintillation indexes in the form of S_4 and σ_ϕ that are provided by ISM receivers. This resulted in implicit separation between scintillation studies that rely on scintillation indexes and those relying on TEC products.

In this paper we tackle this separation by investigating the relationship between scintillation measurements and the corresponding TEC products. We approach this objective by developing a machine learning model able to infer the value of σ_ϕ at high latitudes relying on TEC values. The motivation behind this selection of TEC for inferring σ_ϕ also comes from the result obtained in [1] where the authors presented a machine learning model able to detect phase scintillation relying only on TEC and dTEC values provided by ISM receivers. We extend the investigation by testing the model with TEC data provided by both ISM and IGS receivers.

References

[1] R. Imam, and F. Dovis, "A Machine Learning Approach to Distinguish Between Scintillation and Multipath in GNSS Signals," *Proceedings of the XXXIVth URSI General Assembly*, August 2021.