



Solar Radio Burst Monitoring Using GNSS Receivers in the Azores Archipelago

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Abstract

Solar radio bursts are characterised by intense electromagnetic radiation emitted from the Sun's atmosphere releasing huge amounts of energy in the order of $\sim 10^{32}$ ergs [1] and are crucial indicators of solar activity. These burst events might drive extreme space weather phenomena such as geomagnetic storms, ionospheric disturbances, and communications disruptions. Real-time prediction of such intense solar events is a challenge for solar communities. The permanent Global Navigation Satellite System (GNSS) can play an important role as they constantly receive signals from satellites orbiting the Earth and directly compare them with the data-dedicated solar instruments [2]. Monitoring these data within the unique geographic context of the Azores Archipelago enhances our understanding of their effects on Earth's ionosphere and associated issues with the technological systems. The Azore's location in the North Atlantic Ocean provides an ideal vantage point for capturing solar radio burst data minimised by electromagnetic interference. GNSS receivers across the archipelago region offer an opportunity to monitor signal amplitude variations, signal disturbances, frequency band interactions, and ionospheric total electron content (TEC) maps caused by extreme solar events in the radio regime [3]. More than twenty permanent GNSS receivers in different networks (C4G, REPRA, ReNET, REPGRAM, EPN, IGS) are spanned at the Azores and Madeira archipelagos. Evaluating a 30 seconds cadence data of these receivers, calculating TEC values from dual-frequency GNSS observations and generating spatial representations, and computing the differential delay between L1 and L2 carrier phases for each satellite-receiver pair with inverse distance weighting algorithm offers valuable insights into the effects of solar activity on the ionosphere and its impact on GNSS signals. With this effort, we aim to establish a robust solar radio burst monitoring network in the region, which may help contribute to developing an algorithm to predict solar extreme events and foster a more comprehensive understanding of the dynamic interactions between the Sun and Earth's atmosphere.

References

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