CONTINUOUS LONG-TERM ANALYSIS ON EARTHQUAKE-RELATED TOTAL ELECTRON CONTENT (TEC) SIGNALS ACROSS THE MEDITERRANEAN REGION

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In recent years, the integration of extensive historical satellite records with rapid advancements in artificial intelligence techniques has significantly enhanced the study of space-based detection of seismic-related anomalies. Over the past decade, various geophysical parameters—including electromagnetic field components across diverse frequency ranges, Earth's thermal emissions, ground-level gas discharges, and ionospheric characteristics—have been proposed as potential precursors to seismic activity. Specifically, the analysis of Total Electron Content (TEC) variations has been extensively explored as a potential indicator of ionospheric disturbances linked to seismic events. A comprehensive, systematic, and continuous examination of long-term historical data is crucial to distinguish between TEC fluctuations resulting from natural ionospheric cycles and those induced by non-terrestrial factors, both of which are heavily influenced by solar activity.

In this study, multi-year GNSS-derived TEC datasets are correlated with extended time series of seismic events across the Mediterranean region and analyzed using an interquartile range (IQR)–based methodology. The findings reveal a non-random correlation between the most intense TEC anomalies detected in the multi-year time series and the occurrence of significant seismic events. These results are discussed in the context of evaluating the potential for developing and deploying a TEC-integrated multi-parametric system for time-dependent assessment of seismic hazard (t-DASH).