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Real-time Solar Flares nowcasting from GNSS-based Ionosphere monitoring

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The Sunlit Ionosphere Sudden Total Electron Content Enhancement Detector (SISTED), a method for the indirect detection of solar flares facing the Earth is revisited to re-evaluate its performance. SISTED is based on the monitorization of ionospheric TEC high-frequency variations looking for any positive increase that is simultaneously given in the whole or most part of the sunlit ionosphere. For this purpose, we can take advantage of Global Navigation Satellite Systems (GNSS) and data from open world-wide networks of GNSS permanent receivers, such as the International GNSS Service (IGS) or the IGS-IP (IP for Internet Protocol) in real time (through NTRIP datastreams). In this way, nowcasting of solar flares facing the Earth can be economically affordable with a high temporal resolution and high accuracy (no particle contamination affecting direct sensors on-board dedicated spacecrafts).

SISTED has been running for years and its performance (reliable detection performance of 94% of X-class solar flares and 65% for M-class flares during more than half solar cycle) shall be revisited. In this work, recent results on SISTED will be considered and associated metrics could be derived, such as Probability of Detection (POD) and False Alarm Ratio (FAR). Results are to be validated against NOAA's Solar and Geophysical Event Reports and against direct measurements from space probes. Also, comparison with the so-called GNSS Solar Flare Indicator (GSFLAI; companion to SISTED), proxy of solar flux in EUV band based on the same principles, may also be considered.

Nowcasting and forecasting of solar flares and Solar Energetic Particle (SEP) events has become of great interest nowadays in order to provide the Space Community with warning alerts, for instance hours prior to launch operations. In this context, SISTED and GSFLAI can be accessed through open registration through ESA's MONITOR server and SEPsFLAREs prototype service (at http://monitor.estec.esa.int and http://sepsflares.estec.esa.int, respectively) and are currently being considered in ESA Space Situational Awareness (SSA) Programme.