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Recent improvements of RST-based analysis of long-term TIR satellite observations in relation with earthquake occurrence

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Abstract Text:

In order to build and implement a multi-parametric system for a time-Dependent Assessment of Seismic Hazard (t-DASH), among the others candidate parameters, anomalous transients in the Earth's emitted Thermal Radiation observed from meteorological satellites in the Thermal InfaRed band (TIR) have been since long-term proposed. RST (Robust Satellite Technique) analyses - performed in different continents and seismic regimes on ultra-decennial time series of TIR satellite images – allowed to identify those anomalies (in the spatial/temporal domain) possibly associated to the occurrence of major earthquakes. Results until now achieved can be summarized as follows:

1. Significant Sequences of TIR Anomalies (SSTAs) are quite rare (less than 0,05% of the total investigated space-time volumes)
2. SSTAs, under well-defined correlation rules, exhibit (for earthquakes with magnitude greater than 4) a false positive rate around 25%, oscillating from 7% (Greece) up to 40% (Italy) strongly depending on the considered region;
3. Molchan error diagram analyses gave a clear indication that a non-casual correlation exist between RST-based SSTAs and earthquake occurrence time and location;

Moreover the analyses based on the application of the RETIRA index (Robust Estimator of TIR Anomalies) showed some limitation related to the contextual approach that, in order to take into account of possible large scale changes of the thermal background, consider not just the

TIR signal itself but its excess respect to the background (large scale spatial average of the TIR signal) introducing, this way, a strong dependence on the presence and distribution of meteorological cloud across the scene.

In order to overcome such an issue an alternative possibility has been investigated which can locally filter-out the contributes of occasional warming (typically associated to meteorological fronts) without the need of analyzing the TIR signal at the large-scale. In this paper preliminary results achieved by introducing the RETIRSA (Robust Estimator of TIR Slope Anomalies) index are presented and its impact in reducing the overall false-positive rates particularly discussed in the case of recent earthquakes occurred in different regions of the world.

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