Robust Satellite Techniques to support the short-term assessment of the seismic hazard in Japan: an analysis on 11 years (2005-2015) of MTSAT TIR observations

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In order to increase reliability and precision of short-term seismic hazard assessment (but also a possible earthquakes forecast), the integration of different kinds of observations (chemical, physical, biological, etc.) in a multi-parametric approach could be a useful strategy to be undertaken.

Among the different observational methodologies, the fluctuations of Earth's thermally emitted radiation, measured by satellite sensors operating in the thermal infrared (TIR) spectral range, have been proposed since eighties as a potential earthquake precursor.

Since 2001, the general change detention approach Robust Satellite Techniques (RST), used in combination with RETIRA (Robust Estimator of TIR Anomalies) index, showed good ability to discriminate anomalous TIR signals possibly associated to seismic activity, from the normal variability of TIR signal due to other causes (e.g. meteorological).

In this paper, the RST data analysis approach has been implemented on TIR satellite records collected over Japan by the geostationary satellite sensor MTSAT (Multifunctional Transport SATellites) in the period June 2005 - December 2015 in order to evaluate its possible contribute to an improved multi parametric system for a time-Dependent Assessment of Seismic Hazard (t-DASH). For the first time, thermal anomalies have been identified comparing the daily TIR radiation of each location of the considered satellite portions, with its historical expected value and variation range (i.e. RST reference fields) computed using a a 30 days moving window (i.e. 15 days before and 15 days after the considered day of the year) instead than fixed monthly window.

Preliminary results of correlation analysis among the appearance of Significant Sequences of TIR Anomalies (SSTAs) and time, location and magnitude of earthquakes ($M \geq 5$), performed by applying predefined space-temporal and magnitude constraints, show that 80% of SSTAs were in an apparent space-time relations with earthquakes with a false alarm rate of 20%.