ESC2016-205, 2016
35th General Assembly of the European Seismological Commission

35th General Assembly of the European Seismological Commission
4–10 September 2016 Trieste

Through 47 years of RST analysis of anomalous TIR sequences in relation with earthquakes occurred in different continents and in various geo-tectonic settings.

Valerio Tramutoli (1,2,3), Mariano Lisi (1,3), Carolina Filizzola (2), Nicola Genzano (1,4), Rossana Paciello (2), Nicola Pergola (2,1)

(1) University of Basilicata, School of Engineering, School of Engineering, Potenza, Italy (valerio.tramutoli@unibas.it), (2) Institute of Methodologies for Environmental Analysis of the National Research Council, Tito Scalo (PZ), Italy., (3) International Space Science Institute, Beijing, China., (4) Graduate School of Science, Chiba University, Chiba, Japan.

Real-time integration of multi-parametric observations is expected to accelerate the process toward improved, and operationally more effective, systems for time-Dependent Assessment of Seismic Hazard (t-DASH) and earthquake short term (from days to weeks) forecast. However a very preliminary step in this direction is the identification of those parameters (chemical, physical, biological, etc.) whose anomalous variations can be, to some extent, associated to the complex process of preparation of major earthquakes. In this paper one of these parameter (the Earth's emitted radiation in the Thermal Infra-Red spectral region) is considered for its possible correlation with M$\geq$4 earthquakes occurred in different continents and in various geo-tectonic settings, (Italy, Greece, Turkey, S-W USA and Taiwan). The RST (Robust Satellite Technique) data analysis approach and RETIRA (Robust Estimator of TIR Anomalies) index were used to preliminarily define, and then to identify, Significant Sequences of TIR Anomalies (SSTAs) in 47 years of daily TIR images acquired by using respectively 33 years of Spinning Enhanced Visible and Infrared Imager (SEVIRI) on board the Meteosat Second Generation (MSG) for Italy, Greece and Turkey, 6 years of Imager sensor on board of Geostationary Operational Environmental Satellite (GOES) for S-W USA and 8 years of Visible and Infrared Spin-Scan Radiometer VISSR onboard Geostationary Meteorological Satellite-5 (GMS-5) for Taiwan. Taking into account physical models proposed for justifying the existence of a correlation among TIR anomalies and earthquakes occurrence, specific validation rules (in line with the ones used by the Collaboratory for the Study of Earthquake Predictability - CSEP - Project) have been defined to drive a retrospective correlation analysis process. The analysis shows that, in average, more than 77% of all identified SSTAs occur in the pre-fixed space-time window around the occurrence time and location of earthquakes (M$\geq$4), with a false positive rate smaller than 22%. Moreover, to better qualify the possible contribution of the use of SSTAs in the framework of a multiparametric system for a t-DASH, a Molchan error diagram analysis was applied in order to verify the actual SSTAs added value in comparison with a random alarm function. Notwithstanding the huge amount of missed events (also due to frequent space/time data gaps produced by the presence of clouds over the scene) the achieved results, and particularly the low rate of false positives registered on a so long testing period, seems sufficient (at least) to qualify TIR anomalies (identified by RST approach and RETIRA index) among the parameters to be considered in the framework of a multi-parametric approach to time-Dependent Assessment of Seismic Hazard (t-DASH).