



Long-term (2004-2016) analysis of continuous geochemical, hydrogeologic and satellite TIR observations in a seismic area of central Italy.

Mariano Lisi (1,2), Giovanni Martinelli (3), Gianluca Facca (4), Nicola Genzano (1,2), Fabrizio Gherardi (4), Lisa Pierotti (4), Valerio Tramutoli (1,2,5)

(1) School of Engineering, University of Basilicata, Potenza, Italy, (2) CNR Institute of Advanced Environmental Methodologies, Tito Scalo, Potenza, Italy, (3) ARPAE, Environmental Protection Agency of Emilia Romagna Region, Reggio Emilia, Italy, (4) CNR Institute of Geosciences and Georesources, Pisa, Italy, (5) International Space Science Institute, Beijing, China

Observations during interseismic and pre-seismic periods indicate that large earthquakes are often preceded by signals of different natures. Among them, ground deformations, gaseous and electromagnetic emissions, have been acclaimed to provide the most significant manifestations.

From the development of multi parametric observational systems is nowadays expected the major improvement in our present capability to dynamically assess, in the short term (i.e. from weeks to days before an earthquake) the seismic hazard (t-DASH: time-Dependent Assessment of Seismic Hazard).

In this paper anomalous fluctuations of Earth's thermally emitted radiation (measured by satellite sensors operating in the thermal infrared - TIR - spectral range) and of CO₂ emissions (freely in air and in groundwaters affected by CO₂ discharges) in Central Italy have been particularly considered.

In fact, due to intense crustal deformation processes consequent to the relative motions between the African and the Eurasia plates, in this region the extensional tectonics is responsible for strain values of 1.5-2 cm/year and for intense CO₂ gaseous emissions. Free CO₂ emissions and groundwaters affected by CO₂ discharges introduce in the atmosphere of central Italy over 20 Mt/year of CO₂, about 1/3 of the total geological CO₂ degassed in Italy (Frezzotti et al., 2010).

Twelve years of TIR (Thermal InfraRed) satellite records collected by the geostationary satellite sensor SEVIRI (Spinning Enhanced Visible and Infrared Imager) in the period 2004-2016 have been analyzed together with CO₂ measurements provided by the ARPAE and CNR observational network

The general change detection approach RST (Robust Satellite Techniques) has been used in order to discriminate anomalous signals possibly associated to seismic activity, from its normal variability due to other causes (e.g. meteorological). TIR anomaly maps and intense fluctuations of CO₂ degassing phenomena have been then analyzed looking for possible relations among (space-time persistent) anomalous transients, local seismic patterns and/or major - including L'Aquila (April, 6, 2009, Mw=6.3) and Amatrice (August, 24, 2016, Mw=6.5) - seismic events.