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Different greenhouse gases as a possible origin of the different behaviour of TIR anomalies observed from satellite in seismogenic areas

C. Aliano (1), R. Corrado (1), C. Filizzola (2), V. Lanorte (3), M. Lisi (1), R. Paciello (2), N. Pergola (2,1), V. Tramutoli (1,2), T. Tsamalashvili (4,1)

(1) University of Basilicata, Department of Engineering and Physics of the Environment, Via dell'Ateneo Lucano, 10, 85100 Potenza, Italy, (2) CNR, Institute of Methodologies for Environmental Analysis (IMAA), 85050 Tito Scalo (PZ), Italy, (3) ARPA Basilicata, Via Della Fisica 18 C/D - 85100 Potenza (Italy), (4) M.Nodia Institute of Geophysics - Georgian Academy of Sciences - 1, Alexidze str. 380093 Tbilisi – Georgia

Many studies have been suggesting for decades a relation between Thermal Infrared (TIR) anomalies, observed from satellite, and seismic activity. In particular, the Robust Satellite Technique (RST) for the first time provided a statistics-based definition of "TIR anomalies" and a suitable method for their identification even in very different local (e.g. related to atmosphere and/or surface) and observational (e.g. related to time/season, but also to solar and satellite zenithal angles) conditions.
The application of the RST approach to tens of earthquakes all around the world allowed us not to exclude, as already suggested by previous studies, that the TIR anomaly appearance in seismically active areas may be a consequence of the increase of green-house gas (such as CO2, CH4, etc.) emission rates. However, the application of the RST to seismic events which occurred in areas characterized by different prevailing degassing activities (i.e. CO2 or CH4) seems to highlight that, depending on the greenhouse gas which could be "responsible" for TIR anomalies, the shape of such anomalies appear to be more linear or more diffuse. In fact, it may be expected a more linear shape (i.e. an anomaly which seems to follow tectonic lineaments) in the case of greenhouse gases like CO2 which are heavier than the air so that they tend to gather within low morphological settings often formed along faults. On the other hand, when the diffusing gases are lighter than the air (e.g. CH4) it is expected that the overlapping of TIR anomalies on tectonic lineaments is less marked or even the anomaly seems to be quite scattered.
The observation of such different shapes of TIR anomalies led us to further investigate the phenomenon origin. To this aim, a test was performed over an area with huge and highly variable CH4 emissions. The selected region was Azerbaijan, characterized by a large number of mud volcanoes which typically have methane as the principal component of their emissions. Following RST procedure, Meteosat-TIR images, acquired on the Caucasian area during mud volcano activities, were analysed. The space-time signature of the observed TIR anomalies seems to confirm, even by comparison with the ones observed in presence of degassing activity dominated by CO2 (heavier than air), that their behaviour actually depends on the density (greater or lower than the air) of the main emitted green-house gases.