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Validation of pre-earthquake atmospheric signals and their connection with major seismicity

OUZOUNOV, Dimitar[1*] ; HATTORI, Katsumi[2] ; PULINETS, Sergey[3] ; MOGI, Toru[4]

[1]CEESMO/Chapman University, Orange, CA, USA, [2]Department of Earth Sciences, Chiba University, Chiba, Japan, [3]Space Research Institute, Russian Academy of Sciences, Moscow, Russia, [4]Institute of Seismology and Volcanology, Hokkaido University, Sapporo, Japan

We are presenting a new approach of utilizing multi-parameters space and ground observations to study pre-earthquake processes related to major earthquakes. In this study we are exploring the potential of atmospheric and ionospheric signals to alert for large earthquakes. To achieve this, we start validating retrospectively and prospectively anomalous ionospheric /atmospheric signals. Our method for validation is based on a joint analysis of several physical and environmental parameters (Satellite thermal infrared radiation (STIR), electron concentration in the ionosphere (GPS/TEC), VHF-bands radio waves, radon/ion activities, air temperature and seismicity patterns) that were found to be associated with earthquakes. The science rationale for this methodology is based on the concept of Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) [Pulinets and Ouzounov, 2011], which explains the synergy of different physical processes, usually named short-term pre-earthquake anomalies.

Our validation include continuous retrospective analysis performed over two different regions with high seismicity- Taiwan and Japan for 2003-2011 .The retrospective tests show STIR and GPS/TEC anomalous behavior in advance for most of these events with false positives less than 25%. The prospective tests for Honshu and Hokkaido (Japan) started in 2014. Our initial test results suggest systematic appearance of STIR anomalies, one to several days in advance to major events, including the two largest earthquakes for that period - M7 of July 12, 2014 and M6.9 of Feb17, 2015 in Eastern Honshu. The proposed is multi-parameters approach and new observations could be further integrated into and the synergy of these parameters implying their connection with the earthquake preparation processes.

Keywords: earthquake forecasting, pre-earthquake signals, Thermal amomaly, GPS/TEC, radon, LAIC