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Integrated Sensing, Analysis and Validation of Atmospheric Signals Associated with Major Earthquakes

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The recent catastrophic earthquakes in Italy (April 2009), Haiti (January 2010) and Chile (February 2010) have provided renewed interest in the important question of the existence of signals prior to strong earthquakes. Latest studies (VESTO workshop, Japan 2009) have shown that there were precursory atmospheric signals observed on the ground and in space associated with several recent earthquakes. The major question, still widely debated in the scientific community, is whether such signals systematically precede major earthquakes. To address this problem we have started to study the anomalous atmospheric signals during the occurrence of large earthquakes. Our approach is based on integration of several physical and environmental parameters (thermal infrared radiation, electron concentration in the ionosphere, Radon/ion activities, air temperature and seismicity) that were found to be associated with earthquakes. We used satellite and ground observations and integrated them into the Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) model. We performed hind-cast detection over three different high seismicity regions- Taiwan, Japan and Kamchatka for the period of 2003-2009. We are using existing thermal satellite data (Aqua and POES); in situ atmospheric data (NOAA/NCEP); and ionospheric variability data (GPS/TEC and DEMETER). The first part of this validation included 102 major earthquakes (M>5.9): and five most recent global events for 2008-2010. Our initial results suggest a systematic appearance of atmospheric anomalies near the epicentral area, 1 to 5 days prior to the largest earthquake, which could be explained by a coupling process between the observed physical parameters, and the earthquake preparation processes.