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Use of geospatial information and in situ monitoring data for seismic hazard assessment in Vrancea area, Romania

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Remote sensing and geospatial information tools and techniques, including numerical modeling, have advanced considerably in recent years, enabling a greater understanding of the Earth as a complex system of geophysical phenomena. The information derived from such systems and analyses are beginning to make their way into operational use by decision makers through a number of information products and decision-support capabilities that inform community based mitigation, preparedness, and/or relief and recovery activities. Space-based geodetic measurements of the solid Earth with the Global Positioning System in synergy with ground-based seismological measurements, interferometric synthetic aperture radar data, high-resolution digital elevation models as well imaging spectroscopy (e.g. using ASTER, MODIS and Hyperion data) are contributing significantly to seismic hazard risk assessment. Space-time anomalies of Earth's emitted radiation (radon in underground water and soil and surface air , thermal infrared in spectral range measured from satellite months to weeks before the occurrence of earthquakes etc.), ionospheric and electromagnetic anomalies have been interpreted, by several authors, as pre-seismic signals. Mainly due to the subcrustal earthquakes located at the sharp bend of the Southeast Carpathians, Vrancea zone in Romania, placed at conjunction of four tectonic blocks which lie on the edge of the Eurasian plate is considered one of the most seismically active areas in Europe with high potential of seismic hazard. Multispectral and multitemporal satellite images (LANDSAT TM, ETM , ASTER, MODIS) over a period 1988-2008 have been analyzed for recognizing the continuity and regional relationships of active faults as well as for geologic and seismic hazard mapping. GPS measurements can serve as a reference to these results. In spite of providing the best constraints on the rate of strain accumulation on active faults (coseismic, postseismic, and interseismic deformation; plate motion and crustal deformation at plate boundaries), GPS measurements have a low spatial resolution, and deformation in the vertical direction can not be determined very accurately. GPS Romanian network stations data revealed a displacement of about few millimeters (5-6 mm) per year in horizontal direction relative motion, and a few millimeters per year in vertical direction. As Vrancea area is characterized by a significant regional tectonic activity, evidenced by neotectonic deformation and seismicity, future use of long-term interferometric data will be a useful tool in active tectonic investigation for this region. The joint analysis of geodetic, seismological and geological information on the spatial distribution of crustal deformations as well as the analysis of some earthquake precursors is revealing new insights in the field of hazard and risk approach for Vrancea area.