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Prospective testing based on joint pre-earthquake signal observations: Case studies for 2013

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We present results from our prospective testing of rock deformation measurements (Neumann & Kalenda 2010) in combination with atmospheric pre-earthquake signals (thermal radiation data from several polar orbit satellites) observed during 2013 and related to the major seismic events of M7+. We designed an atmospheric pre-earthquake signals approach according to the theoretical concept of LAIC - Lithosphere-Atmosphere-Ionosphere coupling (Pulinets & Ouzounov, 2011), operating between the crust and the atmosphere/ ionosphere.
The basis of the joint analysis of different pre-earthquake signals follows the Dobrovolsky (1997) formula for the estimation of the earthquake preparation zone and the LAIC physical concept. The non-linear process of preparation of the strongest earthquakes influences the global stress field, which leads to the global response and coupling within the Earth geo-space-lithosphere-atmosphere-ionosphere and affects multi-parameter observations from the ground and space.
In 2013 about 19 major earthquakes ($M \geq 7$) occurred at 16 independent localities. Six of them had been jointly alerted and studied in advance. The satellite monitoring and deformometry measurements could forecast (prospectively) four of them: M7.7 Jan 5, Alaska; M7.9 Feb 6, Santa Cruz; M7.8 April 16, Iran-Pakistan and M7.7 Sept 24, Pakistan. The largest event for 2013 the M8.3 in the Okhotsk Sea was alerted in advance using both the methods but the estimated location from the satellite measurement was outside the real epicenter (unsuccessful forecast). The M7.7 event in the Scotia Sea was alerted only by the deformometry measurement (only as a direction towards Chile from Europe), because the area was not part of the satellite monitoring regions.

The primary outcome from the 2013 test shows two major results: (1) Real-time tests have showed the presence of anomalies in the rocks deformation measurements and the following atmospheric pre-earthquake signals associated with the tested M7+ earthquakes; (2) some improvements in the detection ratio were achieved, when the two geophysical approaches were used in the real-time coordination.

References

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