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Two years of continuous radon observations for a pre-earthquake processes monitoring in Peloponnese, Greece.

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We discuss an integrated radon monitoring system for pre-earthquake signals in Peloponnese, Greece. Recent achievements in radon recording technology have significantly improved the prospects of implementing sensors using this noble gas to monitor ground areas in the soil for earthquake forecasting. Due to the fact that the theoretical background of the radon signals, despite the considerable efforts that have been made, is not yet fully understood and correlated with seismicity, reporting of continuous observations and the statistical results of the method are needed to study and assess the overall precursor phenomena.
In Greece, we have developed and extensively tested a multi-parameter network aimed at studying the pre-earthquake processes and operating as part of an integrated monitoring system in the high seismicity area of the Western Hellenic Arc and the Peloponnese. The prototype consists of the following components:
1. A real-time monitoring system measuring Radon level in the soil, based on five gamma radiation detection probes [NaI(Tl) scintillators] and one alpha-particle probe.
2. A nine-station seismic array to thoroughly monitor the local microseismicity.
3. Real-time weather monitoring systems for air temperature, relative humidity, precipitation and pressure.
4. Thermal radiation emission from AVHRR/NOAA-18 polar orbit satellite observations.
To this date, after our two years of systematic monitoring in the high seismicity area of the Western Hellenic Arc and the Peloponnese, with dozens of events in the range of our radon detectors, we have derived several useful conclusions about the applicability of the method. In particular, it should be noted that during the recording period there were cases of prominent variations of the radon before strong seismic events, such as in the earthquake of Dec 31, 2017 (Mw4.7) in the Corinthian Gulf. Also, the systematic monitoring of the area by a seismic array, installed in SW Peloponnese, revealed a considerable contribution of the local microseismicity to the variation of the radon values. In cases where there was even a small activation in a local fault, radon concentrations in the adjacent stations showed significant variations. Moreover, the tidal influence has been identified and fully analyzed. We noticed also that the time duration of the radon anomaly can be a key indicator that should always be taken into consideration. Finally, we report that radon anomalies are correlated with the release of heat flux in the atmosphere. The recorded thermal radiation anomalies (observed by the remote sensing - infrared radiometers installed on satellites) is a result of an ionization process inside the atmospheric boundary layer (ABL) and gives further credence to the ground observations.