Radon observations as an integrated part of the multi parameter approach to study pre-earthquake processes

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We are presenting experimental measurements and theoretical estimates showing that radon measurements recorded before large earthquake are correlated with release of the heat flux in atmosphere during ionization of the atmospheric boundary layer .The recorded anomalous heat (observed by the remote sounding -infrared radiometers installed on satellites) are followed also by ionospheric anomalies (observed by GPS/TEC, ionosonde or satellite instruments). As ground proof we are using radon measurements installed and coordinated in four different seismic active regions California, Taiwan, Italy and Japan. Radon measurements are performed indirectly by means of gamma ray spectrometry of its radioactive progenies 214Pb and 214Bi (emitted at 351 keV and 609 keV, respectively) and also by Alfa detectors.

We present data of five physical parameters- radon, seismicity, temperature of the atmosphere boundary layer, outgoing earth infrared radiation and GPS/TEC and their temporal and spatial variations several days before the onset of the following recent earthquakes: (1) 2016 M6.6 in California; (2) 2016 Amatrice-Norcia (Central Italy), (3) 2016 M6.4 of Feb 06 in Taiwan and (4) 2016 M7.0 of Nov 21 in Japan. Our preliminary results of simultaneous analysis of radon and space measurements in California, Italy, Taiwan and Japan suggests that pre-earthquake phase follows a general temporal-spatial evolution pattern in which radon plays a critical role in understanding the LAI coupling. This pattern could be reviled only with multi instruments observations and been seen and in other large earthquakes worldwide.