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Active faults on the eastern flank of Etna volcano (Italy) monitored through soil radon measurements

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This study concerns measurements of radon and thoron emissions from soil carried out in 2004 on the unstable eastern flank of Mt. Etna, in a zone characterized by the presence of numerous seismogenic and aseismic faults. The statistical treatment of the geochemical data allowed recognizing anomaly thresholds for both parameters and producing distribution maps that highlighted a significant spatial correlation between soil gas anomalies and tectonic lineaments. In particular, the highest anomalies were found at the intersection between WNW-ESE and NW-SE -running faults. The seismic activity occurring in and around the study area during 2004 was analyzed, producing maps of hypocentral depth and released seismic energy. These maps revealed a progressive deepening of hypocenters from NW to SE, with the exception of a narrow zone in the central part of the area, with a roughly WNW-ESE direction. Also, the highest values of seismic energy were released during events in the southern and northwestern sectors of the area. Both radon and thoron anomalies were located in areas affected by relatively deep (5-10 km depth) seismic activity, while less evident correlation was found between soil gas anomalies and the released seismic energy. This study confirms that mapping the distribution of radon and thoron in soil gas can reveal hidden faults buried by recent soil cover or faults that are not clearly visible at the surface. The correlation between soil gas data and earthquake depth and intensity can give some hints on the source of gas and/or on fault dynamics. Lastly, an important spin-off of this study is the recognition of some areas where radon activity was so high (>50000 Bq/m3) that it may represent a potential hazard to the local population. In fact, radon is the leading cause of lung cancer after cigarette smoke for long exposures and, due to its molecular weight, it accumulates in underground rooms or in low ground, particularly where air circulation is low or absent. In the investigated area this risk is real, as it is inhabited by thousands of people who reside there all year long. Therefore, this study serves as a starting point for the assessment of radon hazard in the Mt. Etna area, considering both spatial and temporal changes in soil radon emissions depending on the presence of faults and/or the occurrence of seismic activity.