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The natural radioactivity map of Umbria (Italy): a multipurpose tool for environmental understanding

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We present the first map of the terrestrial natural radioactivity, with relative uncertainties, of the Umbria Region (Italy). The total specific activity is derived from the abundances of natural radionuclides (^{40}K, ^{238}U, ^{232}Th) measured in 283 rock and 14 soil samples using a high-purity germanium (HPGe) γ-ray spectrometer while an area accounting for $\sim$20% of the territory was investigated through large-volume NaI detectors mounted on an ultralight aircraft. A multivariate estimation method (Collocated CoKriging) for interpolating sparse γ-ray data considering the well-known geological information as ancillary was applied.

This regional radioactivity map is a powerful tool for a number of different applications: (i) for the identification of distinctive lithological characteristics on the basis of radioactive content; (ii) for the definition of the natural baseline of outdoor effective dose rate in the event of a radiological contamination; (iii) for Green Building indoor air quality certifications, through the estimation of the radon flux derived from uranium content in the site location; (iv) for the stone industry, through the radiological characterization of building materials extracted from quarries in the investigated area, following the export regulations of the international market.

Finally, the geo-environmental data presented are also available on an open access platform, supporting the general public understanding and the local authorities decision making.