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Differentiation between the Effect of Temperature and Pressure on Radon Transport within the Subsurface Geological Media

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This work proposes a new method to differentiate between the impact of ambient temperature and pressure on radon transportation within porous media, by long-term radon monitoring based on simultaneous alpha and gamma measurement.
If a monitoring site is a closed measuring space with undisturbed environmental conditions, as in the Amram mountain research tunnel situated 25 km NW of Elat, Israel, the radon in the air space will reach equilibrium with the radon in the rock. Then the radon time series as measured by both gamma and alpha detectors exhibit the same temporal variations. The results in this case indicate that the diurnal, intra-seasonal (multi-day) and seasonal variation in the radon concentration is clearly associated with the ambient temperature gradient outside the rock air interface, to 100m above the monitoring cell.
If the monitoring site is a shallow borehole, as at the Gevanim valley in Makhtesh Ramon, Israel, no equilibrium between the radon within the porous media and the radon in the open borehole air is necessarily established and the results of radon monitoring are different. Gamma detectors measuring the changes in radon concentration in the porous rock indicate a clear correlation between radon concentrations and the daily variations of external surface temperature, from about 1m up to 85m.
On the contrary, the alpha detectors measuring the changes in radon concentration in very shallow borehole air space (about few meters) revealed a clear anti-correlation with atmospheric pressure waves at semi-daily, daily, and intra-seasonal time scales. At depths of several tens of meters, outer pressure waves induce anti-correlated radon variations lasting the same time. The ordered radon daily periodicity in the measuring air space is destroyed but the daily radon variation within the surrounding porous media, as measured by the gamma ray detectors is not disturbed.
The results show that the method to differentiate between the impact of ambient temperature and atmospheric pressure on radon transportation within porous media, by long-term radon monitoring based on simultaneous alpha and gamma measurement, is functional.