



A Comparison of Radon Signals in Natural Environments and in Enhanced Confined Systems

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Radon (^{222}Rn) is a radioactive inert gas formed by disintegration from ^{226}Ra as part of the ^{238}U decay series. In geological environments radon occurs at varying concentrations and shows large and complex spatio-temporal variation patterns which exhibit periodic and non-periodic signals of annual to daily scale. We aim at harnessing its noble gas character and its radioactive decay for using it as an indicator of geophysical processes.

Alpha and gamma radiation were measured under different environmental conditions in natural systems (air, seawater) and in Enhanced Confined Mode (ECM) systems, in which nuclear radiation is measured from an artificial radon source inside a confined air volume. Investigations were performed at the Gulf of Eilat [Inter University Institute (IUI)] at on and off-shore locations. The experiments were placed at a) approximately 3 meters above sea-level (PM-11 gamma detector), b) on the seabed (ECM Barasol alpha detector), c) underwater at different depths using PM-11 gamma detectors and ECM PM-11 gamma detectors.

The results at all locations for Radon natural systems (water, air) exhibit systematic variations composed of periodic and non-periodic signals, implicating different pattern for each location. While the on-shore experiments indicate a clear daily signal (1 cycle per day), the underwater experiments reveal different tidal signal (~ 1.93 cycles per day repetition), which demonstrates a connection between the radon flux and the local marine tide. This marine tide frequency was also observed in air 3 meters above sea-level.

On the other hand, in submerged gamma ECM experiments (PM-11 gamma detectors with 100 kBq artificial sources) revealed clear daily signal with no marine tide signal - same as for identical experiments on land. Unlike the gamma ECM, the alpha ECM experiment (Barasol alpha detector with NH geological source) showed no distinct or clear pattern while located under water at four meter depth. Nevertheless, when relocated out of the water, it exhibited different radiation patterns including day and multi day signals indicating influence of local (environmental?) conditions on the radon behavior.