



Influence of Earth-Sun relations on signals of the radon gas system

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Radon (Rn-222) occurs at highly varying levels as a trace component in subsurface air (geogas). Nuclear radiation from radon (and progeny) in geogas exhibits systematic temporal variations composed of periodic and non-periodic signals spanning several orders of magnitude in time – from annual to daily and sub-daily duration. The outcome of numerous investigations results in an obvious lack of a comprehensive understanding of radon variability while demonstrating its unique behavior and wide spatial and temporal range. In difference to previous interpretations results obtained by the GSI group at subsurface field locations and recent laboratory simulation experiments indicate that nuclear radiation from radon (and progeny) inside a confined volume of air varies spatially and temporally. Based on the results from the laboratory and from the geological environment it is suggested that a component of solar irradiance drives the periodic radon signals to a depth of at least 100 m. This is corroborated by detection of solar rotational periodicity (independent of Earth) in experimental data and a day/night effect in the variation pattern. The notion that solar irradiance influences the temporal pattern of nuclear radiation from radon in air implies a connection to Earth-Sun interactions and constitutes a new paradigm in the earth-sciences. The goal of the project is to substantiate this proposition by extending the experimental approach. In this context the focus will be on the daily signals which are linked to the rotation of the Earth. The main issues to be addressed will refer to: a) detection and verification of directionality in the nuclear radiation from radon and its eventual relation to global orientation; and b) examination of the characteristics of the daily signal (amplitude, phase) and their relation with the annual periodicity. Improving the interpretation frame of the space-time variation of radon by substantiating the influence of a solar irradiance driver will open new prospects for interdisciplinary research. The implications of the research pertain to: a) new understanding of the radioactive behavior of radon in air – in subsurface geogas and possible also in the atmosphere; b) forming new research collaborations on Earth-Sun interactions; c) utilization of radon in the earth-, atmospheric- and environmental sciences.

Main indicators in radon time series for earth-sun interactions are

- Semi-annual and ternary annual periodicity, in addition to the annual periodicity
- The annual cycle – concordance of summer peak with solar radiation peak
- Solar rotational frequencies
- Annual modulation of amplitude and phase of the daily radon signal
- Directionality and global orientation effects in the multi-day and daily signals

Further related attributes are

- Subsurface manifestation of phenomena
- Site effect

The results to date justify developing the radon monitoring techniques as a new type of geophysical observation tool on the earth-sun relations.

References:

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