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Indications for solar influences on the radon system in geogas

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Variation of the radon signal in subsurface geogas and hydrologic systems is often suggested and investigated for significance in terms of active geodynamics, and specifically as to relevance for earthquake prediction. In general the frequently encountered relatively large and complex signals are difficult to interpret in terms of the interactions involved.

Extensive ($>$ 10 years) monitoring at a high-rate (15-minute) of radon in geogas is performed at a series of locations spanning 200 km along the Dead Sea rift (Israel). Measurements, conducted in an arid environment, are in a variety of situations: shallow sub-recent gravels, boreholes in Cretaceous syenite and in Precambrian plutonic and metamorphic rocks, in a research tunnel in Precambrian basement as well as in a shallow seawater shore site. The measured signals display compound temporal patterns, which includes – seasonal radon (periodic), multi-day (non periodic), daily radon (periodic) and sub-diurnal radon (lasting several hours) signals.

Examination of the radon time series from the different sites revealed features and phenomena that seem to associate some of the variation with the diurnal rotation of the earth around its axis and its annual rotation around the Sun. These include:

1. Daily and annual periodic signals are frequent, and sometimes relatively large. Such signals indicate an external/remote periodic influence/driving process, the source of which is either inside Earth or of extraterrestrial origin

2. Negation of climatic influences, specifically atmospheric pressure and ambient temperature

3. Sub-diurnal signals occurring sporadically in time at depth (85 meters) manifest a highly significant bi-modal preferred incidence within the diurnal cycle.

4. Frequent unambiguous presence of S1 and S2 periodic constituents in the daily frequency band, which are consistent with solar tide, in conjunction with

5. Unambiguous absence in the daily frequency band of diurnal constituents associable with gravitational tide (M2, O1)

6. The ratio of co-occurring amplitudes of constituents (S2/S1) defines a linear pattern indicating a fundamental statistical property in the frequency domain of the radon time series. As far as known such a linear pattern is not found in other geophysical time series.

Diverse monitoring sites exhibit both similar and different styles of radon time series. There are indications that depth and especially geologic nature influence the local style of the phenomena. This would indicate an interaction between the external driving process and the country rock to produce a local secondary effect that is reflected in the radon measurement.

From the observations and results it is concluded that hitherto unrecognized processes are partly involved. It is suspected that solar radiation phenomena influence the periodic components. Presently a physical and geophysical frame does not exist to substantiate an extraterrestrial influence on part of the variation pattern of radon in upper crustal levels. Investigation of this notion requires further targeted observations in the natural geological environment and corresponding specific experimental investigations.