Geophysical Research Abstracts
Vol. 17, EGU2015-1333-2, 2015
EGU General Assembly 2015

Sidebands alongside the diurnal frequencies of radon time series in a simulation experiment – an indication for a direct association with the earth-sun system

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A radon simulation experiment using a confined mode is operating at GSI since 2007 at a time resolution of 15-minutes [1]. The nuclear radiation from radon in the confined air is measured using internal alpha and gamma sensors, and external gamma sensors. Detailed analysis [1, 2] demonstrated that the variation patterns cannot be ascribed to local environmental influences. On the other hand the specific features and relation led to the suggestion that a component in solar radiation is driving the signals.
Prominent periodicities dominate the variation in the annual and diurnal frequency bands. The primary periodicity in the diurnal band has a frequency of 1 CPD (S1). Significant multiples occur at 2 CPD (S2), 3 CPD (S3) and also at 4 CPD (S4). The S2 and S3 constituents are clearly observed in the time domain in addition to the primary S1 periodicity.
The measured signal is detrended by removing the large annual variation. Spectral analysis (FFT) of the residual time series reveals sidebands (Sb) alongside and on both sides of the S1 frequency in the time series of the alpha and gamma sensors. The lower sideband (LSb) occurs at a frequency close to the astronomical sidereal frequency (0.9972696 CPD). The upper sideband (USb) occurs at a symmetric frequency relative to S1. The four sensors (alpha and gamma)exhibit the LSb, S1, and USb at the following frequencies (CPD):

Gamma-C: 0.99739; 0.99989; 1.00275
Gamma-W: 0.99717; 0.99986; 1.00257
Alpha-H: 0.99710; 0.99992; 1.00269
Alpha-L: 0.99719; 0.99991

Multiples of LSb and USb are observed around the S1 periodicity. Similar features of Sb and multiples occur also around S2, S3, and S4.
The development of the specific Sb around the diurnal periodicities may be attributed to a driver composed of two waveforms having periodicities of 1 day and 365.25 days, which interacts in a non-linear mode with radon inside the confined volume. The pattern of the alpha and gamma emission of the decaying radon is reflecting this non-linear interaction. The observed patterns of diurnal periodicities together with the associated Sb and their multiples can be demonstrated by statistical simulation using polynomial combinations of these sinusoidal waveforms. Notwithstanding, at this stage the identification of the underlying physical and geophysical processes remains open.
The observation of sidebands around S1 at the specific periodicities indicates that the periodic signals in the radon time series of the experiment are directly related to the cyclic rotational relations in the earth-sun system. This in turn is an independent confirmation of the notion that these signals are influenced by a component in solar radiation [1, 2].

1. Steinitz, G., Piatibratova, O., Kotlarsky, P., 2011. Possible effect of solar tides on radon signals. Journal of Environmental Radioactivity, 102, 749-765. doi: 10.1016/j.jenvrad.2011.04.002.
2. Sturrock, P.A., Steinitz, G., Fischbach, E., Javorsek, D. and Jenkins, J.H., 2012. Analysis of Gamma Radiation from a Radon Source: Indications of a Solar Influence. Astroparticle Physics, 36/1, 18-26.