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Solid Earth
Discussions

Interactive comment on "Influence of a component of solar irradiance on radon signals at 1 km depth, Gran Sasso, Italy" *by* G. Steinitz et al.

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This paper presents previously unpublished data on radon signals measured 1.4 km underground at the Gran Sasso laboratory. Raw data are in the form of alpha and gamma radiation counts, which are calibrated to produce standard radiation measurements in units of Bqm-3. The main novelty of the work is the observation of an apparently significant periodicity in the radon-related radiation, with period 24 and 12 hours. The authors attempt to exclude the possibility that local processes cause the observed radon periodicity, proposing instead a model driven by solar irradiance. Previous work by the authors has promoted the idea that radiation processes may be modulated by solar tides, even when protected by thick lead shielding. The authors highlight recent work by Sturrock et al. which suggests that neutrinos may be involved in this process.

General Comments

In my opinion the authors do not produce a convincing argument that environmentally-related processes are not producing the observed periodic variations in radon. Given that their preferred alternative explanation is somewhat exotic it behoves them to be completely thorough in eliminating the possibility that these variations are simply an artefact of periodic changes in environmental conditions.

I found it troubling that the exact method used to present the diurnal radon (DR) signal was not specified in the text, apart from an unclear comment in the figure caption of Fig. 6 and ambiguous points on pages 1515-1516. DR appears to be produced by subtracting a long-pass filtered version of the radon time series from the data, producing a differential signal around zero as shown in Fig. 6. The explanation given for the data analysis would not produce such a zero-centred normalised dataset. The authors need to specify exactly what data processing was performed to produce the DR time series from the original data.

Figure 3 demonstrates a degree of anti-correlation between radon signals and air pressure. The scale of both temperature and RH have been enlarged so much that it is impossible to ascertain if there is a correlation with radon or not. This gives the reader the sense that the authors are not exhausting the investigation of potential environmental-related processes on the radon modulations. A more detailed presentation of pressure-related changes is given in Fig. 8, and this highlights the presence of short-term modulations which look similar to those seen in the raw radon signal, and which are also observed in the DR data. The authors claim that the datasets 'show a different pattern', but they are only looking at the MD data, not the DR data. Furthermore, there are periods of apparent correlation in the datasets presented in Fig. 8 and the authors statement that they show a different pattern is not substantiated by an objective test.

The authors should determine time series for temperature, pressure and humidity using the same data processing approach used for the production of the DR time series, and

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present these data with appropriate scaling together with the radon data, to allow the reader to see for themselves that there isn't (or is) a correlation. Furthermore, results from FFT studies of these environmental parameters should be presented in the text and discussed.

Fig. 9 presents an analysis which is used to support the idea that pressure variations are uncoupled to radon signals, but the authors ignore the possibility that the radon-pressure relationship may be non-linear, and therefore it may not necessarily produce a linear relationship even if there is a causal factor linking pressure and radon. An unexplained feature of figure 9 is the choice of data set; why was only data from days 193-235 used, and why is the variation in pressure so limited (up to 3-4 hPa) when in figure 8 the pressure varies by 25 hPa? The authors need to explain why they use data from different periods.

Figures 12-16 seem to be redundant, these should be condensed into a single figure.

Overall I feel that the authors do not produce a compelling case for the role of solar irradiance in modulating radon signals. If after revision all reasonable doubt regarding a possible role for environmental causality in the radon modulation can be excluded then the case would be stronger.

Interactive comment on Solid Earth Discuss., 4, 1511, 2012.