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High efficiency and portable monitor of atmospheric radon concentration activity for environmental applications

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The natural radioactive noble gas radon (^{222}Rn) is originated from the decay of radium into the soil and then continuously exhaled to the lower atmosphere. Its diffusion and exhalation rate depend both on the physical and environmental conditions of the soil layers and on the meteorological conditions. With a half-life of 3.8 days and a very limited chemical activity, the ^{222}Rn is nowadays being used as an atmospheric tracer for: i) the improvement of atmospheric transport models used, among others, to identify greenhouse gas (GHG) emission sources; ii) for the indirect estimation of GHG fluxes by the Radon Tracer Method (RTM). These previous applications need high sensitivity and precision at low radon concentrations range (< 100 Bq m^{-3}).

A new monitor, based on alpha spectrometry of ^{218}Po electrostatically collected on a PIPs detector, has been designed and developed at the Institute of Energy Technologies (INTE) of the Universitat Politecnica de Catlunya (UPC) in the mark of the project 'High efficiency monitor of atmospheric radon concentration for radiation protection and environmental applications (MARE^{2}EA), reference: 2019-LLAV-00035, funded by the Catalan Agency for Management of University and Research Grants. The aim is building an instrument able to measure atmospheric radon concentration activities with high precision in order to be running at GHG atmospheric networks for the RTM applications.

The monitor is an improved version of a previous prototype instrument (Grossi et al., 2012, 2020). The new instrument will allow a higher efficiency, robustness and portability. In addition, it will have a GUI interface to be user friendly. Finally, in order to reduce the air sample humidity within the detection volume of the instrument which affects the ^{218}Po collection, a portable drying system has also been built to keep the instrument ongoing without maintenance during several weeks.

References

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