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LOW ACTIVITY RADON EMANATION SOURCES FOR GREENHOUSE GAS MITIGATION STRATEGIE

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ABSTRACT

Atmospheric measurements of radon activity concentration seem to be very useful for the assessment and improvement of atmospheric transport models (ATM). Radon can be used as a tracer to evaluate dispersal models important for identifying successful greenhouse gas (GHG) mitigation strategies. For this purpose, the "traceRadon"(Radon metrology for use in climate change observation and radiation protection at the environmental level) project will provide the necessary measurement infrastructure and use obtained outputs in the Radon Tracer Method (RTM) which is important for GHG emission estimates that support national reporting under the Paris Agreement on climate change. To increase the accuracy of GHG modelling, traceability to SI units for radon release rates from soil, its concentration in the atmosphere and validated methods for its dispersal are needed. There exists correlation between GHG and radon concentration. However, traceability to the environmental level does not exist for measurements of radon fluxes and atmospheric radon activity. Therefore, the radon data used for improvement of the ATM and estimation of the GHG emissions needs significant improvement of accuracy of both radon flux measurements and environmental radon activity concentrations in the range from 1 Bq m-3 to 100 Bq m-3 to be able to provide robust data for use in the RTM. The overall aim of this project is to develop metrological capacity to measure low level of radon in the environments, which can be used to determine remission reduction strategies of GHG. This includes the two new traceable Rn-222 emanation sources (below 100 Bq m-3) for application in climate monitoring and radiation protection networks. Such sources will be used to calibrate a transfer instrument to assure the traceability. The new low level activity emanation sources have been developed and their evaluation is in progress. The first source was created from an emulsion of salts of fatty acids in silicone rubber, formed from the weighed standard solution. Traceability of the Ra-226 activity is established by weighing and gamma spectrometry. Using a stainless-steel cylindrical case with valves and aerosol filters, applying ultra-dried air and a mass flow controller with a humidifier (to control the dilution of the activity concentration) enables to established time-stable radon activity concentration in a low-level radon chamber. The second approach is electrodeposition process of a carrier-free Ra-226 solution on a stainless-steel plate. The emanation of the Rn-222 follows differential equations, by nature, that include the build-up and decay of the Rn-222. Therefore, the measurement of the disequilibrium of the Ra-226 and the Rn-222 progeny is only correct for stable states. In order to overcome this constraint, the project has developed an algorithm using a new statistical method based on Bayes filtering (Kalman filter, assumed density filtering). With this algorithm the emanated Rn-222 in the unit atoms per second as well as the associated uncertainty is determined online from spectrometric data including the knowledge of the already measured spectra. The outcome will be a new validated radon flux dataset to assist with application of the RTM for GHG flux estimates and will lead to more reliable data for policy and decision markers to use in the combat against climate change. The intercomparison of the two types of emanation sources in the frame of the traceRadon project will be presented and the outcome discuss.

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