From greenhouse gas fluxes to early warning networks: The importance of radioactive tracers

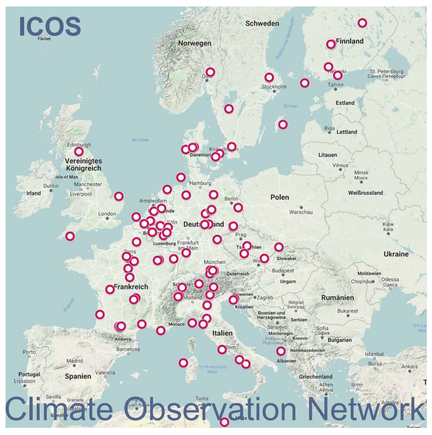
EURAMET

Need:

Climate change is one of the greatest challenges of our time. The temperature rise of the atmosphere of our planet, due to the greenhouse effect, is caused by the increase of GHG.

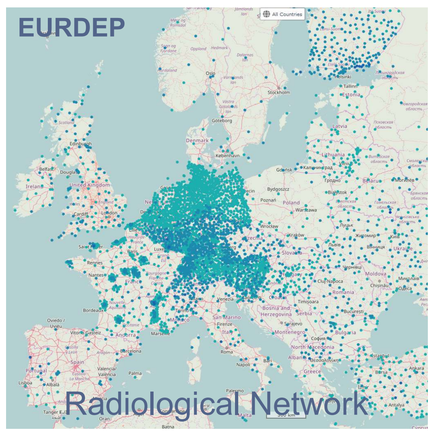
Monitoring of GHG emissions, the dispersion of GHGs and the resulting GHG concentrations in air, is of utmost importance for appropriate climate change mitigation measures. Moreover, Radon and its progeny contribute about **half of the natural radiation dose to the public**. But traceability at the outdoor level is not established.

- Climate research and radiation protection research needs support of traceable low-level outdoor radon measurements according to the needs of **UNFCCC** and the **Council Directive 2013/59/Euratom**.
- Radon and radon flux data is needed to **estimate regional GHG emissions fluxes and radon priority areas (RPA)** but the uncertainties are too large due to missing metrological capabilities.



Objectives: The objectives of this project serve the purpose to establish a metrological base which supports environmental outdoor radon measurements for the use in climate observation and in radiation protection for the public.

- Development of traceable methods for the measurements of outdoor low-level radon activity concentration in air in the range of 1 Bq/m³ to 100 Bq/m³ (WP1)
- To improve radon flux measurements for RPA and to develop standard protocols for radon tracer method to retrieve GHG fluxes (WP2)
- To validate existing radon flux inventories and models with new data from the radiological early warning networks in Europe as well as traceable radon activity concentration and radon flux measurements (WP3)
- To provide dynamic radon and radon flux maps (WP4)
- To facilitate the take up of the technology and measurement infrastructure developed in the JRP (WP5)



Progress beyond the state of art:

The project provides metrology for the growing radon measurement needs for different purposes that influence all parts of modern society and facilitates the use of this data in industry, scientific communities, standard organisations and all kinds of end users like decision makers or the public.

Impact Knowledge transfer and uptake by: workshops, training course, website, publications and standards **WP5**

Environmental:
- New observables for climate observation and radiation protection
- New real-time data and maps for GHG estimations and RPA
- Direct support of the existing and planned AMN

Social:
- Radiation protection of the public as required by European regulation
- New RPA definition: realtime data for decision makers and the public
- Model improvement: efficient countermeasures on climate change

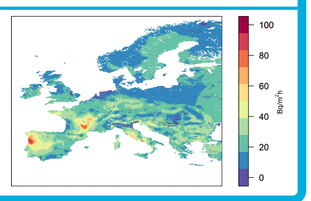
Economic:
- Trigger of development of radon measuring technique worldwide (collaborators from 5 continents)
- Cost-efficient measures in Europe: radiation protection and climate observation
- Support of the EU-ETS by new GHG data

Scientific and technological excellence:
- Merging of big data suppliers like ICOS and EURDEP as well as addition of new observables
- Reduction of uncertainties in GHG estimations
- Validation of radon flux models and inventories for GHG estimations
- Knowledge sharing and capacity building of two large communities

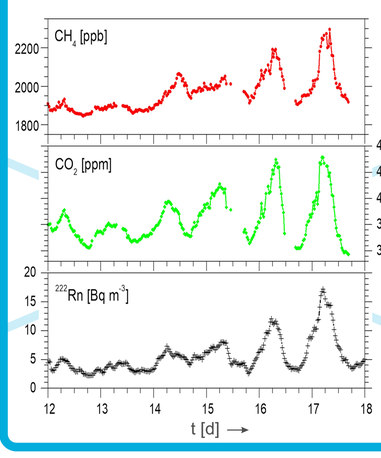
Metrological:
- Traceability for outdoor radon activity concentration measurements
- Traceability for radon flux measurements
- New secondary standards: Sources and instruments
- New and validated data for models used for GHG estimations and risk estimations in radiation protection related to radon
- New standards and protocols

Radon and radon flux in maps for radiation protection issues — WP4

- Identification of RPA
- Quantifying the radon wash-out peak
- Data accessibility and public engagement



$$j_{CH_4} = j_{Rn} \cdot \frac{\Delta c_{CH_4}}{\Delta c_{Rn}}$$

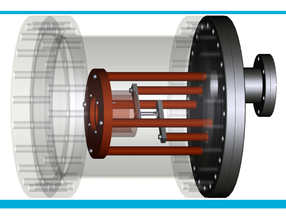


Validation of radon flux models and inventories using radon flux and terrestrial data — WP3

- Radon flux maps in GHG and climate change studies
- Inclusion of data from radiological early warning systems
- Validation of radon flux maps using radon flux measurements and outdoor radon activity concentrations

Traceable measurements of outdoor radon activity concentrations — WP1

- Traceable low-level radon sources
- Development of a transfer standard
- Calibration and long-term stability



Radon flux measurements — WP2

- Development of a reference radon flux monitor
- Test under field conditions
- Measurement campaigns
- RTM application

Management and coordination — WP6

Seven European NMI/DI in the field of climate observation and ionising radiation. ICOS, JRC and other stakeholders directly involved as partners. Sufficient further external partners with high-level expertise to cover the broad spectrum of two scientific communities.
18 project partners and 14 collaborators: Presentation of results in all RMOs and continents worldwide.

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