A SUPERSENSITIVE DETECTOR FOR RADON IN WATER

U.H.FISCHER and J.W.JURY.
(Trent University, Department of Physics, Peterborough, Ontario, Canada).

Development has been carried out of a high-sensitivity, low background detector system for the purpose of directly measuring (without chemical concentration of the sample) radioactivity in water samples. The technique employes a high efficiency liquid scintillation detector consisting of a large volume vessel viewed by two large area photomultiplier tubes. To achieve the required high sensitivity for dissolved radon gas in water, less than 1 Bq/l, radioactively pure construction materials, coincidence counting techniques, and massive lead background radiation shielding with a cosmic ray anticoincidence guard were used. The characteristics of this system, as well as its potential application to the investigation of low levels of environmental radiation will be discussed.

CO_2 FLUXES IN SUBANTARCTIC AREAS FROM CO_2/RADON CORRELATIONS

A.GAUDRY,G.POLIAN,P.MONFRAY,B.ARDOUIN,G.LAMBERT
(CFR, CNRS, F91198 Gif-sur-Yvette CEDEX, France)

Atmospheric CO_2 and Rn-222 have been monitored at Amsterdam island, since 1981.Data were selected in order to eliminate any local influence.

A CO_2 concentration, typical of the subantarctic marine atmosphere, can be determined each month by selecting those values for which the Rn-222 activity was particularly low: <1pCi/m^3. This marine atmosphere CO_2concentration increased from 338.8 to 345.8 ppmv from October 1981 to November 1986.

Rn activities higher than 1pCi/m^3 are essentially due to injections from the continental source of South Africa into the subantarctic atmosphere. It was observed that for Rn activities between 1 and 5 pCi/m^3 the CO_2 concentrations were either higher or lower than the marine atmosphere value. This effect is interpreted as a result of the continental biomass activity, which can act as CO_2 source or sink as well, depending on the time and season.

In contrast, for Rn activities >5 pCi/m^3, the corresponding CO_2 concentrations are systematically superior to the monthly marine atmosphere value. This can be tentatively interpreted by the fact that high Rn activities are essentially observed over continents during the night, when the atmospheric eddy diffusion is low. At this time, the biomass is acting as a CO_2 source. A very good correlation can be observed between Rn activities >5pCi/m3 and the difference between the actual CO_2 concentration and its corresponding marine atmosphere value.

From the knowledge of the global continental source strength of Rn (1 atom/cm^2-second), we can infer the mean CO_2 flux injected from South Africa into the atmosphere during emission periods. This figure is of the order of 3m.mole/m^2-hour, in reasonable agreement with other evaluations. Significant variations of this flux were observed and will be discussed.

RADON AND LEAD-210 FLUXES BETWEEN SOIL AND AIR

W.C.GRAUSTEIN, and K.K. TUREKIAN
(Yale Univeristy Dept.of Geology & Geophysics, P.O Box 6666,New Haven,CT 06511,United States.

Soil profiles record both the long term flux of ^{222}Rn from the soil to the atmosphere and the deposition of its decay product ^{210}Pb from the atmosphere to the ground surface. The change with depth of the abundance of ^{210}Pb relative to its ultimate parent ^{226}Ra in a soil profile provides this information.
An extensive sampling of soil profiles from the United States allows study of the effects of climate, elevation, soil type, vegetation and location on both the escape flux of ^{222}Rn and the deposition flux of ^{210}Pb.
The rate of escape of ^{222}Rn to the atmosphere is principally a function of soil texture, ^{226}Ra content, and the fraction of ^{226}Ra decays that recoil ^{222}Rn atoms to the pore space. The soil moisture and groundwater regime may also modify the escape rate. The geologic environment appears more significant than the climatological environment in influencing ^{222}Rn escape to the atmosphere. The geographic pattern of ^{222}Rn escape shows much local variation.
Precipitation scavenging of aerosols is the dominant method of deposition of ^{210}Pb to the ground surface. Climatic patterns of air circulation and precipitation are the major influences on ^{210}Pb deposition patterns. If suitable meteorologic conditions exist, the effects of elevated topography can triple ^{210}Pb deposition. Vegetation and soil type have little effect on the ^{210}Pb deposition. With the exception of mountainous regions, the geographic pattern of ^{210}Pb deposition to soils shows little local variation but exhibits unambiguous trends on the scale of thousands of kilometers The significance of these results to the understanding of large and small scale atmospheric transport and deposition will be discussed,with particular reference to the controls on the fate of anthropogenic sulfate.

LONG RANGE TRANSPORT OF Rn-222: A TEST FOR 3D TRACER MODELS

M. HEIMANN, P. MONFRAY
(Max-Planck-Institut für Meteorologie,
Bundesstrasse 55, D-2000 Hamburg 13, Germany)
G. POLIAN
(CFR, CNRS, F91198 Gif-sur-Yvette CEDEX, France)

Using an Eulerian 3d transport model of the global troposphere based on the observed meteorological fields of the GWE period (Dec. 1978 - Nov. 1979) we have attempted to simulate the spatial and temporal distribution of the radioactive noble gas Rn-222. A time invariant, uniform, continental source of Rn-222 and a weak, surface windspeed dependent, oceanic source of Rn-222 has been specified in the model simulations. The model results are compared extensively to Rn-222 data from the GWE period with special emphasis given to the Indian ocean region, where measurements from monitoring stations on three remote islands and on the Antarctic coast are available. The advection of continental Rn-222 to these observing sites, each being several thousand kilometers away from major landmasses, requires several days and hence provides a unique opportunity for the validation of a transport model.
Except at the Antarctic coastal stations the seasonal cycle of the Rn-222 concentration is well predicted by the model. A much more severe test of the model is provided for by Rn-222 "storms" associated with synoptic scale weather elements. Several examples of model predicted and observed events are discussed. The model in general predicts the events at the right instant of time, but the agreement with respect to amplitude is far from perfect. Model errors are attributed to the finite spatial and temporal resolution of the model, to the model parametrization of subgrid scale vertical convection, but also to possible errors in the GWE fields. In addition we also discuss the contribution of the oceanic Rn-222 source to the atmospheric concentration signal at these remote monitoring locations.