Research brief
Radon-222 measurements at Cape Point: A characterization of a 15-year time series

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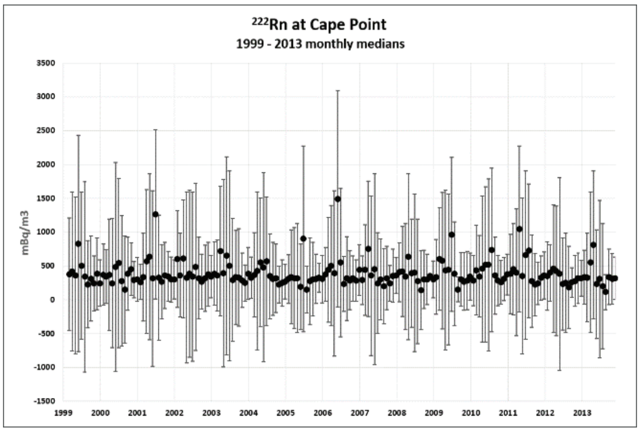
The Cape Point (CPT) Global Atmosphere Watch (GAW) research station have been monitoring climatically significant trace gases for four decades. Among these is radon, a naturally occurring noble gas with a large continental source, which has proven very useful for atmospheric tracer studies. ^{222}Rn, the radioactive decay daughter product of radon gas, forms part of the long-term exposure of radiation dosages that humans are continuously exposed to in the environment. In a first of its kind for the African continent, a radon climatology, based on a 15-year measurement record at CPT, was published in the Atmospheric Environment journal (www.elsevier.com/locate/atmosenv).

The authors found the mean continental air mass (1 004 ± 6 mBq/m³) radon concentration to be a factor of 2–3 times higher, compared to oceanic air masses (479 ± 3 mBq/m³), and that "deep baseline" oceanic air masses (279 ± 3 mBq/m³) are factor of 3–4 times smaller than continental air masses. In addition, the authors described in detail an annual peak (Figure 1b) which reflects major seasonal changes in the patterns of offshore versus onshore flow - associated with regional/hemispheric circulation patterns, as well as diurnal and semi-diurnal peaks which together reflect the influence of local nocturnal radon build-up over land, and the interplay between mesoscale sea/land breezes.

A detailed percentile analysis of the entire date set was performed and several sub-sets were generated and investigated. These included seasonal subsets, diurnal subsets and fetch region (based on wind directions) subsets. An interesting feature of these analyses was the observed slow decline within the higher radon percentiles (75th and 95th) for the winter and spring seasons which was found over the 15-year data set. It was established that most of the observed changes occurred within the first 9 years (1999–2007) of observations, and particularly prominent within the north wind sectors.

The observed inter-annual decline appears to be largely associated with changes in the frequency of air masses having originated from over the African continental surfaces, and no significant trend is found in the lower radon percentiles associated with oceanic air masses. The general observed decrease of atmospheric radon - associated with continental air-masses at Cape Point could be attributed to changing meteorological conditions, possibly driven by climate change. Factors which could potentially contribute to the observed long-



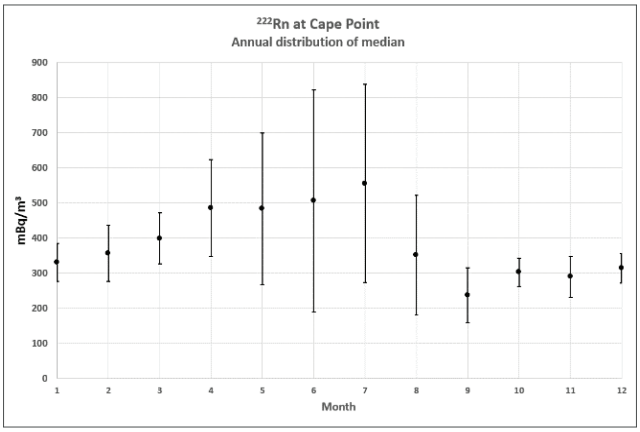


Figure 1 (left): *15-year ^{222}Rn concentration distribution and 1sigma standard deviation showing inter-annual variation.* ***Figure 1 (right):*** *15-year composite monthly median radon concentration showing the seasonal distribution of ^{222}Rn.*

term decreasing higher radon percentiles in the continental sectors (see Figs. 9 and 10 in the full paper) at the Cape Point Station include changes in (1) airflow patterns; (2) surface air temperature; (3) rainfall patterns affecting water-table depth and, consequently, soil-moisture content and therefore radon emanations; as well as (4) mixing depths and removal of radon from the boundary layer by deep convection and frontal systems. Furthermore, large-scale regional wind run decreases of more than 25% have also been observed from a 30-year study (1974–2005) at 20 climatic stations of the Western Cape.

Bibliography

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