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# New Results of Global Ground Level Radioxenon Measurements

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In the past, nuclear explosions in the atmosphere, or just below the ground or water surface, were mostly detected and identified via particulate radionuclide monitoring. With a Comprehensive Nuclear Test Ban Treaty (CTBT) in force, one has to assume that a potential violator would try to avoid detection. Under such evasive scenarios the most difficult radionuclides to contain are the noble gases as they don't stick to crack surfaces or react with any other materials available. Based on characteristic radiation and half-life there are four isotopes of xenon that are the most suitable for Treaty verification: $^{131m}$Xe, $^{133m}$Xe, $^{133}$Xe and $^{135}$Xe.

Measuring very low radioxenon concentrations has been possible due to the introduction of new and sensitive equipment developed specifically for the verification of the CTBT. One technology is based on two-dimensional beta-gamma coincidence, another on beta-gated gamma spectroscopy and a third one on high resolution gamma spectroscopy.

These systems are now undergoing testing at worldwide locations in the so-called International Noble Gas Experiment (INGE). They are continuously measuring these four treaty relevant radioxenon isotopes and the results are analysed and reviewed at the International Data Centre of the CTBT Organisation (CTBTO) in Vienna, Austria.

This paper presents data acquired from different stations around the globe. In some regions, with nuclear facilities around, there is a very high radioxenon background (up to some Bq/m$^3$, mostly of $^{133}$Xe). In others, like remote islands in the southern hemisphere, there is no measurable radioxenon present at all. Recently a very low background of some tens of $\mu$Bq/m$^3$of $^{133}$Xe was established for regions at high northern latitudes.

Time series of the activity concentrations, their distributions and, when present, seasonal trends, are shown in this paper.

By means of atmospheric transport modelling, using the simplified assumption of a continuous bulk release from the nuclear facilities regions, it was determined that the measurements performed are broadly consistent with reported releases from the nuclear reactors. Also month-to-month variation of the time series can be explained and are shown.

Understanding the radioxenon background worldwide taking into account known sources, the actual meteorological situation and large-scale transport processes, is a significant task in the execution of the treaty verification to minimize the rate of false alarms.