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Improving the understanding of the global distribution of the Radioxenon Background caused by known civil emissions and its consequences for CTBT verification

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Monitoring of radioactive noble gases, in particular xenon radioisotopes, is a crucial activity for the verification of the Comprehensive Nuclear-Test-Ban Treaty. In a previous study, it was found that the distribution and magnitude of the global background of the isotope xenon-133 measured at stations of the International Monitoring System is to a large extent consistent with the hypothesis that it results from the currently known civil sources, namely isotope production facilities and nuclear power plants. In the new study, more sophisticated methodologies for background simulation and comparison are applied. All available data on the temporal variations of emissions and production cycles from the background dominating facilities Chalk River in Canada and Fleurus in Belgium are taken into account. Particularly data from the year 2008 provide a unique opportunity to allocate fractions of site specific background to individual sources as there have been several longer downtime periods of major xenon sources. Furthermore, an attempt to better account for batch releases from reactors in a statistical way based on the emission studies available is presented. The subsequent data analysis is enhanced by including not only daily and annual observation values, but also weekly and monthly median values from each station. Consequently, a more complete and consistent picture on the global xenon-133 emissions is presented, and improved conclusions regarding the verification of the CTBT based on noble gas monitoring are drawn. Finally, computations are also expanded to the other three relevant radioxenon isotopes.