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Data-based kernel density equations for probability distributions of CTBT-relevant radioxenon isotopes at IMS stations in normal background from nuclear facilities and as simulated from underground nuclear explosions

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The objective of this study is to apply the kernel density (KD) approach to generate and investigate probability distributions of isotopic ratios for radioxenon releases from certain types of sources. KD equations for nuclear facility releases are derived from the data set of the radioxenon emission inventory of all nuclear power plants and all nuclear research reactors, as well as selected medical isotope production facilities in the calendar year 2014. Analytical equations for the releases from assumed underground nuclear explosions are obtained using Bateman equations for simple scenarios of prompt and delayed releases from underground nuclear explosions with in-growth and decay or alternatively with complete fractionation at time zero after the nuclear fission event. For both types of sources, KD equations will be linked with isotopic ratio calculations that connect source and receiver. The goal is to create probability density functions that could be applied e.g. with a Bayesian method to determine the probability whether an IMS observation could possibly be caused by a nuclear explosion.

Promotional text

This study presents data-based kernel density equations for possible nuclear test signatures and normal background. These can be used e.g. in a Bayesian method to determine the probability whether an IMS observation could possibly be caused by a nuclear explosion.

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