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Variability of Xe-133 Atmospheric Background: Characterization and Implications for the International Monitoring System of the Comprehensive Nuclear-Test-Ban Treaty

Global maps of atmospheric Xe-133 from simulations of the atmospheric dispersion of industrial releases (radiopharmaceutical facilities and nuclear power plants) have revealed a large spatial variability. On annual average, simulated activity concentrations near the surface vary from 0.01 mBq/m3 to more than 5 mBq/m3. At most stations of the International Monitoring Network (IMS) of the Comprehensive Nuclear-test-Ban treaty, simulated levels of Xe-133 are explained by a complex combination of multiple sources. The signature of industrial radioxenon can thus interfere with that of nuclear tests. Therefore, a better characterization of this radioxenon atmospheric background is needed. In this study, the simulations of the Xe-133 atmospheric background are analyzed to characterize the temporal variability of its distributions. The dataset is based on two-year simulations, using 2013 and 2014 meteorological data, and the most comprehensive emission inventory of facilities as possible. Seasonal and monthly means at each of the 39 IMS stations (operational and planned) are calculated. Time series are compared to measurements when available (a total of 6000 detections at the 29 operational stations in 2013/2014 have been used). The seasonal effect is also assessed in terms of variations of the simulated spatial extent of the distributions in the northern/southern hemispheres.

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