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# of Xe133 release from activity concentration measurements with background signal

Estimation of Xe133 emissions associated with nuclear tests is a challenging task for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) due to noble gas background emissions from nuclear power plants, research reactors, and medical isotope production facilities. These background emissions make data interpretation from the International Monitoring System (IMS) a complex issue since the standard linear inverse model for Xe133 measurements often introduces significant errors.

We investigate methods to separate the background signal from potential nuclear test signal, enabling estimation of the Xe133 source term. Our most advanced model seeks for separation of the mixture of signals from civilian and nuclear sources, estimating the Xe133 source term from the rest of the signal after subtraction of the civilian signal.

The methods are evaluated using data from the 1st Nuclear Explosion Signal Screening Open Inter-Comparison Exercise (NESSI) 2021. Results are compared against ground truth information on Xe133 source characteristics, leading to improvement of the identification of nuclear explosion signals in complex atmospheric backgrounds.

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