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# of Synthetic Radionuclide Source Terms Using Bayesian Inference

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The Forensic Radionuclide Event Analysis and Reconstruction (**FREAR**) tool performs source reconstruction using a Bayesian inference framework. Using a statistical model of the radionuclide detection system and atmospheric transport models, **FREAR** infers and reconstructs the best emission source characteristics to fit the supplied observations. This powerful approach provides assessments of source location, release magnitude, release period, compares observed and posterior predicted measurements and ultimately reduces the area of consideration of potential sources.
To test the suitability of **FREAR** for verification applications, blind synthetic trials were constructed at two different environmental scales, using **WRF-HYSPLIT**. These two scenarios were then reconstructed by FREAR at three different organizations using different dispersion and meteorology model input (**NCEP-HYSPLIT**, **ECMWF-FLEXPART**, **CMC-MLDP**). The results of the two trials will be discussed, showing that **FREAR** represents a dramatic improvement in radionuclide event assessment, providing a valuable tool to National Data Centres. The future development of the **FREAR** tool will be shared.

Promotional text

The detection of CTBT-relevant radionuclides by the MS poses important questions for National Data Centres - where did it come from? how much and when was the material released? The Bayesian inference tool, FREAR, helps answer these questions, supporting verification.

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