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A logical source localization approach evaluating SRS-fields from backward atmospheric transport modeling for multiple detections

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In the framework of Comprehensive Nuclear-Test-Ban Treaty (CTBT) verification the use of atmospheric Lagrangian Particle Dispersion Models is well established to confine possible source regions of radionuclide detections. For that Source Receptor Sensitivity (SRS) fields are calculated in backward mode. At the German National Data Center (NDC) the NOAA model HYSPLIT is operational using as well NCEP as ECMWF meteorological data in up to 0.2 degree horizontal resolution. For additional comparisons and tests FLEXPART is also available.
Various localization approaches for atmospheric backtracking are introduced. Especially a logical approach for combining SRS fields for multiple detections and non-detections is presented and compared with the correlation based PSR given by the CTBT-Organization software tool Webgrape. Our logical method is based on an additive coincidence score value combining binary sensitivities of detecting and non-detecting samples pointing to areas of high source location probability. Additionally, weight-functions and variable threshold values are introduced accounting for radioactive decay and for detectable release terms, respectively. The presented test cases comprise detections related to the Fukushima release 2011, scenarios of the NDC Preparedness Exercises NPE2012 and NP2010, and recent radioxenon occurrences at Schauinsland, Germany (DEX 33).
Furthermore, the differences in sensitivity results between simulations in backward and forward mode are discussed. Although the standard backward simulations have huge operational and political advantages in the CTBT context, additional forward simulations for specific cases are essential to provide the most consitent picture of a potential release scenario.