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_toolkit: a Radionuclide Source-term Modeling Package for Rapid Scenario Determinations at the French NDC

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Besides improved instrumentation and operational measurement analysis, radionuclide technology used at National Data Centres (NDCs) also benefits from atmospheric transport modeling (ATM) in their dedication to detect, discriminate and characterize nuclear explosions. A way to enhance NDC expertise is to provide ATM with a likely radionuclide source term emitted to the atmosphere following underground nuclear explosions, thanks to evaluated scenarios.
We have developed a code with user-oriented digital tools to build such scenarios, qualitatively and quantitatively. STM_toolkit first computes the cavity radionuclide inventory for all the CTBT-relevant fission nuclides. Then, the nuclear test is configured by fusion of data from other technologies as well as tabulated data, leading to estimates of the cavity gas pressure and distance of migration, based on empirical laws derived from former nuclear tests. Rapid one-dimensional fluid mechanics calculations determine the gas released for i) prompt venting due to drill-back, with custom delay, or preexisting conduits or fractures, ii) late-time seepage due to barometric pumping. Gas release and cavity inventory determine the atmospheric source term converted to expected activity concentrations at monitoring stations thanks to empirically-parameterized simple ATM. Comparison with measurements allows the scenario to be refined before it is used for state-of-the-art ATM.

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Promotional text

STM_toolkit provides the atmospheric radionuclide source term following an underground nuclear explosion for use by atmospheric transport modeling accounting for test configuration and subsurface gas transport, based on empirical laws, tabulated data and rapid computation.

Oral preference format

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