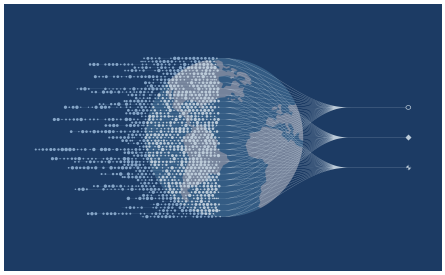

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condensation with decay-chains: A refined model for the calculation of the radioxenon source term produced by underground nuclear explosions

The relative abundances of radioxenon isotopes in underground nuclear explosions depend on the direct production by fission and the β-decay of their radioactive precursors. Since the precursors are moderately volatile elements that can condense into the magma within the nuclear cavity as the system cools off, the radioxenon budget available for subsequent migration to the atmosphere, as well as its potentially distinctive isotopic signatures, are modified as the precursors are removed from the gas phase. We have developed a new model coupling condensation with radioactive decay to predict the behavior of radioxenon and its precursors during the time evolution following an underground nuclear explosion. For each nuclide from the relevant decay chains, thermodynamic calculations for a rock chemical composition depending on the underground conditions were used to estimate the vapor pressure, the net condensation rate and the speciation of each nuclide in the decay chains, along the time-evolving pressure-temperature conditions. This can be extended to any fission chain and gives a more reliable estimate of the source term for different explosion configurations.

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