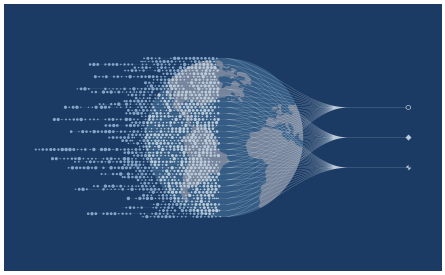

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# of Xenon-133 atmospheric civil source distribution using graph models on simulated data

Xenon radionuclides atmospheric monitoring is part of the International Monitoring System, including multiple measurement stations, that were developed in the context of the Comprehensive Nuclear-Test-Ban Treaty. However, civil infrastructures, mainly nuclear power plants and medical isotope factories, constantly generate these radionuclides, creating a global atmospheric background. Previously, we developed a transport diffusion-based tool to simulate this background at the regional scale, but the discrimination with relevant signals is not straightforward. Here, we investigated, using four years of simulated data, how civil radionuclide concentrations are distributed over the stations, in terms of source range and similarities between stations. These source/station relationships are modelled through new defined variables and a graph structure, allowing the visualisation of a spectral clustering. Finally, applying a Graph Fourier Transform enabled a source separation of the station concentrations. The graph structure shows that stations can be clustered into 11 regional groups, each one with a center of one to four stations that does not vary with seasonality. Also, the source separation provides maximum absolute errors below 0.1 mBq/m^3, lower than sensors detection limit, for most of the stations. These results highlight the potential of such simulations for anomaly detection.

E-mail

atiq.mounir@gmail.com

In-person or online preference

Primary authors: Dr ATIQ, Mounir (Commissariat a l'energie atomique et aux energies alternatives (CEA)); Mr ACHIM, Pascal (Commissariat à l'énergie atomique et aux énergies alternatives (CEA)); Dr OGER, Sentia (Commissariat a l'energie atomique et aux energies alternatives (CEA))

Presenter: Dr ATIQ, Mounir (Commissariat a l'energie atomique et aux energies alternatives (CEA))

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