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A method to locate an accidental release: application to RU106 case in September 2017

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Abnormal presence of RU106 the ambient air had been detected over Europe in a period from 28.9 to 10.10.2017 at about a hundred of stations. No authority took a responsibility for the release, and it is of technical and practical interest to find a method to locate the source. Several studies point southern Ural-region as a probable location of the source. These studies used backward-trajectories and brute-force forward simulations maximizing a correlation of simulated and observed values.

We used adjoint dispersion simulations with Silam chemistry-transport model together with post-processing to aggregate the results. For that we have used about 270 readings of Ru106 concentrations, averaged over periods from several hours to several weeks, published in a report issued by the International Atomic Energy Agency (IAEA), in about 250 of which the presence of RU106 was detected. For each of these readings a 4D sensitivity field (aka footprint) was calculated. A footprint of a "clean" measurement gives an information about the locations in space and time where the source could not present. A footprint of a "dirty" measurement, i.e. RU106 was detected, shows where and when source could be. Aggregating these messages from all 250 observations we could get a poll of "opinions" about each point in space and time. "Clean" measurement can vote for either "no source was there" for areas covered by its footprint or "unknown" outside of it. A "dirty" measurement votes for "source could have been there" or "unknown" correspondingly.

Adjusting weights assigned to "clean" and "dirty" footprints one can quite well localize possible source(s) in space and time without any prior assumption about source spatial distribution and timing. In our case the sharpest picture was obtained of one "clean" vote was taken as ten "dirty" ones.

Two main conclusions have been drawn from the exercise: (1) The voting method was found quite good when no or very little prior information is available, and (2) the "clean" readings are in general more important for source location than "dirty" ones.