Penalty function for zero-measurements in the inverse-modelling of nuclear atmospheric dispersion?

Research group: Atmospheric Physics, position at RIVM, Bilthoven

When the Chernobyl nuclear accident had happened in Ukraine, it was kept silent. Only when a sampling station in Forsmark, Sweden (over 1000 km from Chernobyl) reported alarmingly high radiation levels, then it became clear that "something" had gone wrong. But what was released? And where? And when? It still happens every few years that (smaller) releases of radioactive material are detected and that their release is not claimed. A network of sampling stations over Europe can be used to follow the development of the radioactive cloud. The challenge is to use these measurements to answer the question of "what-where-when?"

In the past year, an algorithm has been developed at RIVM to trace the footprint of significantly non-zero dose-rate measurements from the network of sampling stations back in time via the "dual equation" associated with the advection-diffusion equation describing the time-forward dispersion of the material. Combination of the possible footprints of all measurements, that are given by the solution of the adjoint equation, gives an estimate of the time and location of the accident and its magnitude. Along the significantly non-zero measurements, there are generally also many measurements that indicate no deviation from normal conditions. These measurements too have a footprint and it is unlikely that these footprints harbor the location of the accident. Until now, the information provided by these "zero-measurements" is not used to improve the source term estimate. We seek a trainee who will help

Additional information:

Dr. Jasper Tomas (RIVM):
jasper.tomas@rivm.nl

Dr. S.R. de Roode:
s.r.deroode@tudelft.nl