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On the Localizability of Atmospheric Tracer Sources Using ATM

With the Additional Protocol to the Non-Proliferation Treaty, atmospheric sampling analysis of the noble gas Krypton-85, which is a suitable tracer for plutonium separation, was introduced. Our project focused on the investigation of the effects of temporal sampling resolutions to the localizability of tracer sources using atmospheric transport models (ATM). Predefined weekly quantities of Kr-85 were hypothetically released in 2009 over La Hague reprocessing plant and tracer dispersion was simulated using the Lagrangian particle dispersion model Flexpart. In so-called "catch-the-plume"-scenarios, pseudo concentration samples were generated at fictitious stations. Then, source-receptor-sensitivity fields were simulated and averaged to yield backward sensitivities of different temporal sampling resolutions. Afterwards correlation fields, called "possible source regions" (PSR), of the multiple measurement scenario were calculated to compute localizability parameters values for reliability, e.g. the distance between the spatio-temporal correlation maximum and the source, and sharpness, i.e. the size of a user-defined PSR. A cost-benefit analysis yield optimum results for a sampling interval of 12h applied to two sampling stations. The tracer origin stayed locatable up to 2000km away from the source. Further research is needed to improve the localizability in diffusive weather situations, assessing the minimum detectable source strength and qualify nesting methods for complex topography.

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