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Estimation of the CTBT-Relevant Radionuclides Sources by ensemble Adjoint Atmospheric Transport modeling

This work describes the recent development of Egyptian-NDC approach for the source estimation of CTBT-Relevant Radionuclides (RN) by using an ensemble of Adjoint atmospheric transport and dispersion modeling (ATM). A new deterministic method is developed for simultaneous estimation of the possible source location, time of release, and source strength. This method is based on the least square linear regression. The verification of this method, in case of a simplified perfect adjoint ATM and error-free concentrations measurements, shows that the method provides the exact source parameters. Since, in the real atmospheric dispersion of RN, there are many sources of uncertainty, and the deterministic methods fail. Therefore a system of ensemble adjoint ATM and Bayesian inference approach was developed to address the uncertainty in the source term estimation. Some examples by using synthetic measurements experiments, for real atmospheric conditions, illustrate the ability of this combined method to retrieve the possible source parameters and quantify the uncertainty in this estimation. This approach is currently running over regional scale due to the lack of computing power, but it is applicable also to global scale.

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