

Method for estimation of parameters of instantaneous release of radionuclides to the atmosphere based on remote observations

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Modeling of atmospheric transport of contaminants is considered to be an important tool for supporting the verification functions of CTBTO. The available modeling techniques are good at reproducing major features of the transport process and give fairly close results, as was demonstrated at the recent (May 2000) joint CTBTO-IDC and WMO-RMMC exercises. Difficulties, however, may arise when these techniques are applied for assessing the coordinates and amount of radionuclides released to the atmosphere during nuclear testing based on IDC monitoring. Calculations of back trajectories during exercises reveal major discrepancies and are hardly applicable for the above mentioned task. To solve this problem the method of adjoint transport equations seem to hold some promise (Marchuk, 1975).

In the present work, based on this technique an effective algorithm is proposed for estimating source term (coordinates, amount of released activity) based on long-range measurements.

The method is combined with the Bayesian approach, which makes it possible to add probabilistic dimension to the solutions of adjoint transport equations and extend the class of used transport equations. It has been shown that even with one-point observations, the method permits determination of aposterior distribution of a probability of source coordinates and, given observational data from space-apart points, the uncertainty in location estimation can be significantly reduced. Model calculations are presented to demonstrate how the algorithm works.