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Evaluating the added value of multi-input atmospheric transport ensemble modeling for applications of the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO)

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The potential benefit of ensemble dispersion modeling for CTBTO applications was investigated using input data from the ECMWF-Ensemble Prediction System (EPS). Five different test cases - among which are the ETEX-I experiment and the Fukushima accident - were run. For those test cases run in backward mode and based on a puff release it became evident that Probable Source Regions (PSRs) can be reduced in size compared to results based solely on the deterministic run by applying minimum and probability of exceedance ensemble metrics. It was further demonstrated that a given puff release can be reproduced within the meteorological uncertainty range. For the test cases run in forward mode it was found that the control run, 10- and 51-member medians exhibit similar performance in time series evaluation. The main added value of the forward ensemble lies in producing meteorologically induced concentration uncertainties and thus explaining observed measurements at specific sites. It can be concluded that meteorological uncertainty to a large degree is covered by the 10-member subset because forecast uncertainty is largely suppressed due to concatenating analyses and short term forecasts, as required in the operational CTBTO procedure, and because members from different analyses times are on average unrelated.

Promotional text

enhance the capabilities of the Treaty's verification regime via ensemble dispersion modeling

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