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Joint model correction and inverse modelling for Cs-137 release rate of Fukushima Daiichi Nuclear Power Plant Accident

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An inverse modelling method that simultaneously corrects the inevitable biases in air dispersion models and estimates the release rate was proposed and applied to the Cs-137 release rate estimation of Fukushima Daiichi Nuclear Power Plant (FDNPP) Accident. The proposed method uses an iterative approach to update the model biases correction and the release rate estimate alternately, which provides a complete measurement-by-measurement correction of both deterministic and stochastic deviations. Based on the suspended particle matter (SPM) measurements, the temporal Cs-137 release rate of FDNPP accident was reconstructed using the proposed method. The release rate estimate was validated first by the timeline of the accident sequence and then by the comparison between the corresponding atmospheric dispersion simulation and the measurement of the SPM data (Oura et al. 2015), the Tokai site (Furuta et al. 2011), the daily deposition and the total deposition data (MEXT, 2011). The release rate estimate was also compared with Katata's detailed source term (Katata et al, 2015) in the above two validations with the same model inputs. The results demonstrate that the timing of the peak releases in the estimate coincides with more than 80% of the total 21 direct emission events. In addition, its temporal file is consistent with Katata's source term (Katata et al. 2015). Meanwhile, the simulation with the new estimate agrees well with the four observation data sets both qualitatively and quantitatively.