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Spatio-temporal inversion of atmospheric microplastics emmisions using block-coordinate descent method

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We propose an inversion methodology that allows to estimate large-scale spatio-temporal emission profiles from deposition measurements of airborne microplastics from the Western USA. Traditionally, each spatio-temporal element is solved separately using linear inverse model, however, it is hard or even impossible to deduce which part of measurements is reconstructed by which spatio-temporal element. In this contribution, we treat the unknown spatio-temporal source term as a single unknown variable of a large scale optimization problem. To achieve a tractable algorithm, we propose to use the block coordinate descent (BCD) approach with each spatial element being a block of coordinates. The implied inversion method is an iterative procedure with selected linear inverse method in the inner loop. We have tested the standard linear inversion with Tikhonov regularization as well as self-tuning LS-APC (Least Squares with Adaptive Prior Covariance) Bayesian inversion as inner loop algorithms. The method converges within a small number of iterations. The results are compared with previous approaches for spatio-temporal emission estimation and the potential of the novel method is demonstrated.