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Emission potential estimation in landfill by coupled particle filter

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The emission potential, represented by the total chloride mass in a landfill waste body in this paper, is a key factor in controlling long-term pollutant emissions from landfills. However, the direct measurement of pollutant mass in subsurfaces is usually hard to perform. Traditional model optimization methods use history matching to get the initial emission potential, which gives the best fit for the whole measurement series. However, the estimation at the latest time step is not as reliable as sequential data assimilation, which is a recursively updating method. This study investigates the feasibility of using a weakly coupled particle filtering approach to estimate emission potential. A flow-concentration coupled travel time distribution model is used to simulate the flow transport in the landfill. The weekly coupled particle filter framework assimilates leachate outflow volume and concentration measurements separately to estimate corresponding states in the landfill. The mass states are the product of the evaluated leachate volume and concentration states. Our results show that the uncertainty in chloride mass is quantified with less uncertainty, and the prediction results are also improved. These results indicate that it's promising to use outflow measurement series for emission potential estimation.