Improvement of regional model, AIST-MM and construction of assimilation model using LETKF method for estimation of CO_2 emissions and sinks around mega city, Tokyo

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Carbon dioxide (CO2) is one of greenhouse gases, and it is important to know how they distributed precisely around cities. Presently, there are many researches using observations and model simulations. But it has been often pointed out that regional model has some problems in its calculations. Especially, CO2 emissions and sinks are the problem as they include large errors. CO2 emissions are originated from mainly human activities using fossil fuels and plant respirations, and CO2 sinks are plant photosynthesis and absorption to the ocean. In the Kanto Plain, anthropogenic emissions affect to CO2 distributions as there are mega cities in the area. Moreover, plant activities also affect CO2 distributions as there are mountains and fields to surround the urban areas. Because of their complexed existences, it is difficult to simulate CO2 distributions accurately in Kanto Plain using a numerical model.

In this research, as the model improvement to represent accurate CO2 distributions is essential to estimate CO2 emissions and sinks in the target area. We tried to improve the regional model, AIST-MM (Kondo et al., 2001) and to represent the CO2 distributions accurately replacing some input files with renewal data. To represent CO2 distributions accurately, assimilation model based on the Local Ensemble Transform Kalman Filter (LETKF) method was constructed. It was tested whether the assimilation model works properly using Observing System Simulation Experiment (OSSE). We applied the model for two cases, namely a case using CO2 observation data which were assumed as satellite data and a case using CO2 observation data which were assumed as in-situ data. The results for the two cases, it showed a good performance. This is the first step for estimation of CO2 emissions and sinks based on the assimilation system.

Key words:
CO_2 transport model, data assimilation, Local Ensemble Transform Kalman Filter (LETKF)

References:

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