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Simulation experiments for studying an optimal carbon dioxide monitoring network for Osaka, Japan

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We prototype an Observing System Simulation Experiment (OSSE) system for studying an optimal carbon dioxide (CO₂) monitoring network in Osaka city, one of the populated cities in Japan (population: 8.8 million). In the first phase of our project, we built a multi-resolution, spatially-explicit fossil fuel CO₂ emissions model to better quantify CO₂ emissions with an updated information and detailed geospatial information. In the second phase, we coupled the emission model to the WRF Chem model, and developed an OSSE capability to study an optimal CO₂ observation network for Osaka. After completing an evaluation of the meteorological fields and emission fields, we have started simulating atmospheric CO₂ concentration using possible emission scenarios and examined the emission change detectability by an imaginary ground-based observation networks. We started from existing observational sites for air quality monitoring sites and the selected suitable sites based on how much useful signals can be obtained. In order to fully examine the detectability of CO₂ emission changes in the presence of potential strong local and inflow biospheric CO₂ contributions, we included biospheric fluxes calculated from the BEAMS model. We have also attempted to calculate the cost for establishing the observational sites. Our ultimate goal is to help decision makers to design an effective observation network given their emission reduction target as well as the budget constrain.