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Emissions of carbon dioxide (CO2) are a significant driver of global climate change, and many countries aim to monitor and mitigate anthropogenic sources of this greenhouse gas (GHG). Country-level reporting of GHG emissions, the planning and launch of space-based instruments to monitor local/regional GHG concentrations (OCO-2, OCO-3, GOSAT, GOSAT-2, CO2M, MicroCarb, etc.), and plans/pledges to reduce future GHG emissions (e.g., Paris Climate Agreement) are current efforts toward this goal. In particular, the United States seeks to cut GHG emissions in half by 2050 and requires that progress be monitored toward this objective; however, since the cancellation of the GeoCarb mission, dedicated observational coverage of North America must rely on current and future space-based instrumentation. Urban case studies have focused on individual cities, constraining urban CO2 emissions at the local scale with space-based CO2 observations. However, moving toward a framework to bolster national-level emissions monitoring requires knowledge of the intra-country physical limitations affecting the retrieval of flux information. In this work, effects from cloud cover, aerosols, biospheric influence, and the synthesis of multiple instruments (OCO-2,3) are considered when quantifying the variance in flux information content across the continental United States (CONUS). Results suggest that cities within CONUS are not equally sampled over time, leading to considerable differences in how efficiently city-level emissions can be constrained. Furthermore, unequal sampling across CONUS may influence national-level emissions estimates and flux constraints. Implications for current and future CO2 monitoring efforts are discussed.
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