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Spatial and Temporal Properties of CO_2 concentrations in China's Xinjiang province

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Atmospheric carbon dioxide (CO_2) is the dominant greenhouse gas contributing to anthropogenic global warming. The prediction and mitigation of climate change relies on the accurate quantification of distribution and variability of CO_2 sources and sinks derived from atmospheric CO_2 concentration measurements. Greenhouse gas observing satellites such as NASA's AQUA and JAXA's GOSAT have shown that CO_2 is not distributed evenly around the globe, but instead exhibits higher concentrations in some places and lower concentrations in others. This spatial variation in concentration is - in part - likely driven by spatial variations in economic activity, however, the links between local CO_2 emissions and local CO_2 concentrations are not well understood.
This paper uses satellite data from China's Xinjiang province to identify spatial and temporal properties of CO_2 concentrations to quantify the link between local emissions and local concentrations. We construct a spatio-temporal panel of local CO_2 concentrations from NASA's AQUA satellite, combined with estimates of local CO_2 emissions using the EDGAR emissions database, as well as proxies for local economic, population and urbanization, using observations of night time lights available from the National Oceanic and Atmospheric Administration (NOAA). Estimation results explicitly accounting for spatial-dynamics using spatial panel Durbin models show that local CO_2 emissions have significant explanatory power for local concentration. These results imply that locally emitted CO_2 does not immediately mix into the atmosphere, and supports evidence of local warming effects.