Spatial Disaggregation of Urban GHG Emissions: Empirical analysis based on an expanded Kaya Identity

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Abstract Cities are increasingly recognized as critical nodes in the global carbon footprint. Accordingly, there is an increasing interest in the measurement of urban emissions. Traditional greenhouse gases (GHG) inventories often provide a macroscopic view of emissions, obscuring the heterogeneity of cities. Recognizing this gap, this study proposes an expanded Kaya identity to spatially disaggregate the carbon emissions inventory and depicts future urban GHG emissions scenarios. Including additional variables to expand the traditional Kaya identity allows to retrieve a spatialized approximation of the emissions inventory that considers the heterogeneity of the city 's socioeconomic structure within the model. To contextualize this framework, Bogota, Colombia, was chosen as case study. Following the spatial extent of the planning units of the city as disaggregation extent of the GHG emissions, this article offers a view beyond the limitations of the traditionally aggregated data. Such disaggregation underscores the nature of urban emissions, influenced by the distribution of the population, income levels, and socioeconomic strata. This approach allowed to retrieve a spatialization of the GHG emissions scenarios provided by the local administration with a higher level of granularity and an explicitly spatial methodology. The results facilitate targeted policy interventions for effective urban climate action and the cities' sustainability transition.