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Why to measure a broad range of city sizes? Analysis of globally pooled data of urban GHG measurements for sustainability

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We have assembled a database of urban GHG emissions from various published sources, including about 200 cities globally. Analyzing this CO_2 emission inventory from multiple countries we find power-law relations between the emissions and city size, measured in population. The results suggest that in developing countries large cities emit more CO_2 per capita compared to small cities, i.e. they tend to comprise super-linear correlations. For developed countries the results suggest the opposite, i.e. linear or sub-linear correlations, implying better efficiency of large cities. We derive how the total emissions of an entire country relate with the power-law correlations and find that the size of the most populated city is dominating in the case of linear and super-linear correlations, while a transition occurs to sub-linear correlations, where the size of the largest city has no influence.

It is important to further substantiate an overview of city emission inventories across a broad range of city sizes and types to further clarify the complex relationships between cities and GHG emissions. On the one hand, we propose a minimum set of meta-information to be reported together with the emission inventories, e.g. for determining comparability among inventories. On the other hand, we propose to fill evident gaps with respect to regions (e.g. sub-Saharan African and South American cities) and types of cities (e.g. small medium and low-income country cities) to allow for a better global overview of city sizes, income, and emissions.

We conclude that from the climate change mitigation point of view, urbanization is desirable in developed countries and should be avoided in developing countries, if effinciency increasing mechanisms can not be established. More data acquisition is needed to support our empirical findings.