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Changes in winter season climate within an urban area based on regional climate model results

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Around half of the world‘s population lives in cities. In Germany, even three out of four people (roughly 76 %) live in urban areas (Schlünzen et al., 2018). It is therefore crucial to understand the relationship between the global and the urban climate and to analyze whether and how this relationship will change in a future climate.
Here, we focus on changes in the regional climate for an urban area and analyze data of the Coordinated Downscaling Experiment for the European domain (EURO-CORDEX). The selected urban area is Hamburg, which is the second largest city in Germany and located in the North. Results for projected changes in temperature and precipitation exist for the summer climate, however, assessed knowledge on changes of the winter climate is lacking. This knowledge is, however, essential to develop adaptation measures, e.g. to cope with significant changes in winter precipitation or temperature.
To quantify projected changes on the city level for the winter season, in a first step it is essential to ensure the reliability of the CORDEX model results for the purpose intended. To do so, the regional climate model simulations are evaluated for the reference period 1971 – 2000 with data sets based on observations. This analysis shows, for example, that some of the models reproduce the past climate for the selected 30 years less well than others, while the ensemble average (unweighted multi-model-mean) agrees quite well with observations. Therefore, ensemble averages are used to quantify projected changes in winter on the city level for the near (2031-2060) and far (2071-2100) future. As target variables temperature, wind, humidity and precipitation are chosen because of their impact on the city infrastructure. In addition to average changes, the analysis also includes changes in the frequency of single events since both are essential for developing adaptation measures. Furthermore, for determining possible impacts on the thermal well-being, changes in several thermal indices (Perceived Temperature, PT and Universal Thermal Climate Index, UTCI) are derived.

Schlünzen K. H. et al. (2018): Stadtklima in Hamburg. In: von Storch H., Meinke I., Claußen M. (eds) Hamburger Klimabericht – Wissen über Klima, Klimawandel und Auswirkungen in Hamburg und Norddeutschland. Springer Spektrum, Berlin, Heidelberg.