Global heating and cooling degree-day projections for large cities based on CORDEX dataset

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In the context of a progressively warming World, it is fundamental to develop a common strategy aiming at a more sustainable local and global development. In Europe, the Covenant of Mayors was launched in 2008 with the ambition to gather local governments voluntarily committed to achieving the European Union climate and energy targets. This initiative, supported by the European Commission, lately evolved into the Global Covenant of Mayors, with more than 7000 signatories from more than 50 countries. One of the consequences of the projected temperature increase is the increase in energy spent to air-condition the internal environments and the opposite decrease in energy spent to heat them. The main goal of this study is to estimate the change in two energy-related climate indicators, i.e. the heating (HDDs) and the cooling degree-days (CDDs), that are related to the energy needed to maintain indoor comfort temperature. As input data, we used a very large ensemble of climate simulations (159 combinations of Global and Regional Climate Models) from the CORDEX (Coordinated Regional Downscaling Experiment) project, at spatial resolution of 0.44°. To obtain the degree-days, we used daily minimum and maximum temperature from 1981 to 2100 under two climate scenarios (the Representative Concentration Pathways RCP4.5 and RCP8.5). We present the changes in HDDs and CDDs from 1981-2010 to the periods related to a global temperature increase of 1.5°C, 2°C, and 3°C, and to the end of the century. Moreover, we computed the energy degree-days (EDDs) under the same conditions. We focus on large cities (population > 1 million in 2017) and we combined the projections of degree-day indicators based the RCPs with high-resolution (0.125°) population projections based on five Shared Socio-Economic Pathways (SSPs).