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Future global warming impacts on residential heating and cooling energy demand over part of Pannonian basin and Balkan Peninsula (Young Scientist Travel Award)

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This research investigates the potential changes of heating and cooling degree days (HDD and CDD), as well as residential heating and cooling energy demand in the 21st century over Bosnia and Herzegovina, Hungary and Serbia with Aladin regional climate model (RCM) from Med-CORDEX domain with resolution of 0.110 under two different forcing scenarios (RCP4.5 and RCP 8.5). Residential heating and cooling energy demand is estimated based on climatic, demographic and socio-economic parameters. Spatial distribution of present energy demand is assessed based on current climatic conditions, population distribution and number of existing residential buildings along with their thermal and geometrical characteristics taken from project TABULA - national building typologies. Heating and cooling degree days and global radiation received on diversely oriented facades as climatic parameters are calculated based on Aladin RCM outputs. Base temperature for HDD and CDD calculation is derived from the average insulation properties of households and climatic conditions. Spatial distribution of future heating and cooling energy demand is estimated based on world SSP population projections, future climate conditions and assumed thermal properties, occupancy and life cycle of buildings. According to both scenarios, a significant decrease of HDD and residential heating energy demand, as well as increase of CDD is expected over entire considered region. However, the cooling energy demand projections do not show unique direction, as the population are expected to decrease, as well as the energy efficiency of the households are expected to increase in some areas. The simulations show a spatial heterogeneity in the potential changes, with the largest decrease of HDD and heating energy demand in mountainous area and largest increase of CDD in lowlands. Our study is the first research of future changes in residential heating and cooling energy demand over significant part of the Pannonian basin and Balkan Peninsula based on high-resolution regional climate model. It should also be emphasized that this is the first research that links standardized ISO 13790 method and outputs of regional climate model in the assessment of future energy demand in residential sector. Moreover, demographic and socio-economic parameters have been introduced as an additional dynamic component in the assessment. The results of this study can be very useful for climatologists, public policymakers, economy and energy demand management and any other researchers interested in future changes of heating and cooling energy demand in residential sector within Pannonian basin and Balkan Peninsula.