Convection-Permitting Future Climate Simulation Based on SSP3-7.0 Scenario Over the Black Sea Basin

Mehmet Baris Kelebek and Barış Önol
Istanbul Technical University, Aeronautics and Astronautics Faculty, Meteorological Engineering Department, Istanbul, Turkey (kelebek15@itu.edu.tr)

The regional climate models are recently run at grid spacings of 4 km or less, so-called the convection-permitting scale, over different regions of the world. The previous studies highlighted the added value of the convection-permitting simulations, especially in representing the daily and sub-daily precipitation over complex topography. The Black Sea Basin, including the coastal areas of the Black Sea and a broad part of the Anatolian Peninsula, is one of the climate change hotspots with its complex topographical features and where strong air-sea interactions occur. Previously, this region has become a subject of regional climate modelling studies at horizontal resolutions on the order of 10 km. In this study, we performed a decade-long convection-permitting climate simulation at 3 km horizontal resolution between 2061-2070 based on the SSP3-7.0 greenhouse gas emission scenario over the Black Sea Basin. To this end, we downscaling the last generation CMIP6 MPI-ESM1.2-HR outputs by using the WRF model. The results indicate that the daily 2m mean, minimum, and maximum air temperatures increase in the spring, summer, and autumn by about 3°C compared to the 2005-2014 reference period over the study area. Nevertheless, the increase in the cloud cover suppresses the warming in the winter. In terms of precipitation, the total precipitation amount decreases in spring and summer over the Black Sea Basin. On the other hand, the total precipitation amount increases significantly by about 3 mm/day in winter over the Eastern Black Sea region due to the positive change in evaporation of around 15%. The maximum daily precipitation amount reaches 350 mm over the northeast of Turkey and over the Caucasus. The intensification of the daily precipitation is most pronounced in the coastal subregions of the Black Sea Basin. Furthermore, the results highlight the intensification of sub-daily precipitation in these regions. In particular, the afternoon precipitation increases in autumn over the coastal regions of Turkey.