EGU24-5614, updated on 19 May 2024
https://doi.org/10.5194/egusphere-egu24-5614
EGU General Assembly 2024

Recent past and future climate change over the TRIQUETRA cultural heritage sites and related damage risk

Aristeidis K. Georgoulias, Dimitris Akritidis, Efstathia Tringa, Haralambos Feidas, and Prodromos Zanis
Department of Meteorology and Climatology, School of Geology, Aristotle University of Thessaloniki, Thessaloniki, Greece (ageor@auth.gr)

Within the framework of TRIQUETRA (Toolbox for assessing and mitigating Climate Change risks and natural hazards threatening cultural heritage; https://triquetra-project.eu/) research project, meteorological data from weather stations (observations) as well as simulations from regional climate models (RCMs) have been analyzed to assess recent past and future climate change over eight cultural heritage (CH) sites in six countries. From South to North the CH sites are Choirokoitia in Cyprus, Aegina, Epidaurus, and Kalapodi in Greece, Ventotene in Italy, Les Argilliez in Switzerland, Roseninsel in Germany, and Smuszewo in Poland. The observations were acquired from weather stations (from various networks) with long meteorological records at the proximity of the examined CH sites, while the RCM data come from the EURO-CORDEX. More specifically, 11 sets of high resolution (~12.5 km) RCM simulations were analyzed, covering the historical period 1950-2005 and the future period 2006-2100 under three different Representative Concentration Pathways (RCPs) of the Intergovernmental Panel on Climate Change (IPCC), namely the RCP2.6 (strong greenhouse gas mitigation), RCP4.5 (medium mitigation), and RCP8.5 (no further mitigation). The climate analysis over the recent-past period 1970-2020 revealed a robust warming and increasing of heat stress at the materials of the CH assets. Furthermore, the multi-model climate analysis based on the RCM simulations for the three different future scenarios points towards a hotter and drier future climate for the CH sites at the South and a hotter and wetter climate for the CH sites in the North. Analysis of the Heritage Outdoor Microclimate Risk (HMR_{out}) and Predicted Risk of Damage (PRD) indices over the recent past period indicates notable variations in microclimate conditions with aggravation of heat stress at CH assets made of stone and marble, pointing towards an increase in predicted risk of damage. Analyzing the future changes in HMR_{out} and PRD indices based on the multi-model ensembles of RCM simulations for the three different future scenarios will provide a more comprehensive understanding of how the resilience of materials and the overall preservation of stone and marble CH sites may be affected.

This work is based on procedures and tasks implemented within the project “Toolbox for assessing and mitigating Climate Change risks and natural hazards threatening cultural heritage - TRIQUETRA”, which is a Project funded by the EU HE research and innovation programme under GA No. 101094818.