STECCI Climate Change Modelling for Medieval Limestone Heritage

Nusret Drešković[1], Edin Hrelja[1], Saida Ibragić[1], Edin Bujak[1], Ahmed Džaferagić[1], and Snežana Radulović[2]

- [1]University of Sarajevo, Faculty of Science, Geography, Bosnia and Herzegovina (nusret.dreskovic@pmf.unsa.ba)
- [2]University of Novi Sad, Faculty of Sciences, Serbia (snezana.radulovic@dbe.uns.ac.rs)

In light of accelerating climate change, the STECCI project is concentrating on the critical matter of safeguarding stećci mediaeval limestone tombstones and other limestone cultural heritage monuments throughout Europe. These cultural structures, sculpted during the 12th and 16th centuries, are included on the UNESCO World Heritage List due to their representation of the region's intricate history. Stećci represent one of the most delicate forms of cultural assets in Europe, as they are composed of limestone and lack protection from the elements. The majority are located in Bosnia & Herzegovina, Croatia, Montenegro, and Serbia. STECCI have examined comparable limestone sites in Malta, Austria, Germany, and France for comparative analysis.

We use the Shared Socioeconomic Pathway (SSP2-4.5 and SSP5-8.5) and Representative Concentration Pathway (RCP4.5) scenarios to look at how temperature, precipitation, extreme weather events, and frost frequency are expected to vary in the future: 2021–2040, 2041–2060, and 2081–2100. We employed high-resolution climate information and outputs from the IPCC Interactive Atlas (advanced regional mode) to make site-specific projections for a wide range of geographic areas, including Mediterranean, Continental, and Alpine climates.

The analysis encompasses key UNESCO sites in Bosnia and Herzegovina (Radimlja, Blidinje, Kopošići), Croatia (Cista Velika, Velika i Mala Crljivica), Serbia (Mramorje Perućac, Rastište), and Montenegro (Žugića bare, Žabljak), along with comparative limestone sites in Malta (Mdina Rabat), Austria (Carinthia), Germany (Bavaria), and France (Normandy region). The results highlight substantial regional differences in projected climate impacts. For example, Herzegovinian (BIH) and Dalmatian (CRO) sites are projected to experience more frequent heatwaves, reduced annual precipitation, and extended dry spells, amplifying risks of salt crystallisation and biological colonisation. In contrast, central European sites in Austria and Germany are expected to face increased frost-thaw cycles and intense precipitation events, both of which pose mechanical degradation threats to limestone structures. Montenegrin and Bosnian sites with higher altitude and moisture retention (e.g. Žabljak and Kopošići) are likely to become hotspots for biological weathering due to more frequent dew points and fluctuating thermal gradients.

By linking these projected environmental stressors to known mechanisms of limestone decay -including dissolution, biodeterioration, and mechanical erosion, this study establishes a robust foundation for prioritising conservation interventions. Moreover, it supports the development of a STECCI Preservation guidelines framework, which integrates climate risk modelling with dose - response functions and biomonitoring indicators.

Overall, this interdisciplinary study illustrates the value of applying high-resolution climate scenario modelling to endangered cultural heritage and offers a replicable framework for assessing vulnerability in stone monuments across Europe's diverse biogeographical zones.

Acknowledgement: *This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101094822 (STECCI), managed by the European Research Executive Agency (REA).*

How to cite: Drešković, N., Hrelja, E., Ibragić, S., Bujak, E., Džaferagić, A., and Radulović, S.: STECCI Climate Change Modelling for Medieval Limestone Heritage, EGU General Assembly 2026, Vienna, Austria, 3–8 May 2026, EGU26-13956, https://doi.org/10.5194/egusphere-egu26-13956, 2026.