ICUC12-443, updated on 02 Jun 2025
https://doi.org/10.5194/icuc12-443
12th International Conference on Urban Climate

High-Resolution Bias-Corrected Euro-CORDEX Dataset for Assessing Climate Change Risks to Building Heritage in Belgium

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Quantifying the vulnerability of cultural heritage to climate change is essential, particularly in understanding how facade degradation processes will evolve over the coming century. Will risks diminish or intensify? Addressing this question is critical for guiding future renovation strategies. One approach to quantitative assessment involves hygrothermal simulations of the building envelope using building physics models. However, this method first requires a deeper understanding of historical materials and the mechanisms driving their deterioration.

In this context, dose-response functions provide valuable insights by identifying key degradation processes linked to climatic factors and offering qualitative projections of future risks. This study analyzes the evolution of key degradation indices related to freeze-thaw and salt crystallization exposures at the daily time scale across Belgium.

Given the variability in climate model projections, we employ the Euro-CORDEX ensemble of regional climate models (RCMs) to assess the impact of model uncertainty on degradation indices. To account for potential biases, each simulation was bias-corrected using a high-resolution (5 km) gridded dataset developed at RMI. Recognizing that bias correction introduces its own uncertainties, we compared two correction techniques—univariate (ISIMIP3BA) and multivariate (MBCn)—to evaluate their effects. In this presentation, I will reveal how degradation risks shift in a +2°C and +3°C warming scenario, offering insights into the future resilience of our built heritage.

While primarily developed to assess future building degradation risks in Belgium, this new dataset will also provide indicators for energy consumption and thermal comfort. Ultimately, the atlas will incorporate over 20 indices, alongside bias-corrected daily time series for key climate variables, including near-surface temperature (mean/minimum/maximum), relative humidity and wind speed, surface pressure, precipitation and shortwave radiation.