XV International Conference on Durability of Building Materials and Components
DBMC 2020, Barcelona
C. Serrat, J.R. Casas and V. Gibert (Eds)

The Impact of Climate Change on Material Degradation: Finding a Feasible Approach for Climate Model Evaluation

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Keywords: *Iran, Climate Change, Degradation Criteria, Heritage.*

1 Introduction

Understanding how climate change affects the process of material deterioration is the first step towards assessing adaptive approaches for the preservation of heritage. Choosing an appropriate regional climate model is the first and most crucial step in the analysis of climate change effects on heritage.

Iran is home to one of the world's oldest civilizations. The country's rich cultural legacy is reflected in part by its 22 UNESCO world heritage sites. Iran's climate is diverse, ranging from arid and semi-arid, to subtropical along the Caspian coast and the northern forests.

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change suggests significant changes in regional climate conditions during the twenty-first century, such as drier and hotter summers over the Middle East (Giorgi, F. 2006). To provide accurate climate change scenarios over the region, high-resolution regional climate models are needed. Thus in this paper, high-resolution regional climate projections over Central Asia have been analyzed. For more accuracy, two different climate models have been evaluated to find out which model is more adapted to the domain. ALARO-SURFEX model (Ghent University, Belgium) and REMO model (HZG-GERICS, Germany).

2 Methodology

Given that Iran has an extended range of climate regions, and models are not often used for such a climatic region, these models need to be evaluated first. To analyze the evaluation run of the models over the domain, Mashhad**,** which is located in the northeastern of Iran and features a steppe climate, was picked.

The scatterplot of all years 1987-2010 (Figure 1and2) indicates that there is a good overall representation of the observed air temperature (T) by both models. The linear fit of the hourly temperature almost follows the diagonal (perfect fit). Furthermore, the evaluation metrics, which are essential in the model validation analysis, are computed(table01).

Based on the above descriptions, the correlation and Adjusted R-Squared coefficients of both models indicate high accuracy, but the ALARO model seems more reliable.

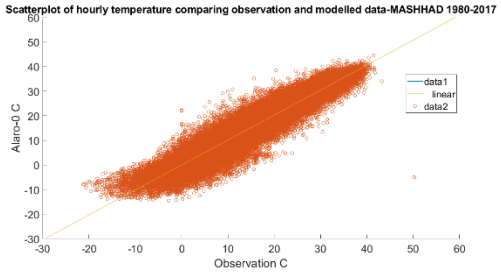

Figure 3. Hourly scatterplot ALARO-0 model.

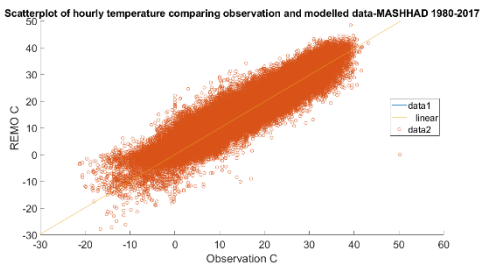

Figure 4. Hourly scatterplot Remo model.

Tabel 1. Validation coefficients, which are computed for temperature parameter.

Mashhad H:999m Lon:59.63 Lan:36.23						
	Correlation	Adjusted R-Squared	Regression	Correlation	Adjusted R-Squared	Regression
hourly Temperature	0.9588	0.919	0.9554	0.9386	0.881	0.9674
Daily mean Temperature	0.9676	0.936	0.9558	0.9596	0.921	0.9848

3 Conclusions

Regarding previous analysis, there can be concluded that the best approach for model validation is comparing the model dataset with the historical observations for different parameters based on daily, seasonal and yearly temporal resolutions. Another critical issue that should be considered in each model validation study is considering relevant indexes to the research i.e., freeze-thaw cycles. The study showed that both models in temperature parameter are surprisingly accurate. Based on reproduced graphs and evaluation metrics like correlation and adjusted R-squared, ALARO-0 model is a little more realistic and is suitable to use for the hygrothermal simulation over the location.

Acknowledgement

The RCM runs used in this paper have performed in the context of the AFTER project, which is granted by the ERA.Net RUS Plus Initiative, ID 166. The computational resources and services for the ALARO-0 regional climate simulations were provided by the Flemish Supercomputer Center (VSC), funded by the Research Foundation-Flanders(FWO) and the Flemish Government department EWI. The CORDEX-CORE REMO simulations were performed under the GERICS/HZG share at the German Climate Computing Centre (DKRZ). We would like to thank Steven Caluwaerts (UGent), Lola Kotova (GERICS), and Sara Top (UGent) for providing climate data.

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