



## **Stained glass and climate change: How are they connected?**

Christopher Simmons (1) and Lawrence Mysak (2)

(1) Earth System Modelling Group, McGill University, Montréal, Canada ([christopher.simmons@mail.mcgill.ca](mailto:christopher.simmons@mail.mcgill.ca)), (2) Earth System Modelling Group, McGill University, Montréal, Canada ([lawrence.mysak@mcgill.ca](mailto:lawrence.mysak@mcgill.ca))

As expressions of vernacular architecture, medieval Gothic churches often possess adaptations to their prevailing climate regime. The late medieval period in Europe is also marked by a transition from warm and sunny to cooler and cloudier conditions in the thirteenth and fourteenth centuries. It is within the context of this climate change that we consider interior daylighting, one of the most important features in Gothic churches, during the transition from the Medieval Warm Period (MWP) to the Little Ice Age (LIA). For the first time, an extensive data set of luminance and illuminance measurements has been collected in Gothic churches in France, Germany, and Spain. In addition, in order to determine the light-admitting capacity of windows from different eras, recent advances in HDR imagery were used to construct luminance fields and determine the relative transmissivities of authentic medieval windows. This quantitative overview reveals a significant increase in the use of high-translucency glazing, raising interior lighting levels by as much as an order of magnitude as precipitation and cloudiness likely increased in the late thirteenth century. Furthermore, we determine that this clearer glass provided limited lighting gains compared to earlier programs under sunny conditions but substantial lighting improvements for cloudy conditions. The results suggest that the human response to naturally-induced climate change, as seen through the lens of architecture, may have been significant in the middle ages, providing important implications for the adaptability of construction in today's greenhouse era.