Climate datasets for designing buildings resilient to climate and natural disasters

Abhishek Gaur, PhD., PEng.

National Research Council Canada
1200 Montreal Road, Ottawa, Canada K1A0R6

ABSTRACT

The global community is experiencing rapidly escalating socio-economic losses as a result of changes in climate and the increasing intensity, severity, and frequency of natural hazards such as flooding, wildfires, prolonged heat spells, and other extreme events. These impacts are projected to worsen over the coming decades, placing growing pressure on governments, industries, and communities to develop robust strategies for adapting to a changing climate. Reducing these losses requires proactive planning of communities, infrastructure, and buildings that fully considers the projected future changes in climate as well as the evolving profiles of natural disasters. Because people spend close to ninety percent of their time indoors, buildings play a central and indispensable role in strengthening the climate resilience of communities and safeguarding public health and well-being.

Designing resilient buildings requires reliable estimates of the climatic loads and hazard conditions that buildings may be exposed to throughout their design lives. Such information is essential not only for structural design and material durability assessments but also for determining indoor environmental quality, energy performance, overheating risk, and long-term maintenance needs. In this presentation, using Canada as an illustrative case study, several examples of climate and natural hazard datasets that support climate-resilient building design will be presented, along with a discussion of the scientific and technical methodologies used to develop them.

The datasets fall into three major categories. The first category includes building design climate indices that explicitly incorporate climate change effects and will form part of the 2025 National Building Code of Canada. These indices represent a significant advancement beyond the historical-only datasets traditionally used in codes and standards. The second category consists of building simulation climate datasets that capture projected future climate change impacts together with the influences of urban heat islands, providing inputs required for hygrothermal modelling, energy simulations, and overheating analyses. The third category contains natural hazard datasets - such as wildfire exposure maps, flood hazard layers, and extreme heat indicators - developed for reference locations included in the National Building Code of Canada.

The presentation will conclude with examples demonstrating how these datasets are being applied within Canada to inform building design, policy development, and climate adaptation planning. Collectively, these efforts illustrate how scientifically derived climate information can support evidence-based decisions, enabling buildings and communities to remain safe, functional, and resilient under future climate conditions.

KEYWORDS

Climate change, resiliency, buildings, natural disasters, adaptation