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Potential impacts of climate change on the built environment: ASHRAE climate zones, building codes and national energy efficiency

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Statement of the Problem: ASHRAE releases updates to 90.1 "Energy Standard for Buildings except Low-Rise Residential Buildings" every three years resulting in a 3.7%-17.3% increase in energy efficiency for buildings with each release. This is adopted by or informs building codes in nations across the globe, is the National Standard for the US, and individual states elect which release year of the standard they will enforce. These codes are built upon Standard 169 "Climatic Data for Building Design Standards," the latest 2017 release of which defines climate zones based on 8, 118 weather stations throughout the world and data from the past 8-25 years. This data may not be indicative of the weather that new buildings built today, will see during their upcoming 30-120 year lifespan.

Methodology & Theoretical Orientation: Using more modern, high-resolution datasets from climate satellites, IPCC climate models (PCM and HadGCM), high performance computing resources (Titan) and new capabilities for clustering and optimization the authors briefly analyzed different methods for redefining climate zones. Using bottom-up analysis of multiple meteorological variables which were the subject matter, experts selected as being important to energy consumption, rather than the heating/cooling degree days currently used.

Findings: We analyzed the accuracy of redefined climate zones, compared to current climate zones and how the climate zones moved under different climate change scenarios, and quantified the accuracy of these methods on a local level, at a national scale for the US.

Conclusion & Significance: There is likely to be a significant annual, national energy and cost (billions USD) savings that could be realized by adjusting climate zones to take into account anticipated trends or scenarios in regional weather patterns.

Biography

Joshua R New is a Computer Scientist serving as Full-Time R&D Staff at Oak Ridge National Laboratory, Joint Faculty at The University of Tennessee, and Founder and CEO of Tunation, LLC. He received his PhD in Computer Science at the University of Tennessee in 2009. He serves at Oak Ridge National Laboratory's Building Technology Research Integration Center (BTRIC) as Subprogram Manager for software tools and models. He has over 95 peer-reviewed publications and has led more than 45 competitively-awarded projects in the past five years involving websites, web services, databases, simulation development, visual analytics, supercomputing using the world's fastest supercomputer and artificial intelligence for big data mining. He is a Voting Member of ASHRAE TC4.2 and SSPC-169 which define the climate data and HVAC design conditions for international building codes.

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