Bauhaus-Universität Weimar

Institute of Structural Engineering
Chair of Modelling and Simulation of Structures
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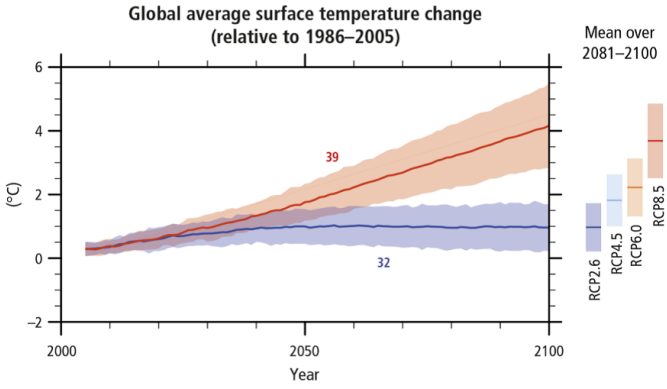
Effects of climate change on buildings and neighborhoods - Structural integrity, indoor climate and energy efficiency (TAB)

Motivation

Climate change effects have shown in the recent years that severe weather conditions have an increased tendency of occurrence, such as high winds, excessive precipitations and downbursts, that could endanger the integrity of the structures over their lifetime. Lightweight and flexible structures with low damping ratios, being exposed to wind-induced vibrations could be prone to fatigue and serviceability issues. Existing structures and indoor climate need to be assessed to account for increased wind load characteristics and extreme variation in temperatures.



Expected changes in mean global surface temperature as a result of climate change

Research goal and approach

According to the climate agreement, a number of scenarios, called representative concentration paths (RCP), are estimating the consequences of anthropogenic greenhouse gas emissions based on their associated temperature increase. The range of prognoses starts from a mitigation scenario leading to a very low propulsion level (RCP2.6), two stabilization scenarios (RCP4.5 and RCP6.0) and a scenario with very high greenhouse gas emissions (RCP8.5). Each of these scenarios has in its interpretation a set of climate change models, used to extrapolate temperatures and wind speeds from a past data to a future time horizon. By using this statistical data we can analyze the wind characteristics and load effects on built environment, thus assessing the structural integrity and serviceability criteria for existing structures as consequence of climate change, such as the impact of higher wind speeds on structures. The project entails three areas of knowledge, from civil engineering, building physics, and building informatics, which aims to cooperate with the industrial advisory board for achieving a study assessment of climate change models on structures. Reference objects are selected and worked on together in the sub-projects, such as load models, measurement concepts, and adaptation strategies for the effects of climate change on structural integrity and the effects on thermal comfort and energy consumption in buildings.

Innovations and outlook

The work of this research group is intended to show, on one hand, in what form the prognostic assumptions of various climate models and forecasts can occur and what is impact of these variations on the design of structures. On the other hand, the consequences by applying the aforementioned models has to be determined for the structural behavior with the necessary strategies in the design and execution, along with the developing of smart sensor solutions for the monitoring and adaptation of structures. In this way the load-bearing behavior and energy efficiency of structures due to climate changes can be assessed.

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Project partners
Bauhaus-University Weimar - Chair of Modelling and Simulation of Structures/ Chair of Computing in Civil Engineering, Building Physics and Mathematics/ Chair of Steel and Hybrid Structures

Industrial advisory board
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