Typological studies for passive design strategies based on coupled measured and modelled data

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ABSTRACT: Preliminary measured and simulated data will be presented from two comparative field studies in Turkey and the United States. The project validates spatial typologies of traditionally inherited passive heating and cooling strategies situated in two distinct climate zones (hot and arid and continental humid). Sustainable buildings today demand a holistic approach towards the design of spaces, envelope systems, occupant behavior, dynamic environmental control strategies; the materials used in the construction, as well as the energy produced, used and stored in the building. This is specifically important in the developing world where high tech solutions might not always be available therefore passive strategies which use the building fabric to mediate the climate are essential to meet the needs of a warming planet. Our overarching research goal is to enhance the utilization of naturally occurring energy flows through, within or around buildings, their spatial shapes, and their construction materials to achieve thermal comfort, individual control and improved air quality, while eliminating fossil fuel consumption and negative environmental health impacts. Our methodology is the coupling of measured performance data with high performance CFD simulations. The collaborative pilot project presented here studied the fundamental energy flow characteristics executed in the conical roofed Harran houses in Turkey and in the Midwestern sun porch. The long-term goal of the research project, once the fluid dynamics in those buildings is understood and modeled is to develop typology guidelines for passive cooling and heating strategies for extreme climates. This international collaboration aims for transformative impact on building design for the extreme climates as encountered in the hot and arid Middle East and the continental humid climate of the US Midwest. The outcome is a validated knowledge base for passive design strategies, which can be integrated into contemporary designs for sustainable high performance buildings through dynamic building information modeling.