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- towards climate change services

Probabilistic Climate Projections Influencing Future Weather Years for Energy Modelling

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Abstract

Energy demands associated with the built environment are influenced by many factors, such as building form, the wider urban landscape, its infrastructure, and critically the meteorological conditions that influence urban form and energy related behaviours. With growing demand to regulate the energy performance of buildings, simulation programs have been developed to provide numerical analysis of dynamic thermal and electrical loading under given design conditions. These models have developed to incorporate hourly values of weather variables significant to energy performance, such as dry-bulb and wet-bulb temperature, solar radiation intensity and wind velocity.

For energy concerns, Typical Meteorological Years (TMYs) are an internationally recognised method to account for a climatic regions typical annual weather profile. The UK also uses Design Summer Years (DSYs) for comfort and health impact studies during extreme weather events (i.e. heat waves) - especially for analysing building designs with little or no mechanical cooling capacity. These reference years are generally accredited by the relevant professional institutions in each country, providing practitioners with confidence in demonstrating design compliance with standards.

Until recently, TMYs and DSYs have been derived from periods of observed weather data by statistical analysis of what is considered a representative period of a stationary climate. The realisation that the design life of current building and retrofit projects are expected to experience significant climate change has led to recent adoption in the UK of a 'morphing' of existing weather reference years according to change factors derived from the UK Climate Impacts Programme of 2002 (UKCIP02).

The recently released probabilistic climate projections of UKCP09 open up the possibility of incorporating climate model uncertainty into this process, but there are as yet no recognised methods of transforming the output of probabilistic climate models into the type of weather data that can be used by building design professionals in design analysis.

This paper reports on recent research which is aimed at producing new future weather reference years which incorporate the probabilistic elements of the new projections without placing a further layer of selection and decision-making on a non-expert user. Some methodologies for the generation of probabilistic future reference years are described, together with a comparison with the weather data which is available to designers at present.