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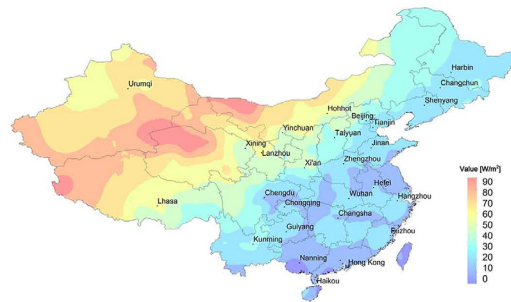
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Understanding downward longwave radiation for cooling buildings

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Two scientists fill in gaps in current models for downward longwave radiation in China to include consideration of different weather conditions such as cloud coverage.



Downward longwave radiation is heat emitted back to Earth from the atmosphere and can change depending on the composition of the air. The relationship between this radiation and other meteorological elements has not been extensively researched across China but plays a crucial role in the design of passive cooling systems in buildings. The greater the radiative cooling potential of an area, the more suitable it is for passive cooling design.

Most previous studies for China have focused on clear-sky conditions and generally did not consider factors such as cloud coverage, although downward longwave radiation strongly depends on weather conditions. Kai Chang and Qingyuan Zhang developed a new empirical model that considers all sky conditions.

“For building simulation and passive cooling design, we need typical weather data for a long period of time. This should include both sunny and cloudy conditions,” author Chang said.

The new model considers meteorological parameters such as ambient temperature, water vapor pressure and relative humidity under all-sky conditions. They tested their model based on measured longwave radiation in four locations in China, for daytimes and nights, as well as with and without cloud modification factor, and compared their results with existing models.

They also specifically developed a distribution map of radiative cooling potential during the night, in July which is the hottest month of the year throughout most of China.

“When designing the passive cooling system of buildings, we need to understand the environmental characteristics around the building. One important factor to be considered is the nighttime radiative cooling potential,” Chang said.

To further this research, the authors intend on verifying the applicability of their models for Southern China and improving their nighttime models to include cloud parameters.

Source: “Modeling of downward longwave radiation and radiative cooling potential in China,” by Kai Chang and Qingyuan Zhang, *Journal of Renewable and Sustainable Energy* (2019). The article can be accessed at <https://doi.org/10.1063/1.5117319>.

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