Revisiting the climate impacts of cool roofs around the globe using an Earth system model

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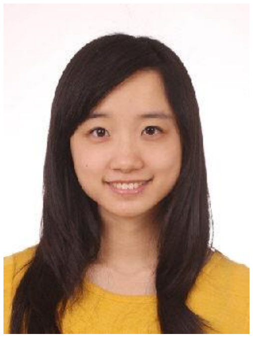
October 21, 3:00pm, SLH 102

Abstract:



Solar reflective “cool roofs” absorb less sunlight than traditional dark roofs, reducing solar heat gain, and decreasing the amount of heat transferred to the atmosphere. Widespread adoption of cool roofs could therefore reduce temperatures in urban areas, partially mitigating the urban heat island effect, and contributing to reversing the local impacts of global climate change. The impacts of cool roofs on global climate remain debated by past research and are uncertain. Using a sophisticated Earth system model, the impacts of cool roofs on climate are investigated at urban, continental, and global scales. We find that global adoption of cool roofs in urban areas reduces urban heat islands everywhere, with an annual- and global-mean decrease from 1.6 to 1.2 K. Decreases are statistically significant, except for some areas in Africa and Mexico where urban fraction is low, and some high-latitude areas during wintertime. Analysis of the surface and TOA energy budget in urban regions at continental-scale shows cool roofs causing increases in solar radiation leaving the Earth-atmosphere system in most regions around the globe, though the presence of aerosols and clouds are found to partially offset increases in upward radiation. Aerosols dampen cool roof-induced increases in upward solar radiation, ranging from 4% in the United States to 18% in more polluted China. Adoption of cool roofs also causes statistically significant reductions in surface air temperatures in urbanized regions of China (−0.11±0.10 K) and the United States (−0.14±0.12 K); India and Europe show statistically insignificant changes. The research presented here indicates that adoption of cool roofs around the globe would lead to statistically insignificant reductions in global mean air temperature (−0.0021 ± 0.026 K). This counters past research suggesting that cool roofs can reduce, or even increase global mean temperatures. Thus, we suggest that while cool roofs are an effective tool for reducing building energy use in hot climates, urban heat islands, and regional air temperatures, their influence on global climate is likely negligible.

Fragility of Floating Docks for Small Craft Marinas

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Abstract:

As a result of damage from the 2010 Chile and 2011 Japanese teletsunamis, the tsunami risk to the small craft marinas in California has become an important concern. This paper outlines an assessment tool which can be used to assess the tsunami hazard to small craft harbors. The methodology is based on the demand and capacity of a floating dock system. Results are provided as fragility curves and give a quantitative assessment of survivability. This tool is not exact and is provided only to give an indication as to survivability and/or failure of a floating dock system of vessels and floating components/piles, subject to tsunami events. The purpose is to quickly evaluate whether or not a floating dock is likely to survive or be destroyed by a tsunami having the input properties.