5.2 Regional impacts of large-scale cool roof and rooftop solar photovoltaic deployment on near-surface air temperature and cooling energy demand

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We assess summertime regional impacts of large-scale cool roof and rooftop solar photovoltaic (PV) deployment on near-surface air temperature and cooling energy demand for the two major cities of Arizona (USA). For this task, we develop and implement a detailed physics-based parameterization of PV panels in a multilayer building energy model that is fully coupled to the Weather Research and Forecasting model. We simulate a 10-day clear-sky extreme heat period over the Phoenix and Tucson metropolitan areas at high spatial resolution (1 km horizontal grid spacing). Results show that high large-scale deployment of cool roof and rooftop PV panels reduce near-surface air temperature across the diurnal cycle and citywide cooling energy demand. During the day, cool roofs are more effective cooling than rooftop solar photovoltaic systems, but during the night PV panels seem to be more efficient reducing urban heat island.