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Stronger Global Warming on Sunny Days

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Global warming is typically evaluated using trends in mean temperature. However, temperature is affected quite differently on sunny and cloudy days, with sunny days typically showing higher maximum temperature and greater diurnal temperature range. Here, we show that global warming is considerably stronger on sunny days. To do so, we evaluated warming trends using observations from meteorological stations in China and distinguish between sunny and cloudy days using rainfall records as a proxy. We find that warming trends on sunny days are about 50% higher than on cloudy days, and that 70-80% of the total temperature increase is contributed by sunny days. The main reason is likely to be a stronger sensitivity of atmospheric emissivity to water vapor on sunny days, which would be dominated by clouds on cloudy days, resulting in a stronger water vapor feedback on sunny days. Our results are consistent with observations that drier regions show stronger warming trends and imply that the anticipated greater frequency of heatwaves under global warming may mostly be attributable to this greater sensitivity of sunny days to the greenhouse forcing.