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Contribution of solar radiation to decadal temperature variability over land

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Global air temperature has become the primary metric for judging global climate change. The variability of global temperature on a decadal timescale is still poorly understood. This paper examines further one suggested hypothesis, that variations in solar radiation reaching the surface (Rs) have caused much of the observed decadal temperature variability. Because Rs only heats air during the day, its variability is plausibly related to the variability of diurnal temperature range (daily maximum temperature minus its minimum). We show that the variability of diurnal temperature range is consistent with the variability of Rs at timescales from monthly to decadal. This paper uses long comprehensive datasets for diurnal temperature range to establish what has been the contribution of Rs to decadal temperature variability. It shows that Rs over land globally peaked in the 1930s, substantially decreased from the 1940s to the 1970s, and changed little after that. Reduction of Rs caused a reduction of more than 0.2 °C in mean temperature during May to October from the 1940s through the 1970s, and a reduction of nearly 0.2 °C in mean air temperature during November to April from the 1960s through the 1970s. This cooling accounts in part for the near-constant temperature from the 1930s into the 1970s. Since then, neither the rapid increase in temperature from the 1970s through the 1990s nor the slowdown of warming in the early twenty-first century appear to be significantly related to changes of Rs.