

Climate Change Over Past and Recent Solar Minima

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Abstract: The Earth's atmosphere is a vastly complex system which is affected by both human influence and natural climate effects. One natural forcing component is our sun's contribution to climate. It is well known that the sun provides the majority of the energy for the Earth and that variability of the total solar irradiance (TSI) during the 11 year solar cycle affects our climate. Historically the sun's variability has been the primary input to climate change, but within the past 100 years, the sun's contribution has been diminished by the growing impact of mankind's industrialization. This study attempts to quantify the solar forcing on troposphere climate change over the past 30 years so that we could better understand our own human impact on global warming. We use a linear regression model with forcing parameters of TSI, anthropogenic warming, volcanic aerosol, and El Niño-Southern Oscillation (ENSO) components. Our focus is upon regions including the entire planet, the northern hemisphere, the United States, and central to eastern United States. We also took a seasonal approach to mitigate the large annual variations associated with Earth's orbit. Our main period of interest is the difference in temperature between this most recent low solar minimum (2007-2009) and the previous solar minimum in 1996. Our results suggest a 0.1 K or less cooling in surface temperature during the recent low solar minimum on the global and northern hemisphere spatial scales. Our model results are much less accurate for the smaller regions due to an increase in temperature variability, possibly due to dynamical effects such as the North Atlantic Oscillation (NAO). It appears that more forcing components are needed in the model, or a different model is needed, to properly study the smaller regions (USA and central to eastern United States).