

**Solar Forcing of the Earth's Climate on Multi-Decadal Time Scales**

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At the beginning of the 21st century the Earth's global temperature trend leveled off to a plateau, called the climate hiatus. One of the potential contributors to this climate change could be the extended, deep minimum of solar activity associated with the low solar irradiance input to the Earth. The current extended, deep minimum of solar variability and the extended minima in the 19<sup>th</sup> and 20<sup>th</sup> centuries (1810-1830 and 1900-1920) are consistent with minima of the Centennial Gleissberg Cycle (CGC), a 90-100 year variation of the amplitude of the 11-year sunspot cycle observed on the Sun, solar wind, and at the Earth. The CGC has been identified in the Total Solar Irradiance reconstructed for over three centuries. The Earth's climate response to the prolonged low solar irradiance involves heat transfer to the deep ocean with a time lag longer than a decade. The CGC minima, sometimes coincidently in combination with volcanic forcing, are associated with severe weather extremes. Thus the 19th century CGC minimum, coexisted with volcanic eruptions, led to especially cold conditions in United States, Canada and Western Europe ("a year without summer"). We identify the timing and spatial pattern of the Earth's climate response that allows distinguishing the solar forcing from other climate forcings.