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Global temperature response to radiative forcing: solar cycle versus volcanic eruptions

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I demonstrate that the peak-to-peak amplitude of the global mean surface temperature response to the 11-year cyclic total irradiance forcing is an order of magnitude less than the amplitude of a cyclic component roughly in phase with the solar forcing which has been observed in the temperature record in the period 1959-2004. If this cyclic temperature component were a response to the solar forcing, it would imply the existence of strong amplifying feedbacks which operate exclusively for solar forcing, such as top-down mechanisms responding to the large variability in the ultraviolet part of the solar spectrum. I demonstrate, however, that the apparent cyclic component in the temperature record is dominated by the response to five major volcanic eruptions, some of which incidentally took place a few years before solar minimum in four consecutive solar cycles, and hence that the correlation with the solar cycle is coincidental. A temperature rise of 0.15 K over the 20th century ascribed to an increasing trend in solar forcing is more than offset by a cooling trend of -0.3 K due to stratospheric aerosols from volcanic eruptions.