



## **Periodicity, Amplitude, and Rate of Temperature over China and Response to External Forcing during the Last Millennium**

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To better understand the forcings and mechanisms of variability of regional climate, including periodic, amplitude and rate on different timescales, over the past 2000 years or even longer time is one of the key goals for study of past global changes. Here, we used the developed new temperature series representing the whole China based on the 28 temperature series at individual sites, and simulated temperatures, which are from 4 AOGCMs models: BCC-CSM1.1, CCSM4, IPSL-CM5A-LR, and MPI-ESM-P under CMIP5-PMIP3 last millennium (850-1850) and historical (1850-at least 2005) full forcing run experiments, to conduct the comparison. We will address the contributions of solar and volcanic forcings on the periodicities, amplitudes, and rates of temperature changes in China during the last millennium, by comparing the simulations and reconstructions datasets. Our primary result shows that: Control run and reconstruction both have 100-150-year and 230-270-year cycles, but that is very weak in the simulation runs; In addition, reconstruction well agreed with the solar activity at 100-year time scale; simulation well agreed with the volcanic activity at 200-year time scale. For the amplitude, at decadal time scale, simulation run and reconstruction are very close, but at centennial time scale, the simulation run only present the one fourth magnitude of that in decadal time scale, which is much lower than that of reconstruction. For the temperature changing rate per 100 years, when the solar and volcanic signals are both weak, the rate in the simulation run is close to zero, which is significant different with that of reconstruction.