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The impact of external forcings on climate during the past millennium: Results from transient simulation with BCC_CSM1.1

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The last millennium experiment with the climate system model BCC_CSM1.1 is just finished recently, covering the period from 850 A.D. to 1850 A.D.. The transient simulation is conduced following the CMIP 5 experiment design, incorporating year-to-year changes in the volcanic aerosols, solar irradiance, greenhouse gases, as well as the orbital parameters. Surface temperature variability falls well within the range of proxy-based reconstructions. The Medieval Period (around 950 to 1250) is about 0.11K warmer than the following cold period - Little Ice Age (around 1400 to 1700). Due to the strong positive Albedo-Temperature feedback in Antarctica, changes of surface temperature in the Southern Hemisphere show larger amplitude than that in the Northern Hemisphere. External forcings act differently in modulating the climate: volcanic eruptions tend to cool the planet, especially in the tropical ocean; strong solar irradiance tends to warm the planet with significant changes at the high latitude in the Southern Hemisphere; although positive CO_2 anomalies also lead to moderate climate condition, significant changes are more pronounced in tropics and the Northern Hemisphere. Same as the previous model results, the La Nina – like tendency in the Medieval is still a challenge for BCC_CSM1.1. The persistent positive NAO phase in the Medieval is consistent with reconstructions. Changes in East Asian Summer Monsoon are also examined. Possible mechanisms are discussed.