



## Decadal circulations and mid-continental summer cooling in CMIP5 models

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Parts of central United States and central China experienced a up to 2 oC cooling during the 20th century, while the global mean temperature rose by 0.6 oC (0.76 oC from 1901-2006). Studies have suggested that the Pacific Decadal Oscillation (PDO) and Atlantic Multidecadal Oscillation (AMO) may be responsible for this cooling, termed “warming hole (WH)”, while other works reported that regional scale processes like the low-level jet and evapotranspiration contribute to the abnormality. In phase 3 of the Coupled Model Intercomparison Project (CMIP3), only a few of 53 simulations could reproduce the cooling. This presentation examines newly available simulations in CMIP5 (phase 5 of CMIP) experiments from 25 models, totaling 100 ensemble members. We found that (i) only 19 out of 100 ensemble members simulated negative temperature trend (cooling) over the south-central United States with 99 members under-predicting the cooling rate. (ii) The missing of cooling in the models is likely due to the poor performance in simulating the spatial pattern of the cooling rather than the temporal variation, as indicated by a larger temporal correlation coefficient than spatial one between the observation and simulations. (iii) The ensemble members that simulated PDO and AMO indices reasonably well are not necessarily those that performed better in capturing the mid-continental cooling, indicative of disassociation between the circulations and the cooling in the CMIP5 models.