Geophysical Research Abstracts
Vol. 16, EGU2014-2545, 2014
EGU General Assembly 2014

Interdecadal Connection between Arctic Temperature and Summer Precipitation over the Yangtze River Valley in the CMIP5 Historical Simulations

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This study assesses the ability of the Coupled Model Intercomparison Project phase 5 (CMIP5) simulations in capturing the interdecadal precipitation enhancement over the Yangtze River valley (YRV) and investigates the contributions of Arctic temperature and mid- to high-latitude warming to the interdecadal variability of the East Asian summer monsoon rainfall. Six CMIP5 historical simulations including models from the Canadian Centre for Climate Modeling and Analysis (CCCma), the Beijing Climate Center, the Max Planck Institute for Meteorology, the Meteorological Research Institute, the Met Office Hadley Centre, and NCAR are used. The NCEP–NCAR reanalysis and observed precipitation are also used for comparison.Among the six CMIP5 simulations, only CCCma can approximately simulate the enhancement of interdecadal summer precipitation over the YRV in 1990–2005 relative to 1960–75; the various relationships between the summer precipitation and surface temperature (Ts), 850-hPa winds, and 500-hPa height field (H500); and the relationships between Ts and H500 determined using regression, correlation, and singular value decomposition (SVD) analyses. It is found that CCCma can reasonably simulate the interdecadal surface warming over the boreal mid- to high latitudes in winter, spring, and summer. The summer Baikal blocking anomaly is postulated to be the bridge that links the winter and spring surface warming over the midto high latitude and Arctic with the enhancement of summer precipitation over the YRV. Models that missed some or all of these relationships found in CCCma and the reanalysis failed to simulate the interdecadal enhancement of precipitation over the YRV. This points to the importance of Arctic and mid- to high-latitude processes on the interdecadal variability of the East Asian summer monsoon and the challenge for global climate models to correctly simulate the linkages.