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Quantifying future changes in extreme precipitation events based on resolved synoptic atmospheric patterns

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Abstract

Global warming is expected to increase the frequency and intensity of extreme precipitation events. However, climate models remain inconsistent in capturing precipitation changes, especially at the regional scale. In this study, an analogue method is developed to detect the occurrence of extreme precipitation events without relying on the uncertain modeled precipitation. Our approach is based on the use of composite maps to identify the distinct large-scale atmospheric conditions that lead to extreme precipitation events at local scales. The development of composite maps, exemplified in the south-central United States, is achieved through the joint analysis of 27-yr (1979-2005) CPC gridded station data and NASA's Modern Era Retrospective-analysis for Research and Applications (MERRA). Various circulation features and moisture plumes associated with extreme precipitation events are examined. The scheme is evaluated for the multiple climate model simulations of the 20th century from Coupled Model Intercomparison Project Phase 5 (CMIP5) archive to determine whether the statistical nature of modeled precipitation events (i.e. the numbers of occurrences over each season) could well correspond to that of the observed. Further, the approach is applied to the CMIP5 multi-model projections of various climate change scenarios (i.e. Representative Concentration Pathways (RCP) scenarios) in the next century to assess the potential changes in the probability of extreme precipitation events. The presented analyses will highlight the complementary/comparative nature of these results to previous studies that have considered modeled precipitation output to assess extreme-event trends. The results could provide useful insights in helping society develop adaptive strategies and prevent catastrophic losses.

Biography

Xiang Gao has completed her Ph.D in 2001 from the University of Arizona and postdoctoral studies from Center for Ocean-Land-Atmosphere (COLA) Studies. She is currently a research scientist at MIT Joint Program on the Science and Policy of Global Change. She has been actively involved in the research projects of *NASA EOS Moderate Resolution Imaging Spectroradiometer (MODIS), NASA Energy and Water Cycle Study (NEWS)*, and *Global Soil Wetness Project Phase 2 (GSWP-2)*. She is also a member of *the Permafrost Carbon Research Coordination Network* Working Group.