
Rise in Northeast US Extreme Precipitation Caused by Atlantic Variability and Climate Change

Huanping Huang^{*1}, Christina M. Patricola^{1,2}, Jonathan M. Winter³, Erich C. Osterberg³, and Justin S. Mankin^{3,4}

¹Lawrence Berkeley National Laboratory – Berkeley, CA, United States

²Iowa State University – Ames, IA, United States

³Dartmouth College – Hanover, NH, United States

⁴Columbia University – Palisades, NY, United States

Abstract

Extreme precipitation (EP) in the Northeastern United States increased abruptly after 1996, coinciding with warming Atlantic sea surface temperatures (SSTs). We examine the importance of internal variability and external forcings to these EP and SST increases by using the Community Earth System Model large ensembles and an optimal fingerprint method to isolate the effects of different forcings on 1929–2018 Northeast EP and North Atlantic SSTs. We find anthropogenic and natural forcings combined have significantly influenced both Northeast EP and North Atlantic SSTs, with a time of detection in 2008 and 1968, respectively. Beyond SST changes attributable to internal variability of the Atlantic, aerosols and greenhouse gases are important drivers of SST changes, first detected in 1968 and 1983, respectively. Greenhouse gases are the only anthropogenic forcing exerting substantial influence on EP, first detected in 2008. We therefore attribute the 1996 EP shift to both unforced Atlantic variability and anthropogenic forcings.

Keywords: Extreme precipitation, Atlantic sea surface temperatures, Anthropogenic forcings, Atlantic multidecadal variability, Optimal fingerprinting, Time of detection

*Speaker