



Climate dominates changes in flood magnitude and timing across China during 1960-2017

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Riverine floods are exhibiting temporal shifts in both magnitude and timing under the context of climate change as well as human alternations of the river systems (i.e., construction of reservoirs and land management practices). A nation-wide assessment of changes in riverine floods is still lacking over China, despite the societal perception that recent Chinese flood trends are dictated by drastic environmental changes associated with rapid economic development. Here we examine changes in flood magnitude and timing based on the most comprehensive database of annual maximum flood peak discharge (AMF) over China during the period 1960-2017. We find both increasing and decreasing trends in AMF magnitude and timing. Trends in AMF magnitudes range from -4.29% to 2.86% (per year relative to long-term mean flood peak discharge). Decreased AMF magnitudes are observed in central and northern China, while increased AMF magnitudes mainly in northwestern and southern China. The shifts of AMF timing range from -16 days to +18 days per decade. Changes in AMF timing show less spatial consistency than that in AMF magnitude. We categorize the gauged watersheds into human-modified and natural categories. Flood changes in natural watersheds can only be attributed to climate variability. The spatial pattern of changes in AMF magnitude and timing in human-modified watersheds resembles those in natural watersheds, pointing towards the dominant role of climate in dictating recent flood changes over China. Impacts of reservoirs and land management practices are only isolated cases. We further provide a predictive understanding of climatic controls on flood hazards over China (and East Asian countries) by establishing connections between changes in AMF magnitude/timing and climate indices. Our analyses, together with similar efforts in other continents, contribute to a general understanding of space-time dynamics of riverine floods around the globe.