Linking timing, magnitude and process-controls of floods in the United States

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River flooding can have severe societal, economic and environmental consequences. However, limited understanding of the regional differences in flood generating mechanisms results in poorly understood flood trends, and consequently, uncertain predictions of future flood conditions. Through systematic data analyses of 420 catchments we expose the primary drivers of flooding across the contiguous United States. This is achieved by exploring which flood-generating processes control the seasonality and magnitude of maximum annual flows. The regional patterns of seasonality and interannual variability of the magnitude of maximum annual flows are, in general, poorly explained by rainfall characteristics alone. For most catchments soil moisture dependent precipitation excess, snowmelt and rain-on-snow events are found to be much better predictors of flooding responses. The generated continental-scale classification of dominant flood generating processes emphasizes the disparity between extreme rainfall and flooding, and can assist predictions of the nature of flooding and flood risk within the continental US.