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Process-based flood frequency analysis in an agricultural watershed exhibiting nonstationary flood seasonality

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Fig. S1 shows that process-based FFA using CPC precipitation from 2002-2016 closely resembles the Stage IV-based FFA, suggesting that rainfall differences, rather than model structures, are the primary drivers of the differences in this figure. It also shows two features that result using CPC data. First, the extreme tail is underestimated, relative to the Stage IV-based simulations and the statistical approach. CPC is known to contain errors in the extreme tail, due to gage undercatch, insufficient gage density to properly sample convective rain cells, and spatial averaging of such cells over large areas, which effectively reduces peak rainfall depths. Second, CPC overestimates the magnitude of more frequent events. This is likely the result of its coarse spatial resolution, which will "smear" rainfall over larger areas (i.e. entire ~600 km^2 grid cells) when it should be more localized. This would serve to increase the likelihood of rainfall over the watershed, albeit at relatively lower depths/intensities. Thus, if one is to restrict the time period of the rainfall data to recent years (for example, the 2002-2016 time period for which Stage IV is available), then Stage IV would likely be better.

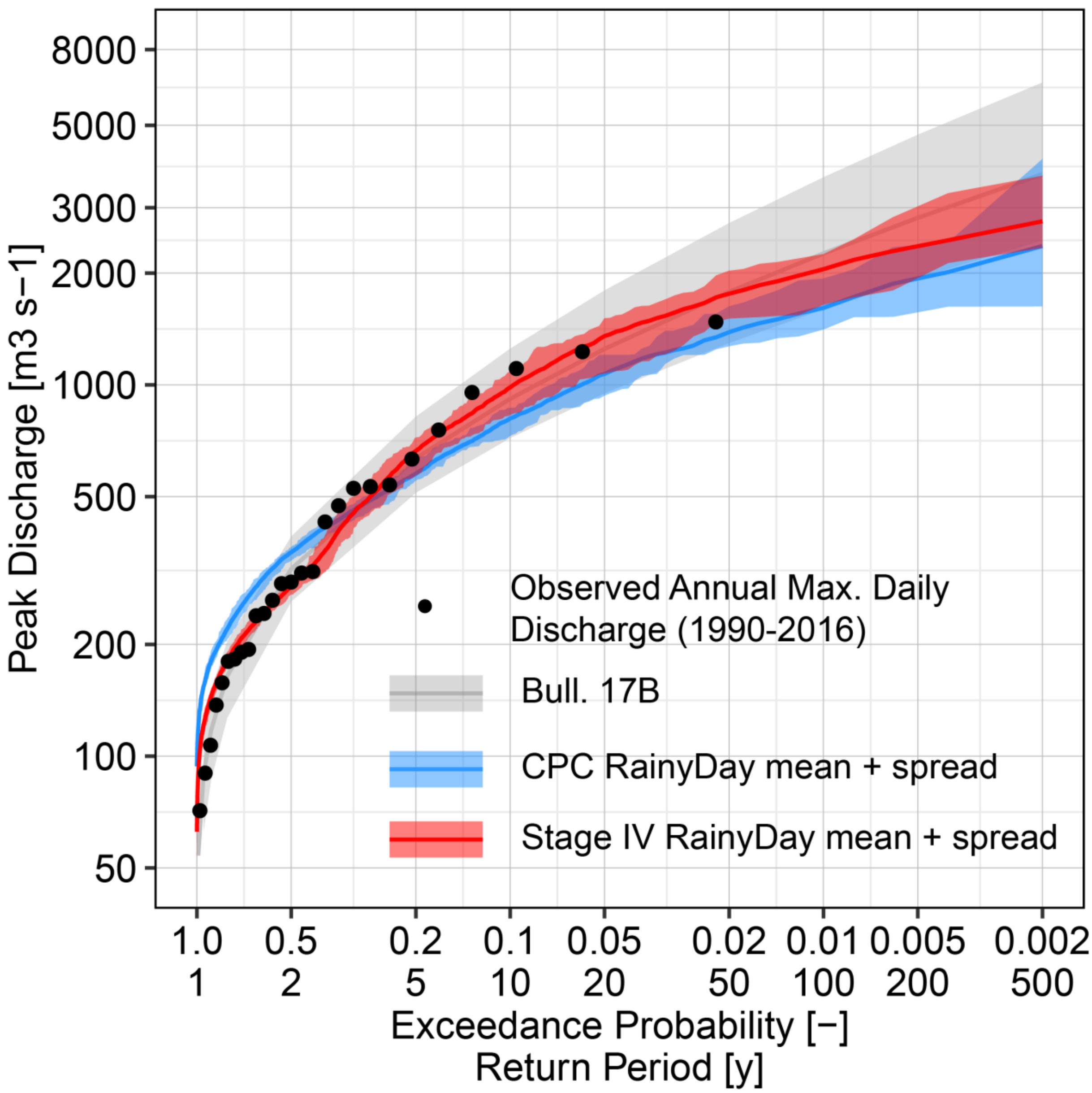

Figure S1. Three peak discharge analyses for Turkey River at Garber, IA: RainyDay with Stage IV (2002-2016) and CPC-(2002-2016) rainfall and USGS frequency analyses (1990-2016) using Bulletin 17B methods. Shaded areas denote the ensemble spread (RainyDay-based results) and the 90% confidence intervals (Bulletin 17B-based analysis), respectively. All observed annual daily streamflow maxima from 1990 to 2016 are shown in black dots.