Robert Horton’s “Rule of Hydrologic Data” (EOS, 1931): “[hydrologic analysis] is nearly always determined by the nature and extent of the data available. The best possible use should be made of all the available data... tempered according to the necessities of economy of labor.” Nonstationarity, and the wealth of new hydrologically-relevant data, suggest that we can and should revisit Horton’s rule. I first show recent work in quantifying and reducing errors in precipitation remote sensing data using a modeling framework based on censored shifted gamma distributions, an alternative formulation to the conventional Gamma distribution that can describe both precipitation occurrence and magnitude. I demonstrate that merging satellite- and numerically-based precipitation estimates using this framework can leverage the complementarity in these two data sources to reduce random errors beyond what can be achieved using standard error modeling. This merging can also be used to create probabilistic estimates of precipitation that are more accurate than either data source individually. I also argue that modern rainfall data, whether from radar, satellites, numerical models, or rain gage networks, give us new ways of exploring important and often overlooked spatiotemporal aspects of rainfall extremes and their impacts. Despite the obvious role that rainfall (and its complex variability in space and time) plays in floods, most flood frequency analyses do not make use of rainfall information at all. Trends in rainfall and flooding due to climate or land use change place further limits on existing techniques. I show how we can couple modern rainfall data with a probabilistic framework known as stochastic storm transposition (SST) to perform rainfall and flood frequency analysis at multiple scales. SST “lengthens” the rainfall record by resampling observed storms and extracting space-time information from rainfall data. I have codified the approach in RainyDay©, a platform for quickly generating large numbers of realistic probabilistic extreme rainfall scenarios. I highlight some advantages of SST and discuss the implications for understanding the nature of flood risk in a changing environment.

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