Uncertainty Analysis of Sub-daily Precipitation Extremes estimated from Satellite Datasets on a Global Scale

Lanxin Hu  
University of Connecticut, Engineering School, Civil and Environmental Engineering, Storrs, United States of America  
(yzhlx2002@gmail.com)

Precipitation extremes and associated hazards pose a significant risk to society and the economy on a global scale. Effective mitigation strategies require accurate estimates of the intensity and frequency of those extremes. Traditional approaches for precipitation frequency analysis rely on long-record from in-situ observations, which however are not available on a global scale. Satellite and reanalysis-based products provide global precipitation estimates suitable for frequency analysis due to their extensive spatial coverage. However, errors in global precipitation products lead to significant bias in the quantification of extremes and potential changes. To examine this issue, five regions (Austria, north Italy, Florida, Texas, Arizona) that include a high-density gauge network (>3 gauges/satellite pixel) are selected as references to evaluate the uncertainty in retrieving extreme value statistics based on four global precipitation products (MSWEP, IMERG, GSMaP, CMORPH). The statistical properties of extremes are based on the application of the Metastatistical Extreme Value (MEV) framework. MEV has been validated in previous studies that have demonstrated that the method is able to provide robust estimates of high quantiles from short data records. In this work we evaluate the uncertainty on the estimation of extremes focusing primarily on the dependence to a) data characteristics and b) hydroclimatic region. Additionally, we evaluate the sub-grid variability of extreme precipitation and we demonstrate the impact of spatial scale mismatch (i.e. point vs satellite pixel) on the frequency analysis of extremes. This work provides a relatively comprehensive assessment of the use of MEV for estimating precipitation extremes from globally available datasets and an understanding of the variability of sub-daily precipitation extremes at different hydroclimatic regions of the world.