Geophysical Research Abstracts
Vol. 21, EGU2019-6835, 2019
EGU General Assembly 2019

Understanding temperature dependence of global observed daily and sub-daily precipitation extremes

Haider Ali (1), Hayley Fowler (1), Elizabeth Lewis (1), and Vimal Mishra (2)

(1) Newcastle University, School of Civil Engineering, Newcastle upon Tyne, United Kingdom (haider.ali.hydo@gmail.com), (2) Civil Engineering, Indian Institute of Technology (IIT), Gandhinagar, India

Intensities and frequencies of extreme precipitation events have increased globally and are likely to rise further under the warming climate. The Clausius -Clapeyron (C-C) relationship provides a physical basis commonly used to understand the change of precipitation extremes with temperature. However, the local 'scaling' relationship can be affected by precipitation characteristics, geographical location, season, and methodology. Using global station-based observations of precipitation, near-surface air temperature (SAT), and dew point temperature (DPT), we show that the negative scaling relationship between extreme daily precipitation and SAT found over the tropics is associated with the seasonality in temperature. When using a binning technique (BT) or quantile regression (QR) not accounting for seasonality in temperature this produces a negative scaling for the majority of stations in the tropics, with higher temperatures producing smaller precipitation extremes. After removing temperature seasonality, we find that most locations show positive (median 5.2%/K) scaling with SAT and 96% of the global locations exhibit positive (median 6.1%/K) scaling with DPT. Moreover, about 33% (22%) of locations show super C-C scaling (higher than 7%/K) with DPT (SAT). Our results indicate that the impact of warming on extreme precipitation (especially over the tropics) may be higher than previously thought. The higher sensitivity of precipitation extremes to temperature will lead to more frequent flooding under the warming climate and have strong implications especially in global urban areas.
We have also made a preliminary analysis of precipitation-temperature relationships for hourly extremes for global locations to understand the differences in scaling rates from those for daily extremes.