

Citizen Science Based Rainfall Monitoring

Patterns of 2018 Monsoon Rainfall in the Kathmandu Valley, Nepal



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Main Point: Based on 6656 citizen science precipitation measurements during the 2018 monsoon, there are significant spatial variations in cumulative monthly rainfall throughout the Kathmandu Valley.

Introduction

- Precipitation is the start of the terrestrial water cycle; without it our streams, springs, and lakes would gradually disappear.
- Rainfall is the only source of water in the Kathmandu Valley (before Melamchi).
- Average annual rainfall in Kathmandu Valley (Valley) roughly 1300 mm.
- About 80 percent of the annual rainfall in the Kathmandu Valley occurs during Monsoon.
- Spatially distributed and timely accessible precipitation data is critical to understanding spatial deviations from long term average precipitation within the Valley.
- Representative local precipitation measurements are critical for local scale water resources planning.
- Objective:** To analyze spatial and temporal patterns in monthly cumulative rainfall during the 2018 Monsoon.

Methods and Materials

- Study Area:** Kathmandu Watershed
- Data Collection:** Monsoon Expedition Campaign 2018
- Number of citizen scientists (CS):** 154
- Duration:** May - September



Figure 2. S4W-Nepal CS and recycled rain gauge.

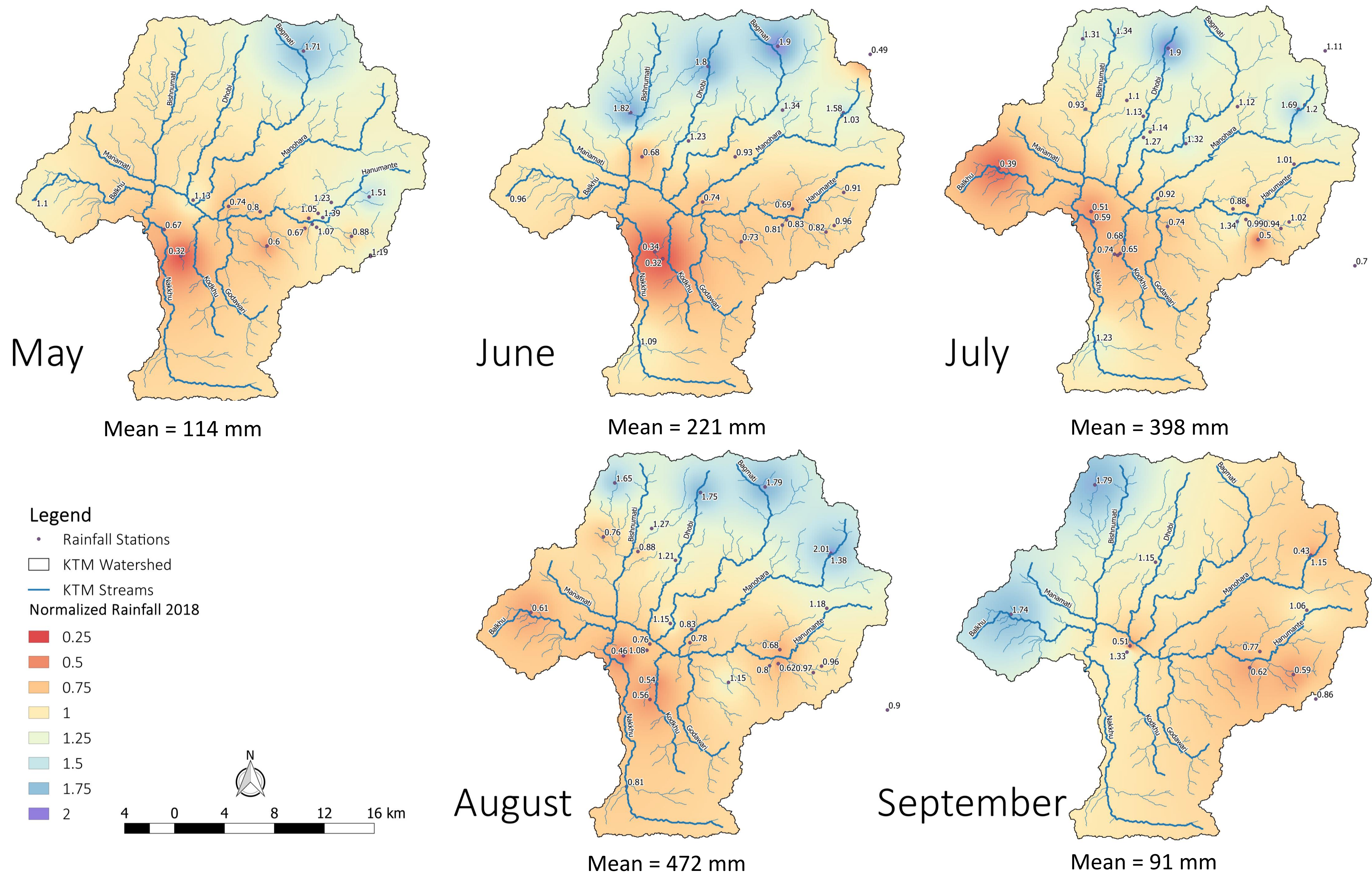


Figure 1. S4W-Nepal Monsoon Expedition 2018.

- Who?:** CS
- What?:** Cheap (< 1 USD) soda bottle gauges
- How?:** Android Open Data Kit (ODK) application
- Quality Control?:** Review all CS measurements and associated photos

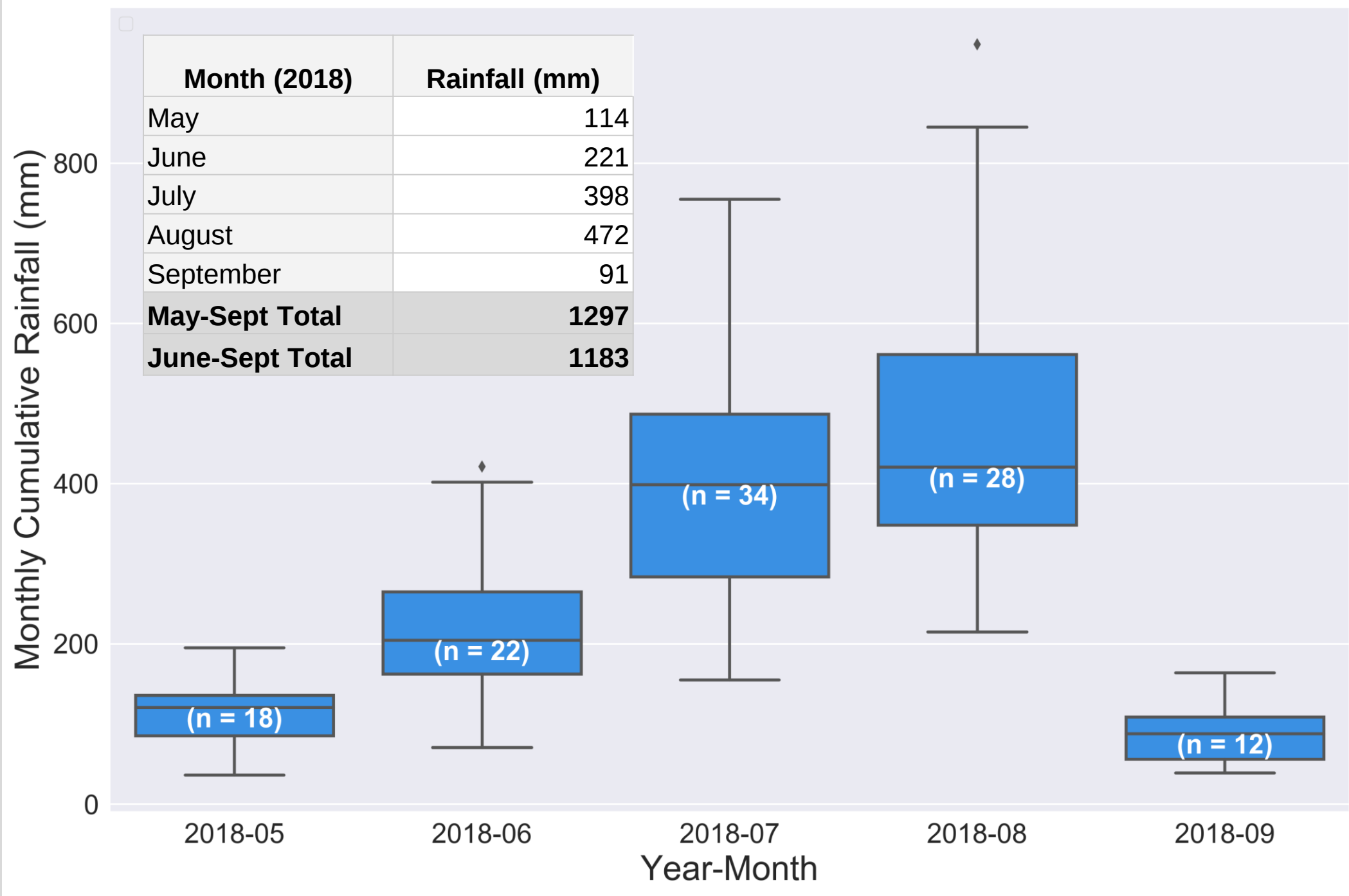
Results

Figure 3. Monthly mean normalized rainfall distribution in the Kathmandu Valley during 2018 Monsoon.



Note: Monthly maps were prepared with Quantum GIS (QGIS), an open source GIS software, by normalizing (i.e. dividing) monthly precipitation from each station by the mean precipitation from all stations for the same month. The number of stations used can be seen in Figure 4.

Figure 4. Box plot showing monthly cumulative rainfall in 2018 monsoon.



Discussion

- Significant spatial variation in cumulative monthly rainfall occurs in the Valley.
- On average, cumulative monthly rainfall was higher on mountain slopes (e.g. Nagarkot, Budhanilkantha, Okherna, Nagarjun, etc.) compared to the Valley floor.
- Windward (assuming southerly approaching storms) Northern and Eastern parts of the Valley had higher cumulative monthly rainfall compared to leeward Western and Southern slopes.
- The spatial distribution was roughly consistent from May to August, but changes in September.

Conclusions and Applications

- Significant spatial variation was observed in the amount of cumulative monthly rainfall inside the Kathmandu Valley.
- From June 1st to September 23rd, 2018, DHM reported 1080 mm for average cumulative rainfall for the Valley; S4W-Nepal's 2018 Monsoon Expedition results of 1183 mm from June 1st to September 30th compares well with this value.
- Improved understanding of the spatial and temporal variation in monsoonal rainfall in the Valley (as characterized by this study) can be used for making improved water management decisions (e.g. sizing of rainwater harvesting infrastructure) and can facilitate the design and implementation of further meteorological and hydrological studies.

Recommendations

- Additional CS should be recruited to "fill the gaps."
- Consistent CS measurements should be motivated.
- CS water monitoring can educate communities and improve awareness and responsible for their water.