

Citizen Hydrology - Tradeoffs between Traditional Continuous Approaches and Temporally Discrete Hydrologic Monitoring

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Traditional approaches to hydrologic data collection rely on permanent installations of sophisticated and relatively accurate but expensive monitoring equipment at limited numbers of sites. Consequently, the spatial coverage of the data is limited and the cost is high. Moreover, achieving adequate maintenance of the sophisticated equipment often exceeds local technical and resource capacity, and experience has shown that permanently deployed monitoring equipment is susceptible to vandalism, theft, and other hazards. Rather than using expensive, vulnerable installations at a few points, SmartPhones4Water (S4W), a form of citizen science, leverages widely available mobile technology to gather hydrologic data at many sites in a manner that is highly repeatable and scalable. The tradeoff for increased spatial resolution, however, is reduced observation frequency. As a first step towards evaluating the tradeoffs between the traditional continuous monitoring approach and emerging citizen science methods, 50 U.S. Geological Survey (USGS) streamflow gages were randomly selected from the population of roughly 350 USGS gages operated in California. Gaging station metadata and historical 15 minute flow data for the period from 01/10/2007 through 31/12/2014 were compiled for each of the selected gages. Historical 15 minute flow data were then used to develop daily, monthly, and yearly determinations of average, minimum, maximum streamflow, cumulative runoff, and streamflow distribution. These statistics were then compared to similar statistics developed from randomly selected daily and weekly spot measurements of streamflow. Cumulative runoff calculated from daily and weekly observations were within 10 percent of actual runoff calculated from 15 minute data for 75 percent and 46 percent of sites respectively. As anticipated, larger watersheds with less dynamic temporal variability compared more favorably for all statistics evaluated than smaller watersheds. Based on the results of these analyses it appears that, in certain circumstances, citizen science based observations of hydrologic data can provide sufficiently reliable information for both real-time management and water resources planning purposes. To further evaluate the merits of citizen science methodologies, S4W is launching field pilot projects in Nepal.