



Jie Liu

Jie is from Guangdong, China and earned her Bachelor degree in computer science from Southwest University in China.

From 2015 to now, she works as a graduate assistant with Prof Dev Niyogi. And she works on analysis of urbanization impact on rainfall with massive raw climate data (including radar data (NXTRAD), reanalysis data (NARR) *etc.*).



Impact of urbanization on precipitation from meta-analysis and causal discovery

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Recent decades have seen rapid urban development around the world. Many studies have already shown trends that cities can modify thunderstorms and impact the rainfall distribution in and around urban areas. However, the results from different studies are inconsistent. So, a core objective of this thesis work is conducting a systematic meta-analysis that combines the results of urban impacts on precipitation change from prior published studies. A total of 51 unique papers were identified for the quantitative assessment. Results show that rainfall is enhanced by 16% downwind, 10.8% over the city, 5.2% on the left while 6.2% on the right with respect to the prevailing storm track as per the meta-analysis. Results were further analyzed for summer vs winter, day vs night, case studies vs climatology studies, and observation vs modeling studies.

Building off these results, the second part of this thesis research explored data-driven graphical causal models to identify the relation between urban heat island (UHI) intensity and rainfall change from gridded climatological datasets. Eight different graphical causal discovery models were tested and results show a proof of concept for their use in understanding the urbanization impacts on rainfall changes. These models can be used in future studies without resorting to complex dynamic climate/weather models.

Study finding highlights that urbanization has a significant, detectable and causal impact on precipitation changes around cities.