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Using High-resolution Radar Rainfall Products to Improve City-scale Flood Models for Urban Resilience

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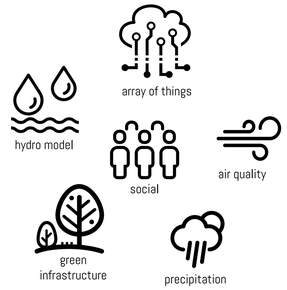
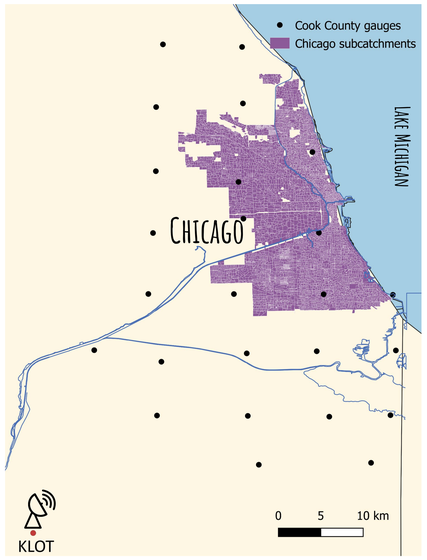
Read more about SAVEUR project!



SAVEUR will combine natural science, social science, data science, and engineering to predict extreme weather events, assess vulnerabilities in neighborhoods and cities, and propose sustainable, adaptive infrastructure changes.

1. The challenge:

How can we improve resiliency-focused infrastructure design in Chicago neighborhoods?
Will using high-resolution precipitation data from radars improve representation of rainfall estimates over the urban catchments?



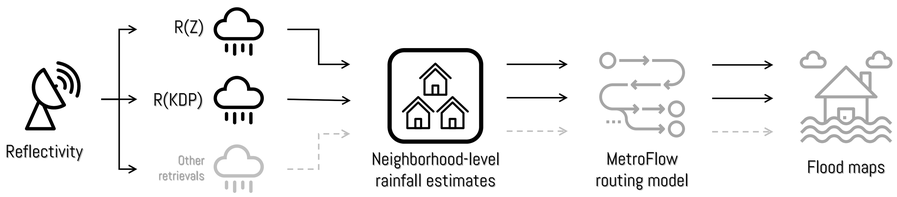
2. The current state:

Management decisions for a 600 km^2 metropolitan area are made based on precipitation data from just **12 gauge sites**

3. The proposed first step:

3.1 Using high-resolution radar-derived precipitation data

- Proximity of the NEXRAD KLOT radar to Chicago allows us to improve the spatial resolution of rainfall estimates to 500m, which will be used to produce **neighborhood-scale rainfall hindcasts**
- Dual-polarimetric radar-rainfall retrieval methods are tested: R(Z), R(KDP) using out-of-the-box coefficients
- Improve understanding of water flow using city-scale flood models (MetroFlow)



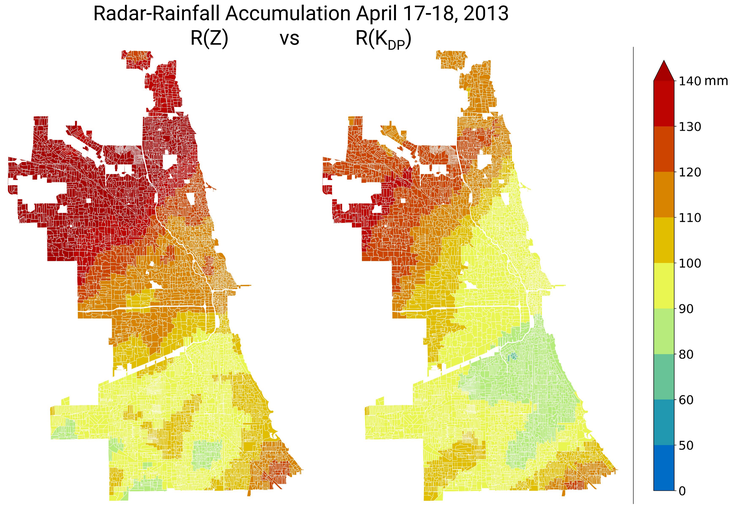
4. The next steps:

- Additional quality control for radar data
- Validate rainfall-radar estimates (consider other precipitation sources)
- Input catchment-level precipitation estimates to an urban hydrological-hydraulic model (MetroFlow)
- Investigate sensitivity of hydrological model to spatial and temporal resolution of rainfall products
- Data and codes will be made publicly available for potential application of SAVEUR approach to other cities

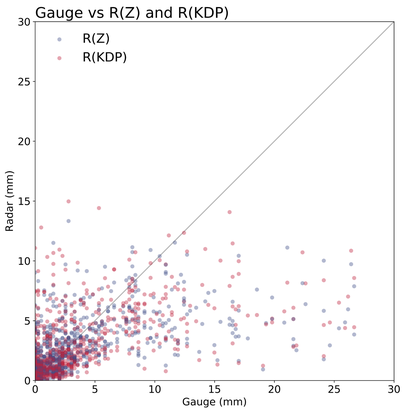
3.2 Case study: April 2013 floods in Chicago

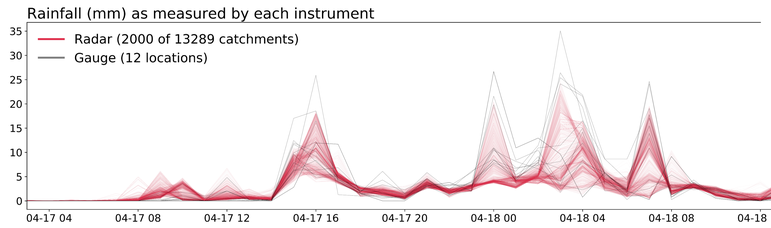
- April 17-18, 2013: slow moving storm across Midwest
- Record-breaking 7 inches rain (~180mm rain in 2 days)
- Cook county declared state of emergency; widespread road closures

Radar-Rainfall Accumulation April 17-18, 2013
R(Z) vs R(K_{DP})



- High resolution radar data captures the high gradient rainfall distribution in the metropolitan area
- Rainfall accumulations differ between rainfall-retrieval methods--- **Which one will be the best input in the hydrological model?**





- Radar captures the temporal signature of the rainfall event, but not quite yet the magnitude
- Radar detects low-intensity rainfall as well as the gauges, higher rain intensities can be improved
- Catchment-level radar estimates capture and represent high-gradient of precipitation better than gauges

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