Natural Hazards and Earth System Sciences Discussions

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Comment on nhess-2022-77

Anonymous Referee #1

Referee comment on "Estimating the likelihood of roadway pluvial flood based on crowdsourced traffic data and depression-based DEM analysis" by Arefeh Safaei-Moghadam et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-77-RC1, 2022

The authors developed a statistical model to predict the frequency of pluvial flash flooding (PFF) based on topography, rainfall, road class, and crowd sourced flood observations from the Waze app. The team tested two competing models, Empirical Bayes and Random Forrest on roadways in Dallas, Texas, U.S. and found that Empirical Bayes to perform best in this context. The paper makes an important contribution to advancing our understanding of pluvial flooding by both introducing a new data source for a data poor phenomenon and by developing a model uses readily available information to estimate pluvial flood risk. I have several comments and questions, that if addressed would strengthen the paper. The paper would be of interest to the readers or NHESS and with revisions would be well suited for publication.

Comments

- In Section 2.1.1 the authors describe the process for extracting depressions. This is an important and challenging step given the heterogeneity of the urban environment and noise present in high resolution DEM's. The authors manually identify the smallest meaningful flood prone depression. Can you elaborate on the heuristics used to make this choice? For example, if a researcher were to repeat this process in another city, how would you guide them? Also is there any potential to automate this step in the future by perhaps brining in other spatial information such as shape files of roadways?
- On line 193 the authors mention that several individuals made assessments of which flood alerts to assign to which depressions. Please elaborate on this process. Did these several individuals making the determination together? Or did these individuals make their assessment separately? If it was the later, how much agreement was there between assessments and how did the research team make the final determination? Was this process followed for all 4,996 Waze alerts in the Dallas case?
- In the EB model, how was the weighting factor, w, determined? Is w also a calibrated parameter?

- In section 2.1.4 of the methodology it was not clear how were three precipitation categories selected. The authors mention agglomerative clustering but not what selection criteria was used. The criteria is mentioned in the Case study pre-processing section, but I recommend moving it up to the methods section.
- In the discussion section, please include a discussion of the limitations of the data sets and models presented.

Minor Comments

- Line 40, in addition to speed limits when driving through water, full loss of control is also possible. "As little as one foot of water can move most cars off the road." NWS 2011.
- In preprocessing the Waze data (Section 2.1.5), is there information on direction of travel? If so, is that information used to constrain the possible flooded locations?
- In Figure 1, why does the last bullet point of the central section read "Alerts/depressions." Please clarify.
- In Table 2, in the Count of Flooding column, should j = moderate and severe for the 2nd and 3rd row respectively? If not, what does light refer to?
- Figure 6: It is hard for the viewer to make accurate comparisons between pie charts (see Helsel et al. 2020). I suggest replacing this figure with a bar graph. Additionally, the font sizes vary notable between Fig 6a and 6b.
- A sentence in the text could substitute for Table 5.
- Add the results for the RF model to Table 6 as well for comparison.
- Figure 16: include numeric probabilities associated with high, moderate, etc. flooding on the figure or in the caption.

References

Helsel, D. R., Hirsch, R. M., Ryberg, K. R., Archfield, S. A., & Gilroy, E. J. (2020). Statistical methods in water resources: US Geological Survey Techniques and Methods. **Chapter 16. Presentation Graphics.** *US Geological Survey: Reston, VA, USA*, 458.

NWS. (2021). Flood Safety Rules. NOAA's National Weather Service. https://www.weather.gov/mlb/flashflood_rules