

Interactive comment on “Towards Measuring Resilience of Flood Prone Communities: A Conceptual Framework” by Victor O. Oladokun and Burrell E. Montz

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REVIEWER’s COMMENT –Section 1 This manuscript contributes to broad research field on community resilience and aims to develop framework on measuring resilience. After examining and discussing the challenges of different definition and concepts in this context, the authors presented a conceptual and mathematical model as well as applied a fuzzy logic approach to generate a resilience index, which was applied in three flood-prone communities in the US (North Carolina and Virginia). AUTHORS’ RESPONSE to REVIEWER COMMENT –Section 1 Comments reflect the broad scope of the paper

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REVIEWER's COMMENT –Section 2a The manuscript is in general well written but the structure and the different level of information provided in the sections challenge the reader to follow the argumentation of authors and relate the different parts of the framework. AUTHORS' RESPONSE to REVIEWER COMMENT –Section 2a We have noted this useful observation. We shall improve on the structure and level of information to enhance overall flow of our argument and readability by the target audience

REVIEWER's COMMENT –Section 2b For example, the introduction provides a selected overview on the topic and challenges of community resilience and different frameworks to measure resilience. However, the focus is on different definition of resilience and not on the differences in approaches to measure resilience, which are only mentioned but not explain. I see here a high potential to reduce the definition discussion and provide more details on measuring resilience. AUTHORS' RESPONSE to REVIEWER COMMENT –Section 2b We appreciate the need to beef up discussions on existing measuring approaches as well as their differences. We will therefore include further discussions and literature on the differences in measuring approaches. However, it may be helpful to retain our current discussion on definitions with slight modifications that relate to differences in measuring approaches. The revision will explore this.

REVIEWER's COMMENT –Section 3 Moreover, I suggest to present also a clear objective for the study, which would help to follow the structure of the manuscript. Perhaps a flow chart showing the interrelation of the different models would also increase the understanding of the chosen structure. AUTHORS' RESPONSE to REVIEWER COMMENT –Section 3 These suggestions are noted. We will include a clear objective as well as explore the inclusion of a flowchart.

REVIEWER's COMMENT –Section 4a Furthermore, in the design of the model (also including Fig. 1) it is not very well explained why resilience leads than to recovery, as one part of resilience would be 'how the community is able to recover?' and thus this parameter should contribute to measure resilience. AUTHORS' RESPONSE to



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REVIEWER COMMENT –Section 4a We appreciate the need to improve the clarity of Figure 1, firstly by using a two-way arrow arc to depict the interaction between resilience and recovery and secondly by enhancing the explanation of the figure with respect to the proposed model. It should be noted that this reviewer's comment underpins our argument about how the absence of consensus on definition leads to divergent interpretations of the interactions among the components of the resilience system. According to Cutter, Barnes, Berry, & Burton (2008), multiple definitions of resilience exist within the literature, with no broadly accepted single definition. Our schematic model recognizes that resilience enhances recovery or that recovery is an outcome of resilience whereby when a community, as a coupled system, becomes more resilient its capacity to experience post disaster recovery increases. In other words, recovery, in terms of the time taken to attain post disaster recovery and the degree of recovery attained are influenced by the resilience. This understanding is supported by the DROP resilience model as illustrated in Cutter, Barnes, Berry, & Burton (2008). Thus, our model implicitly suggests that recovery (recovery time or quality) can be a substitute for resilience. This is reasonable because post disaster recovery is driven by factors that characterize resilience

REVIEWER's COMMENT –Section 4b The authors illustrated in section 2.5 some extreme cases and showed the gained insights to model structure, however it also shows the limitation of the model regarding dynamical change, e.g. if you consider in case 1 that you have no efficiency in the resource utilization processes = no resilience, then your model ignores any preparedness and coping capacity. I would agree on a long term but you measuring only in static manner, thus should not there be a difference of communities with different hazard absorbing capacity? AUTHORS' RESPONSE to REVIEWER COMMENT –Section 4b The model does not ignore preparedness and coping capacity. Rather the 'extreme' scenarios were used so as to demonstrate the nature of the model's 3 consolidated dimensions of Hazard absorbing capacity, Resource use processes, and Resource availability. Note that from Table 3, these 3 main dimensions are each functions of several resilience factors. For instance, preparedness



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is one the factors or components of the resource use system (or process efficiency or community governance processes) simply termed efficiency, while coping capacity is one of the factors captured in the dimension of Hazard absorbing capacity. This will be made clearer in the revision

REVIEWER's COMMENT –Section 5 The authors are also encourage to provide more thoughts about their assumption of that 'negative' resilience is another expression of vulnerability. **AUTHORS' RESPONSE to REVIEWER COMMENT –Section 5** We note this observation and therefore adopt a clearer expression to avoid misinterpretation. The idea being conveyed is that the bulk of the 'resilience area' lies in the low (negative) quadrant when the hazard absorbing (Coping) and governance process/resource use efficiency deteriorate. Note that the absorbing capacity encompasses social, infrastructural, technical, and psychological factors that determine system's vulnerability. This will be made clearer in the paper.

REVIEWER's COMMENT –Section 6 The structure of section 3 is confusing because in the beginning it is not clear why the fuzzy logic is addressed and how it is related to the previous sections. Furthermore, from 3.2. onwards more detailed information on chosen criteria for selecting variables, number of rules, type of membership functions, weights : : : are needed. Currently, in this section a lot of questions arise, but I see a high potential to improve the whole manuscript if you revise this section (see detailed remarks in the attached file). **AUTHORS' RESPONSE to REVIEWER COMMENT –Section 6** After developing a mathematical model, the next logical step is model analysis or solution method. We have adopted the fuzzy inference system as the mathematical/computational tool for analyzing the resulting model. The objective section is to develop the fuzzy inference equivalent of the model. We will deal with need for more detailed information by providing further references on the criteria and also shed light on some of the questions.

REVIEWER's COMMENT –Section 7 In general the application in case study is only a very vague description and it is not clear on which assumption you based your hy-



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pothetical input score. AUTHORS' RESPONSE to REVIEWER COMMENT –Section 7 The data we used were actual real life data. Maybe the phrase 'hypothetical input score' may not have been the best to use. Our sample application was based on the outcome of field study, reflective interactions with experts, and stakeholders familiar with the study locations. Our sample scoring was therefore based on our interactions with these various stakeholders, which include academics, community leaders, and our understanding of their opinions, as well as the data extracted from various historical records. For instance, at Windsor during a planners' conference that brought together academics, officers from state and federal agencies dealing with emergency management, community leaders, and officers of the towns, we gained useful insights on flood resilience activities. Similarly, the authors visited Norfolk VA and took a tour of the city under the guide of GIS experts from one of the local universities. These interactions and associated field study were used to generate the sample scoring.

REVIEWER's COMMENT –Section 8 I also would see an added value - if you stay with hypothetical inputs - to gain more insights on the sensitive of your model with systematically testing of different input data but also on the rule setting and membership functions. The added-value would be a better understanding of model. The discussion and conclusion is very generic and needs to be rewritten regarding the points highlighted in the introduction, the (missing) objectives and the gained insights. I indicated different ways how the authors may restructure and rewrite the manuscript to show the added value of this study to the readers and scientific community. See detailed comments in the attached file. AUTHORS' RESPONSE to REVIEWER COMMENT –Section 8 These observations are noted, and efforts will be made to improve the discussion

Please also note the supplement to this comment: <https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-217/nhess-2018-217- RC2-supplement.pdf> Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2018-217, 2018>.

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