

## ***Interactive comment on “Measuring county resilience after the 2008 Wenchuan earthquake” by X. Li et al.***

### **Anonymous Referee #2**

Received and published: 6 March 2015

This paper examines earthquake resilience of counties significantly impacted by the 2008 Wenchuan Earthquake. Through application of the RIM model, this paper aims to measure and validate disaster resilience within this study region. The paper addresses an important topic in the hazards and disasters field and may be of interest to scholars studying in this area. However, the claims that the authors have developed a valid and theoretically sound metric of disaster resilience and have subsequently validated this model may be somewhat overstated. Below are my specific comments that I hope will aid in improving this manuscript.

Introduction: Page 82 Lines 25 through Page 83 Line 2: Citation Needed.

Page 83 Line 10-11. You note that “. . . few convincing approaches measured resilience

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quantitatively and with validation.” Please provide some description either here or in the literature review of some of these studies that have been successful in doing this.

Pages 84 and 85. It is unclear why you are emphasizing indicators of vulnerability as opposed to those utilized in the examination of disaster resilience. Why discuss SOVI when Cutter et al. propose the DROP Model for measuring disaster resilience? Page 88 Lines 22-24 – need to cite your sources.

Page 89 Lines 11-14: Citation needed.

Page 91 – Footnote: Should read: 1”Without special note, Lixian County is the one which is located in Sichuan Province.”

Section 2 Lines 17-20. You need a citation at the end of this sentence.

Related Work: There needs to be a more thorough discussion of the research that has been done examining disaster resilience. While the limitations of the previous studies are emphasized in this section, more attention should be placed on the work that has been done and how it guides your study. In particular, since your study focuses on using sociodemographic variables to measure disaster resilience, work done in this area should be adequately discussed.

Somewhere in the paper (either in the Related Work or Methods section) there needs to be a general discussion of model validation. For example : What does validation mean in the context of your paper and in the context of examining disaster resilience? Are you doing internal or external validation? What are the pros and cons to these approaches?

You need to provide some background acknowledging other studies that have been conducted on issues pertaining to the validation of vulnerability and resilience models. I recommend looking at these papers as a starting point: Tate, E. (2012). Social vulnerability indices: a comparative assessment using uncertainty and sensitivity analysis. *Natural Hazards*, 63(2), 325-347. Fekete, A. (2009). Validation of a social vulnerabil-

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ity index in context to river-floods in Germany. *Natural Hazards and Earth System Sciences.*, 9, 393-403.

Methods: It is unclear why the variables noted in Table 2 were selected for inclusion in your resilience model. What guided the selection of these variables? You need to provide justification as to why these variables are appropriate for examining and measuring disaster resilience in China. This information should be included in the literature review section. You do note that some of these variables are mentioned in Cutter et al.'s 2010 paper, however are indicators used in the US appropriate for studies of a different county? Or are specific modifications need to be made in order to best reflect the Chinese culture?

How do the identified sociodemographic variables influence (e.g. increase or decrease) resilience? For example, do you hypothesize that a higher percentage of population in urban areas increases or decreases disaster resilience? Please note how you expect these variables to influence resilience in your model.

The disaster resilience model for this study only examines one dimension of disaster resilience: the socioeconomic dimension. It may be helpful to examine other dimensions identified in the literature (see DROP model) in order to get a more holistic representation of disaster resilience in your study area.

The RIM Model: As noted in the manuscript, the RIM model accounts for exposure, damage, and recovery. The technical aspects of how the analysis was conducted were adequately described, however, further discussion needs to be provided as to how and why the indicators representing exposure, damage, and recovery were selected. It seems problematic that the damage dimension is only reflected by economic losses, when there are many different kinds of losses (social, long-term economic, short-term economic, structural, environmental, etc.) that result from disaster. Similarly, the use of population growth as the sole indicator of recovery is also problematic, and many different indicators of recovery have been identified in the disaster literature. I am

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curious as to how sensitive the model validation process is to the selection of these variables. If you switched out an indicator or added more, how much would your model change? For example, if you substituted GDP growth for population, would you get similar results?

Are there any limitations of using population data from 2002 and 2011? Why not use 2007 or 2008 data for pre-event population? Why did you select 2011 to reflect post event population? Was there a significant change in population between 2002 and the earthquake? To what extent did fatalities influence population, especially in the areas highlighted as having a largest population decreases? Also, if 2002 population data was selected because data was not available for years closer to 2008, how do you think this impacts your model?

Do you happen to know what percentage of the population left the counties near the epicenter and migrated to neighboring counties following the event? Since recovery was measured by population change, I wonder if this partially explains why your model indicated that resilience in the epicenter counties was low, resilience increased in the neighboring counties, and then decrease as distance from the epicenter increased.

Figure 3: It is difficult to find the epicenter on this map. Please make the symbol larger and / or a different color.

Overall, the maps are well done and informative.

Discussion Discussion / Conclusion – There is no discussion of limitations in this model and only one recommendation for future research is provided. Please expand on these.

Page 98 Lines 20 and 21. You note that “Counties that were farther away from the epicenter returned to the normal level of resilience.” What is implied by “normal resilience”? Did you intend to say that counties further away from the epicenter recovered more quickly? Resilience and recovery are not synonymous.

One of your findings is that the counties near and adjacent to the epicenter had the

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lowest resilience values (sections 4.2 and 5.1). Was this a result of pre-event conditions (such as sociodemographic characteristics) that made the counties less resilient? Or is the model showing that these counties were less resilient as a result of their proximity to the epicenter?

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 81, 2015.

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