

Interactive comment on “Review Article: A review and critical analysis of the efforts towards urban flood reduction in the Lagos region of Nigeria” by U. C. Nkwunonwo et al.

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Thank you for the invaluable time you put into this review. Your comments and critical observations are most helpful. I hope they will prove fundamental to improving the quality and readability of this article. Please find below the comments and amendments in relation to the points raised:

1. “Flood risk is the combination of hazard, vulnerability and exposure. The abstract creates the expectation that these three components are separately considered.”

The definition of risk as a function of hazard, exposure and vulnerability by Crichton

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(1999) is fundamental, but risk as a function of hazard and vulnerability is more widely used (Giuliani & Peduzzi, 2011; Schmidt et al., 2011). However, no consensus has been reached at an ideal risk definition within natural hazards framework. The presentation of flood risk in this study was not actually on the basis on any defined risk framework. Rather, a general view of what has been since done to manage urban flood risk in Lagos area was identified. For example previous works on hazard and vulnerability assessment were identified. Although exposure component was not explicitly investigated, land use and land cover (LU/LC) modifications driven by anthropogenic activities particularly public and private sectors investment decisions were implied.

However, this is an important observation, which will give a completeness to the abstract in particular and the study in general. As a result, the abstract will be rewritten similar to below:

Abstract

Urban flooding has been and will continue to be a significant problem for many cities across the developed and developing world. Crucial to the amelioration of the effects of these floods is the need to develop a knowledge base of the magnitude and frequency of these floods. Within the area of flood research, attempts are being made to gain a better understanding of the causes, impacts and pattern of urban flooding. This is an aid to reducing the severity of the hazard, exposure and vulnerabilities of environmental systems. This research reviews flood risk within the Lagos area of Nigeria over the period 1968-2012. During this period, floods have caused harm to millions of people physically, emotionally and economically. Arguably over this period the efforts of stakeholders to address the challenges appear to have been limited by, among other things, lack of reliable data, lack of awareness among the population affected, and lack of knowledge of flood risk mitigation. It is the aim of this research to assess the current understanding of flood risk and management in Lagos and to offer recommendations towards future guidance.

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2. "Which areas did you finally identify? It is not clear reading the last sections."

The real meaning of the sentence was undermined by lack of clarity. Actually, what the authors meant here was to suggest measures for possible improvements. The statement is now reworded:

This study in general and the recommendations in particular are driven by three key aims: firstly, to understand the unique situation which exists in Lagos in relation to flooding; secondly, to align the focus of flood risk reduction in the Lagos area with that of more developed countries such as the US, the Netherlands and United Kingdom; and finally, to suggest measures for possible improvements.

3. "Preparedness, spatial planning and land management do not affect hazard. See also the general comment."

Yes the factors do not affect the hazard in terms of increasing the severity. However, addressing them, which is what is intended in the statement, will go a long way to mitigate the impacts of the hazard. The statement is now reworded:

In relation to possible hazard mitigation and adaption responses, researchers have suggested several options. Adededeji et al. (2012) highlighted the importance of building the capacity for flood preparedness through spatial planning and land management . . .

4. "LiDAR (Light Detection and Resolution)"

It is a typographic error. Corrected to LiDAR (Light Detection and Ranging)

5. "Who is then using the data?"

Your comment which suggests that the side of the story reflecting on who uses the data is well conceived. Truth is that the data are available for public use, but at a cost. The authors intend to say because the data are sold, their uses are limited. May be the statement is better put this way:

Since these dataset are mainly vended, the poor access of researchers to them ar-

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guably undermines their usefulness.

6. "Do you mean those areas have higher hazard levels, higher potential consequences or both?"

This is an important observation which if data had been available, providing answers will be easy. But what is meant here is that those places have more frequent floods. The statement is like:

According to previous studies flood threats in Lagos are more frequent for Lagos Island, Apapa, Ikeja, Mushin, Surulere and parts of Ikorodu (Oyebande 1974, Odunuga 2008).

7. "Since you have the list of flood events and affected areas, would it be possible to couple them with population density map in order to qualitatively identify risk levels?"

This is really a fascinating idea, although the authors initially it would imply a different research direction altogether since the data available on flood incidence are at very low scales. However, the map (figure attached)below is an attempt to conceptualise the idea. It shows that Ajeromi-Ifeledun and Mushin LGAs are at higher of flood risk than the rest of the LGAs. A recommendation for future work will be to improve the accuracy of this map.

8. "This is the so called resilience."

Not sure what is implied here. Actually, the lack of coping capacity means there is no resilience.

9. "Hydrometry?"

It is a typographic error. Corrected to hydrology

10. "It seems that the challenges in reducing flood risk impact are introduced in section 4."

Well observed. Although the authors were simply restating the main focus of the study,

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it appears the statement does not fit in. Would saying something it differently make sense? Something like: The present study discusses the challenges faced by Lagos in managing and reducing flood risk impacts. . .

11. "I would appreciate a deeper discussion about these 5 mitigation measures. Are they effective, feasible, already done? Are they respecting human/social rights?"

It makes a good discussion to talk about this. First, these measures are practicable and are in place, but they are not effective, since they cannot deliver the major objectives of flood risk management. Therefore this study is aimed at pinpointing those limitations and recommending better options. Bearing this mind, some studies such as those of Ahonshi (2002), Kamunyor (2007) and Basinski, (2009) cited in Lawanson (2015) argued that the achievement of government's urban sustainability goals in Lagos are often without regards to the needs of the poor residents. The authors substantiated their claim using 'institutional hostility', which poor residents are repeatedly faced with. These include threats of eviction from their homes which are mostly informal settlements and slums. Their means of livelihood, although unconventional because they have not being recognized by authorities, are termed illegal. These issues have received little attention.

12. "Resolution? Resolution of LiDAR surveys is important information for flood modellers. Also with high resolution there are many issues related to the huge area you are considering. Why not using open available world DEM (such as SRTM)?"

Resolution of spatial data such as DEM / DTM is a very crucial factor in flood modelling and flood risk assessment. The use global datasets such as ASTERDEM and SRTM for assessing urban risk does not provide realistic results because of the scale of urban features which significantly contribute to water flow. Flood modelling research is still looking into possible ways of simulating accurate flood variables on the basis of low scale global datasets.

13. "It would be interesting to understand the development in time of environmental

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laws related to floods (maybe through a table?)"

We totally agree with you. It will really be interesting, but no such detailed data are available. However, the federal government of Nigeria has since the First, Second and Third National Development Plans of 1962-68, 1970-74 and 1975-80 respectively initiated plans for management of all disasters including flooding. This was through the federal and state ministries of works. On the basis of flooding and associated hazards, the primary aim of these initiatives was to create awareness among the citizenry and to develop sound response strategies. This development has evolved to the present time in what is now known as institutional approaches to managing disaster. Since the main focus of the study is not purely about the structure or specific functions of these agencies, as pointed out by another reviewer, this part of the discussion may be de-emphasized.

14. "Hydrological analysis is a key step for flood risk and flood hazard mapping. Are the data provided by NIHSA covering an adequate number of years? Are they well distributed in space? Please discuss."

Indeed, hydrological analysis is a key step for flood risk and flood hazard mapping. To the best of the authors' knowledge, the data provided by NIHSA are not sufficient to meet the requirements for mapping purposes. Inflow and outflow discharge, runoff hydrograph and stage information are not readily provided.

15. "Please clarify."

Whilst it is unreasonable to claim that the weakness of these flood mitigation measures probably leads to more frequent flooding in the area, the fact that such measures have not improved Lagos with regards to the idea of "living with floods" is fundamental.

References

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Schmidt, J., Matcham, I., Reese, S., King, A., Bell, R., Henderson, R. ... & Heron, D. (2011). Quantitative multi-risk analysis for natural hazards: a framework for multi-risk modelling. *Natural Hazards*, 58(3), 1169-1192.

Please also note the supplement to this comment:

<http://www.nat-hazards-earth-syst-sci-discuss.net/3/C2054/2015/nhessd-3-C2054-2015-supplement.pdf>

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 3897, 2015.

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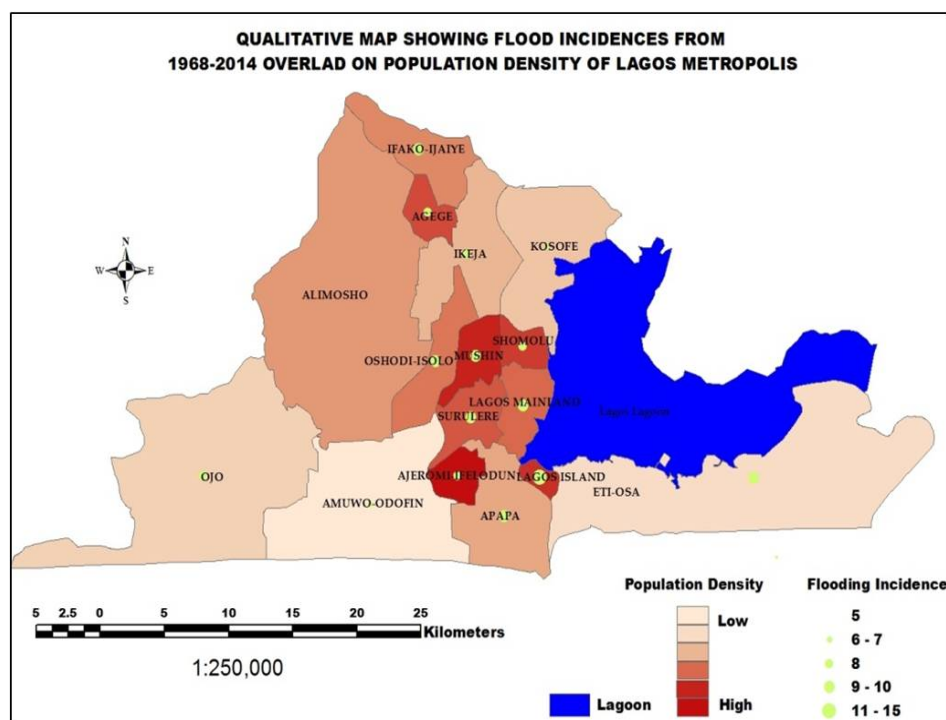


Fig. 1.

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