Hydrology and Earth System Sciences Discussions

Interactive comment on "Reconstructing the tropical storm Ketsana flood event in Marikina River, Philippines" *by* C. C. Abon et al.

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RESPONSES TO COMMENTS OF REFEREE#2 TO THE PAPER
"RECONSTRUCTING THE TROPICAL STORM KETSANA FLOOD
EVENT IN MARIKINA RIVER, PHILIPPINES"

General comments

We thank the reviewer for reading our manuscript thoroughly and for the constructive

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comments about the text. We have revised the manuscript following all receive corrections and comments:

Specific comments

Introduction
The introduction doesn't flow well: at present the argument is structured as follows: "1) There was a large event that resulted in unprecedented flooding; 2) This is the Marikina River Basin; 3) Here is the climate of the Manila Region, 4) Flood warning systems are missing".Can you restructure this to make a clearer argument, and in particular to motivate particular questions or hypotheses for this study? For instance: 1) There was a large event that resulted in major flooding 2) A major factor in the destructiveness of the flood was the lack of a warning system 3) Here are the things we would need to do to generate such a warning system, and here is how we can learn from the TS Ketsana experience. You could then move details of the basins and climates to the Methods under a new heading such as: "Basin Characteristics" or similar.

RESPONSE: We have accepted this suggestion and we have moved the Basin Characteristics to the methodology.

Methodologies
The survey used to determine people's ideas about the flooding is a novel methodology and needs to be linked to literature about similar methods. I am not familiar with the use of such interview techniques for flood reconstruction elsewhere, but similar participant-centred research approaches

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are used in many contexts and the authors should attempt to contextualize their method by reference to such literature. This would also give a sense of whether 5 respondents per station is enough to give robust information.

RESPONSE: This type of methodology is indeed novel, especially when it comes to hydrologic studies. And we have not found any available material that will support the validity of this method. We however added a satellite image from Phased Array type L-band Synthetic Aperture Radar (PALSAR) showing the portion of the Marikina River that have swollen and the time when it was taken (Fig. 1). This image was taken at 14:35 where it showed. This image supports somehow the information from the interviewed residents about the time of the flood.

Basin and sub-basin delineation
The vast majority of this section is highly redundant. HESS readers are aware of DEMs and their importance to hydrological modeling. Rather than providing 2 paragraphs of background, please provide more detail on how you processed the STRM data to generate the basin boundaries.

RESPONSE:We have removed sentences that are redundant and we have provided a detailed description on how we processed the SRTM to generate the basin boundaries.

What uncertainties or errors might remain?

RESPONSE: ILWIS cannot delineate basins in the low elevation areas (floodplains), we have to do the manual delineation in GIS using the SRTM digital terrain image. SRTM has a limited resolution, and therefore the floodplains will appear to be flat. Although we have the topographic maps to augment the manual delineation, there will still be uncertainties on the exact location of the divide. Although this is only for the floodplain (minor portion of the entire basin) because most of the Marikina Basin area is part of the Sierra Madre Mountain ranges, therefore have high relief and can be delineated accurately by the ILWIS software.

Do these data conform to ground truthed situations (or even local knowledge of where the watershed divides are likely to be?).

RESPONSE:These watershed divides conform to ground truth stations as verified from the topographic maps at hand. Moreover the delineations also coincide with all other ground delineations of previous works.

What were the "necessary adjustments" to the basins performed in ArcView that were not sufficiently clear from the ILWIS processing? What are the implications of any errors made in this step for the simulations made down the track?

RESPONSE: ILWIS processing delineates the watershed boundaries by locating the topographic highs in an input digital elevation data. The capability of this software works well in elevated regions, but fails to delineate the divides in low elevation areas such as in floodplains. Its delineation is also very fine that more than 400 sub-basins

were derived. For the purpose of the study, this number will be too cumbersome and these small sub-basins associated with one another can be merged without compromising the accuracy of the results of the model. There could be errors especially on the delineation of watershed divides in the floodplain, but these errors do not make significant contributions to the overall results of the model.

> HEC-HMS
> Again, don't include unnecessary background. For instance, given that you chose to use the SCS-CN loss method, why bother listing all the other potential loss methods you did not choose to use? Instead it would be better to defend this choice of loss method (presumably including the lack of soil data for the watersheds that could be used for a more mechanistic treatment of runoff generation)? You should however specify that the chosen curve number is determined by the land use, so that the link into the final paragraph in this section is clearer.

RESPONSE: We agree to this. And we have removed the lines that mention the other methods that we did not use and we focused on the SCS-CN instead. We did use the soil type along with the land use to calculate for the CN of each sub-basin as stated in p 6087 line 2. However it was mentioned to be Type II soil condition instead of soil group. We therefore added a discussion on the soil group that we used and our basis on why we used this soil group in calculating the CN.

> Interviews and Fieldwork
> I would be cautious about saying that the consistency between interviewed subjects "proves" anything–everyone could be systematically making the same error for instance! Tone down the language.

RESPONSE: We accept this suggestion and we have used the word "supports" to replace the word proves. The new statement is: This supports the accuracy of the first-hand accounts of flood characteristics.

>   Given the differences in the timing of the flood peak did you attempt to assess the velocity of the flood wave? Or were there multiple flood waves? What were the features of sites where high flood stages were reported from interview?

RESPONSE: We do have estimates of the velocity of the flood wave but we did not include it in the discussion as we are after presenting the discharge and the timing, although we can also include it in the discussion if it will make the accounts clearer. There was only one flood wave.

>   What were the features of sites where high flood stages were reported from interview?

RESPONSE: The sites that registered high flood heights were those close to the river and where the river has low banks. Some areas are also narrow that the flood waters even reached up to the 10 m high (from the ground) bridge.

>   HEC-HMS model results
>   What other sources of floodwater are there that could have generated the discrepancies you saw?

RESPONSE:The discrepancies would have come from the clogged canals that eventually broke and the water eventually flowed to the river. But all these floodwaters came from the rainfall and only got delayed due to these clogs.

Can you determine to what extent the downstream errors are associated with these other water sources versus back-water effects due to floodplain characteristics?

RESPONSE: We have not actually done a study correlating these other water sources with the downstream errors as well as with the back-water effects. We think it might be done in a different study.

Flood mapping
Given the model for the basin and the aims of the study, I would really like to see one additional element in this study: namely a synthetic approach that could be used to determine levels of flood risk in space and time. If, for instance, you forced your model with rainfall corresponding to the 1 year, 2 year, 5 year, 10 year, 50 year and 100 year storms, what sorts of predictions could you make about peak discharge, peak flood stage, which areas in the floodplain would become inundated, and how long you would have to employ warning systems? Including this final piece of the study would move from analyzing one event to developing a preliminary indication of high risk areas for flooding, and the potential frequency at which such flooding might occur. Surely this would be extremely useful for future disaster relief and planning in the Manila metropolitan area?

RESPONSE: We do understand the importance of such an output. In fact, there have been previous studies showing the inundated regions of the Marikina River floodplain. However, what we want to achieve in our study is to present a real-time basin model that can be simulated during typhoons that can be used to issue early warnings. Therefore, we think that such scope can be done in a separate paper.

Minor comments: This paper, while generally well written, needs to be edited carefully by a native English speaker. There are several areas where the language and grammar are not correct or appropriate for an international journal. I've identified a few such examples below, but I ran out of energy for making these changes.

Abstract:
Line 1 and throughout the paper–is "Metro Manila" the local term for the Manila urban area? Or is this an abbreviation for metropolitan Manila? If the latter, please use the more formal language throughout the paper.

RESPONSE: Metro Manila is abbreviation for Metropolitan Manila. However, the Manila urban area is commonly referred to as Metro Manila so we adapted the more common term.

Line 7-9: The logic of this sentence does not make sense–consider re-structuring it (it does not follow that the presence of anthropogenic factors should have prevented the models from being able to reproduce the flood characteristics–I would separate these ideas) The study revealed that while there were anthropogenic factors that exacerbated flooding in Marikina, the observed flood heights can be simulated in the models generated.

RESPONSE: We agree on the comment and we will take the suggested phrasing of the sentence as suggested.

Introduction:
Line 19: unit consistency–are you reporting depths (mm) or intensities (mm/day)? Either way keep it consistent between all storms you describe (an intensity of 371mm/day might not be very important if the storm lasts only 2 minutes!)

RESPONSE: Those are total amounts of rainfall recorded within the day but does not mean they fell in the span of 24 hours. For the Typhoon Ketsana, the rainfall depth is as follows: Starting at 8:00 am:
6 hrs: 347.5 mm
9 hrs: 413.0 mm
12 hrs: 448.5 mm
It could be stated that the bulk of the rainfall happened at the first six hours.

Line 20: Informal and awkward wording, consider revising The volume of rainfall resulted in a flood that was exceptionally high and extensive which made it extremely devastating.

RESPONSE: We accept this comment and we propose that the new sentence would be: The extensive flooding caused by this sheer amount of rainfall produced extreme damages to buildings, electric posts and other structures.

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Line 25: Is the Marikina Basin located within Metro Manila; or is Metro Manila located within the MRB?

RESPONSE: Marikina City, which is inside the Marikina River Basin is a part of Metropolitan Manila.

Figure 1 – as a general comment, most of the readership of HESS will not be familiar with the geography of the Manila area – you may want to show a location map that firmly relates the study area to the rest of the Philippines, and shows the basin outlines of interest. The resolution of the figure provided here is not good, so I apologize if this is what the Figure currently does.

RESPONSE: We accept this comment and we will provide a clearer index map where the specified qualifications of the reviewers are met.

Methodology
Lines 18-19: "were inquired". . . poor grammar. Consider rephrasing, something like: "Respondants were asked to estimate the time the flood peaked, the maximum flood height and the rate at which water depth was increasing."

RESPONSE: We accept this comment and have rephrased the sentence as suggested by the reviewer.

Basin and sub-basin delineation
Line 4: "The availability and globally available DEMs" – poor language, revise

RESPONSE: We accept this suggestion and we have revised the sentence. The revised form is: The access to free DEMs...