Dear Editor and the reviewer,

We do appreciate your constructive, thoughtful, careful, and helpful comments and suggestions. After careful discussions and analyses, we finished the preparation of responses to you. If there are any new comments or suggestions, please let us know.

Best Regards,

Paulo Victor N Araújo and the coauthors

Response to General Comment:

1) [Ph.D. Samela]: The introduction is focused almost exclusively on the importance and the role of flood hazard maps. The background of the research has not been delineated. Traditional procedures for flood hazard studies, or alternative methods, and the problems/limits related to both of them are not mentioned. Therefore, it is not clear what is the gap or issue that the proposed research aim to address? In few words, the aims are not clearly defined. Also, data, methods, models, performance measures should be illustrated in more detail.
[Authors´s answer]: [ACCEPTED and MODIFIED INTRODUCTION]

2) [Ph.D. Samela]: The extent of the study area is not clear. Section "Study area" reports that the full Uruguay basin has a total area of 385,000 km2. Then, it is also reported that the study area corresponds to Ibicui sub-basin, the largest Uruguay river sub-basin, and that this study area has a territorial area of 3,406,606 km2. How can this sub-basin have a drainage area larger than the full hydrographic basin?
[Authors´s answer]: We apologize for the punctuation and correct it in the text. MODIFIED FOR "… and that this study area has a territorial area of 34,066.06 Km2 …".

3) [Ph.D. Samela]: A SRTM-DEM has been calibrated using ground control points (GCPs) of high vertical accuracy. Can you provide a quantitative indication about GCPs vertical accuracy?
[Authors´s answer]: [ACCEPTED and MODIFIED]: "The database with 697 control points from Federal University of Pampa (UNIPAMPA) were acquired with GNSS receivers on the field through high-accuracy post-processed kinematic (PPK) mode and linked to SGB (Silva et al., 2017). These high-accuracy control points had the mean of the altimetric error the value of 0.006 ± 0.0007 meters" [page 6, line 26].

4) [Ph.D. Samela]: In carrying out the visual comparison in Section 4, please, explain more clearly what do you mean with "simulated flood altimetric quota". More details as regards the simulation need to be provided.
[Authors´s answer]: MODIFIED FOR: "Finally, a visual comparison between a modelled flood versus a DIP from flood area satellite image was performed, which both were registered concomitantly on the same day in study region" [page 4, line 28].

5) [Ph.D. Samela]: Section "4.2.1 Digital Elevation Model (DEM) calibration" specifies that in performing the linear regression, GCPs values have been used as independent variable and SRTM data as dependent variable. The independent variable is usually a measurement you are not manipulating in your experiment, and conventionally it is on the x axis. Instead Figure 5 puts SRTM values on the x-axis. Can you clarify Figure 5, the linear function y=0.7031x+13.913 you derived, and how did you use it?
[Authors´s answer]: We apologize for the mistake in writing the text, but in fact the independent variable was SRTM values and dependent variable was GCPs values. Common procedure found in the literature for DEM calibration (e.g., Gorokhovich and Voustianiouk, 2006; Du et al., 2012; Forkuor and Maathuis, 2012).

[TEXT MODIFIED FOR]: “This dataset was submitted to Linear Regression analysis, with ground control point values as dependent variable and SRTM data as independent variable. Common procedure found in the literature for DEM calibration (e.g., Gorokhovich and Voustianiouk, 2006; Forkuor and Maathuis, 2012).” [page 5, line 6].

Reference

Forkuor G. and Maathuis, B.: Comparison of SRTM and ASTER Derived Digital Elevation Models over Two Regions in Ghana – Implications for Hydrological and Environmental Modeling, in: Studies on Environmental and Applied Geomorphology, edited by: Piacentini, M. and Miccadei E., IntechOpen, https://doi.org/10.5772/28951, 2012.

Gorokhovich Y. and Voustianiouk A.: Accuracy assessment of the processed SRTM-based elevation data by CGIAR using field data from USA and Thailand and its relation to the terrain characteristics, Remote Sensing of Environment, 104, 409-415, https://doi.org/10.1016/j.rse.2006.05.012, 2006.

6) [Ph.D. Samela]: As far as I understand, the function obtained in Linear Regression has been used to predict the dependent variable values (the DEM values) as a function of the GCPs. Then the original SRTM DEM and the DEM adjusted with GCPs have been compared and RMSE has been evaluated. More interesting, in my opinion, would be to make a statistical comparison between the “new” adjusted DEM values against GCPs different from the ones used for the calibration, in order to validate the improvement in accuracy produced by this procedure.

[Authors´s answer]: We understand the concern, however for this study, we defined use of 100% of the control points for calibration and evaluation, as found in the literature (e.g., Araújo and Amaral, 2016).

Reference

Araújo, P.V.N. and Amaral, R.F.: Mapping of coral reefs in the continental shelf of Brazilian Northeast through remote sensing, Journal of Integrated Coastal Zone Management, 16, 5-20, http://dx.doi.org/10.5894/rgci629, 2016.

7) [Ph.D. Samela]: As regards the comparison showed in Figure 8 between the results of the proposed approach and CBERS-4/MUX satellite image for 12 June 2017, I suggest complementing this visual comparison with some statistics and performance measures. I believe this validation will improve the manuscript and the reliability of the proposed method.

[Authors´s answer]: It would be very interesting this strategy of validation, however to materialize it we faced the spectral limitation of the MUX sensor of CBERS-4 satellite. Due to the existence of trees with high crowns, in sectors affected by the flood, these would be masked in the PDI process. In our strategy, we opted to perform only comparative visual analysis. A future solution would be the use of other sensors, which are not currently available to authors.

Response to Minor comments:

1) Line 2, Abstract: replace “historic” with “historical”. [ACCEPTED and MODIFIED]

2) Line 15, Abstract: instead of “fluviometric temporal series records” I suggest “temporal series of streamflow records”. [ACCEPTED and MODIFIED FOR]: “…temporal series of maximum annual level records of Uruguay river…”

3) Line 15-16, Abstract: Check subject-verb agreement in “The annual maximum. . .were linked to. . .”. [ACCEPTED and MODIFIED FOR]: The temporal series of maximum annual level records of Uruguay River, for years of 1942 to 2017, to Brazilian Geodetic System were linked using geometric levelling and submitted the descriptive statistical analysis and probability.

4) Line 16, Abstract: “submitted the statistical analysis”. Unclear. [ACCEPTED and MODIFIED]: “submitted the descriptive statistical analysis and probability”.

5) Line 18-19, Abstract: “Using the temporal series statistical analysis results, was assessed the spatialisation of flood hazard classes on the calibrated DEM and validated”. Please, rephrase and move the verb “was assessed” after its subject “the spatialisation of flood hazard classes on the calibrated DEM”. [ACCEPTED and MODIFIED]

6) Line 23, Abstract: instead of “Were determinate 5 classes of flood hazards”, move the verb at the end of the sentence and correct it in “were determined”. [ACCEPTED and MODIFIED]

7) Line 28, Introduction: check subject-verb agreement: “causes” instead of “cause”. [ACCEPTED and MODIFIED]

8) Page 2, lines 3-7, Introduction: “These geohazards can be prevented and reduced by providing reliable information to the public about the flood hazard through flood inundation maps (Alaghmand et al., 2010; Demir, 2015). Information about the flood’s extension is extremely important to evaluate the hazard of flood-prone areas and to help the rescue operations during these events (Cook and Merwade, 2009). Flood hazard mapping is one of the tools used to help communities avoid or mitigate such losses and damages (Arrighi et al., 2013; Savage et al., 2014; Speckhann et al., 2017). Flood hazards maps need therefore to be created as they provide a basis for the development of flood risk management plans”. 9) Please, rephrase and avoid repetition of the same concept.
[ACCEPTED and MODIFIED]: These hazards can be prevented and reduced by providing reliable information to the public about the flood hazard through flood inundation maps (Alaghmand et al., 2010; Demir, 2015). This information can, for example, assist urban management or even to help the rescue operations during these events (Cook and Merwade, 2009). Thus, helping the communities directly to avoid or mitigate such future losses and damages (Arrighi et al., 2013; Savage et al., 2014; Speckhann et al., 2017). Flood hazards maps need therefore to be created as they provide a basis for the development of flood risk management plans”.

10) Page 2, lines 15-16, Introduction: use “high vertical accuracy” in “topographic data. . . must possess vertical highly accuracy altimetric”. [ACCEPTED and MODIFIED]

11) Page 3, line 16, Study area: “official” instead of “oficial”. [ACCEPTED and MODIFIED]

12) Page 3, line 15, Study area: correct “rive” with “river”. [ACCEPTED and MODIFIED]

13) Page 4, Line 4, Section “3 Previous studies in Itaqui city on flooding”: Check subject-verb agreement and grammar in “The flooding process of Uruguay River in Itaqui city are a natural phenomenon that afflicts the riverside population for decades”. [ACCEPTED and MODIFIED]

14) Page 4, Line 6, Section “3 Previous studies in Itaqui city on flooding”: “risks” instead of “riscks”. [ACCEPTED and MODIFIED]

15) Page 4, Line 15: “fulfill” instead of “fulfil”. [ACCEPTED and MODIFIED]

16) Page 4, Lines 15,16: “priming in the use on the high elevation accuracy of altimetric and fluviometric data to the modelling of flood geohazard mapping”. Revise English. [MODIFIED FOR]: “…priming in the methodological application of use of high accuracy altimetric data to the modelling of flood hazard mapping…”.

17) Page 4, Lines 20-22: “was submitted the statistical analyses”. Unclear. [ACCEPTED and MODIFIED]

18) Page 5, line 26: “Was considered as GCPs only the orthometric altimetry points acquired from high accuracy Geodesy which data were based in Global Navigation Satellite System (GNSS)”. Revise English and subject-verb agreement. [ACCEPTED and MODIFIED FOR]: Was considered as GCPs the orthometric altimetry points acquired from high accuracy Geodesy.

19) Page 6, lines 28-29: “temporal series descriptive analysis of the orthometric heights’ annual maximum fluvial levels records”. Revise structure. [ACCEPTED and MODIFIED FOR]: “To determine the classes of flood hazard mapping, a descriptive analysis of the orthometric heights temporal series (annual maximum fluvial levels records) of Uruguay River was performed (minimum, maximum, quartile and percentile).”.

20) Page 6, lines 29-30: “It was assumed” or “we assumed” instead of “Were assumed that if . . .” [ACCEPTED and MODIFIED]

21) Page 7, line 15: move the verb “Was performed” at the end of the sentence. [ACCEPTED and MODIFIED]

22) Page 8, line 25: “. . .shows” instead of “This return period shown”. [ACCEPTED and MODIFIED]

23) In the whole manuscript, I suggest just using “flood hazard”, instead of “flood geohazard”. [ACCEPTED and MODIFIED]