Detection of inundation areas due to the 2015 Kanto and Tohoku torrential rain in Japan based on multi-temporal ALOS-2 imagery

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Our responses to reviewers' comments are written in Italic letters. Red letters are sentences reflected in the revised paper taking the comments.

The authors present a study that uses remote sensing techniques to detect inundated areas in Joso city, Japan after torrential rainfall in 2015. The manuscript is well written, interesting and scientifically sound. The study builds up on a previous study of the authors that uses the same satellite imagery, but seems to deploy a different detection method (Yamazaki and Liu 2016). The authors mention their previous study briefly in the manuscript, but it is not clear how this study differs from the previous one. Differences in method and results as well as the added-value of the new work would need to be clearly outlined in the manuscript.

Response: Thank you for your kind comments. We revised the manuscript as "One threshold value on backscattering intensity was investigated using the pre-event water regions and the pre-event PALSAR-2 images, and it was applied to all co-event images. In addition, the obtained results were only verified via visual comparison. In this study, the method of the inundation extraction was improved by introducing land-cover information and elevation data. The flooded urban areas were also extracted using the intensity difference between the pre- and co-event images. The obtained results are verified quantitatively via comparison with those from visual inspections of airborne imagery."

Introduction: I strongly suggest adding a more in-depth review of the state-of-the-art on inundation mapping from SAR images and how your study differs from other existing ones. More emphasize should also be given in presenting other studies that focused on the same disaster and study area (if any). Based on this and a review of work that has been done related to inundation mapping from SAR images, it would be important to outline clearly the objectives of this study, the added-value that it can bring to improve existing inundation detection methods and the scientific understanding of the flood disaster.

Response: We reorganized the introduction and added more descriptions of the previous study accordingly. Most of the previous studies on inundation mapping using X- or C-band SAR images. Due to the long wavelength, inundation extraction from L-band SAR images is one challenging point in this study.

Discussion: The manuscript would strongly benefit from a separate discussion section that clearly outlines the limitations and benefits of the applied method, and compares the results with findings of other studies (in particular your previous study).

Response: We will add a new chapter for discussion. The validity of introducing land-cover map will be verified. In addition, a comparison of the proposed method and an automated thresholding method will be added in the new chapter.

Page 1, line 16: ": : :good level of agreement." Suggest replacing it with a more quantitative statement that mentions the actual accuracy metrics that you have computed.

Response: According to the comment, we revised it as "more than 85% of the maximum inundation areas were extracted successfully".

Page 2, lines 11-19: Suggest moving this paragraph to Chapter 2 (Study area).

Response: According to the comment, we revised this part to the beginning of Chapter 2.

Page 4, line 16: "washed way" should be "washed away".

Response: It has been revised accordingly.

Page 5, line 2: "an SAR image" should be "a SAR image".

Response: It has been revised accordingly.

Page 5, lines 2-9: Suggest moving this paragraph to Chapter 1 (Introduction) as part of the state-of-the-art.

Response: According to the comment, we revised this part to Chapter 1.

Page 7, line 21: Could not find "Figure 3(b)". Please check the figure references.

Response: It has been revised to Figure 2(c).

Page 8, line 5: I suggest adding here also a quantitative comparison with the results of your previous study. This would be needed to justify the mentioned improvements (Page 2, line 22).

Response: According to the comment, we added a paragraph as "In the previous study (Yamazaki and Liu, 2016), the inundation areas in the three co-event PALSAR images were extracted using one threshold value of -12.4 dB, which was estimated by comparing the backscatter intensity for the original water regions (Kinugawa and Kogai rivers, Sanuma lake) and the other areas in the whole study area. As a result, 20.4 km^2 on September 11 and 16.3 km^2 on September 13 were extracted as inundations. Since the threshold values used in this study were -13.5 dB for September 11 and -14.2 dB respectively, lower than the previous study, the extracted areas including the inundated built-up areas were similar in size to that of the previous results. However, the producer and user accuracies increased 3%, whereas the O.A. increased 2% for the results on September 11. For the results on September 13, the producer accuracy decreased whereas the user accuracy increased from 68.8% to 87%. The O.A increased significantly from 77.4% to 81.3%, while the kappa coefficient increased from 0.53 to 0.58. The induvial threshold values for the images taken in different acquisition conditions were more effective than one common value."