Referee #2

The paper presents an interesting work that joins SAR remote sensing and DEM in order to asses extension and the water depth in the area affected by the flood with a user-friendly methodology.
The paper is clearly written, and the topic appropriate for NHESS, but some points that need a better explanation I don't feel qualified to evaluate English I suggest that minor revisions are needed before the publication

General questions
1. cap 3.1 data used. There are some data from river gauge stations that allow understanding the flood dynamic? (e.g. when occurred the flood peak?)

Yes, there are data of river gauge stations (see Figure below). We would also change the description of the flood as it follows, in order to explain its dynamic more clearly:

"The first levee rupture in the study region occurred south of Vicenza in the afternoon of November 1. Afterwards, the flood propagated South-East to Veggiano, where the banks of the Bacchiglione River were broken in the night between November 1 and 2. During November 2 the Bacchiglione banks broke also in the area of Bovolenta, while the area of Saletto started to be flooded due to the rupture of the Frassine River banks on the same day (see Figure 3). Based on the analysis of SAR imagery (Cian et al., 2018), in the area of Vicenza and Veggiano the peak of the flood event was estimated between November 2 (north-west of frame A in Figure 3) and November 3 (placeholder "A1" in Figure 3). Instead, in the Bovolenta (frame B in Figure 3) and Saletto (frame C in Figure 3) areas it occurred on November 4 .
Figure 4 shows the measurements of hydrometers along the Bacchiglione River (hydrometers 1 to 5) and along the Frassine River (hydrometers 6 and 7) (ARPAV, 2010). We can notice how the flood wave moved from Vicenza (hydrometer 1) to Bovolenta (hydrometer 5), in accordance with the analysis of SAR data, which estimated the maximum extent after the highest measurement of the hydrometers. Concerning the Frassine Rriver (hydrometers 6 and 7), we observe a similar behavior."

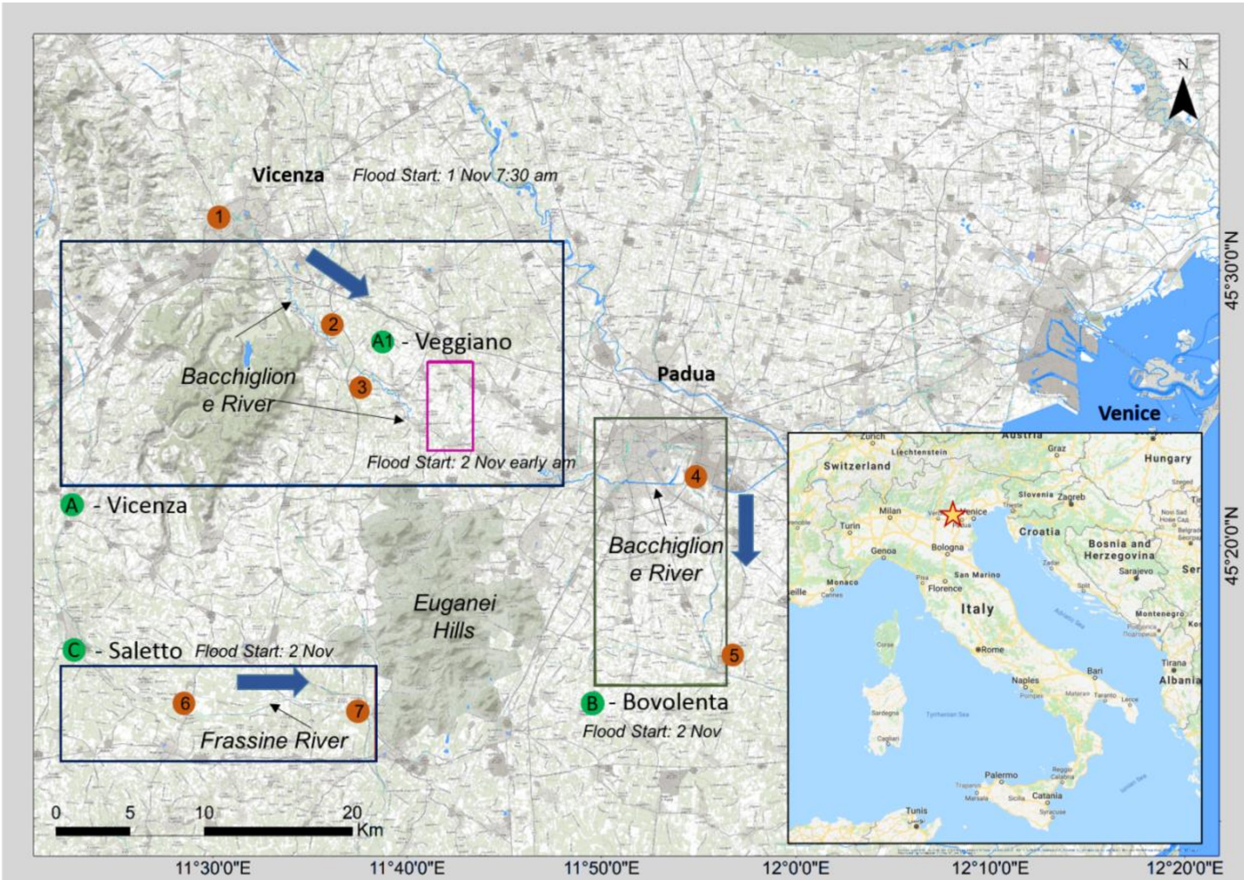

Figure 3 Overview of the area affected by the 2010 flood event occurred in the Veneto region (Italy). The main areas of interests are highlighted by the three frames: A) Vicenza, B) Bovolenta and C) Saletto. Placeholder A1 refers to the Veggiano area covered by the hydrodynamic modeling used for comparison purposes. The numbers in orange circles indicate the location of the hydrometers, whose measurements are reported in Figure 4. For each frame the flood start date is reported along with the direction of the flood wave (blue arrows).

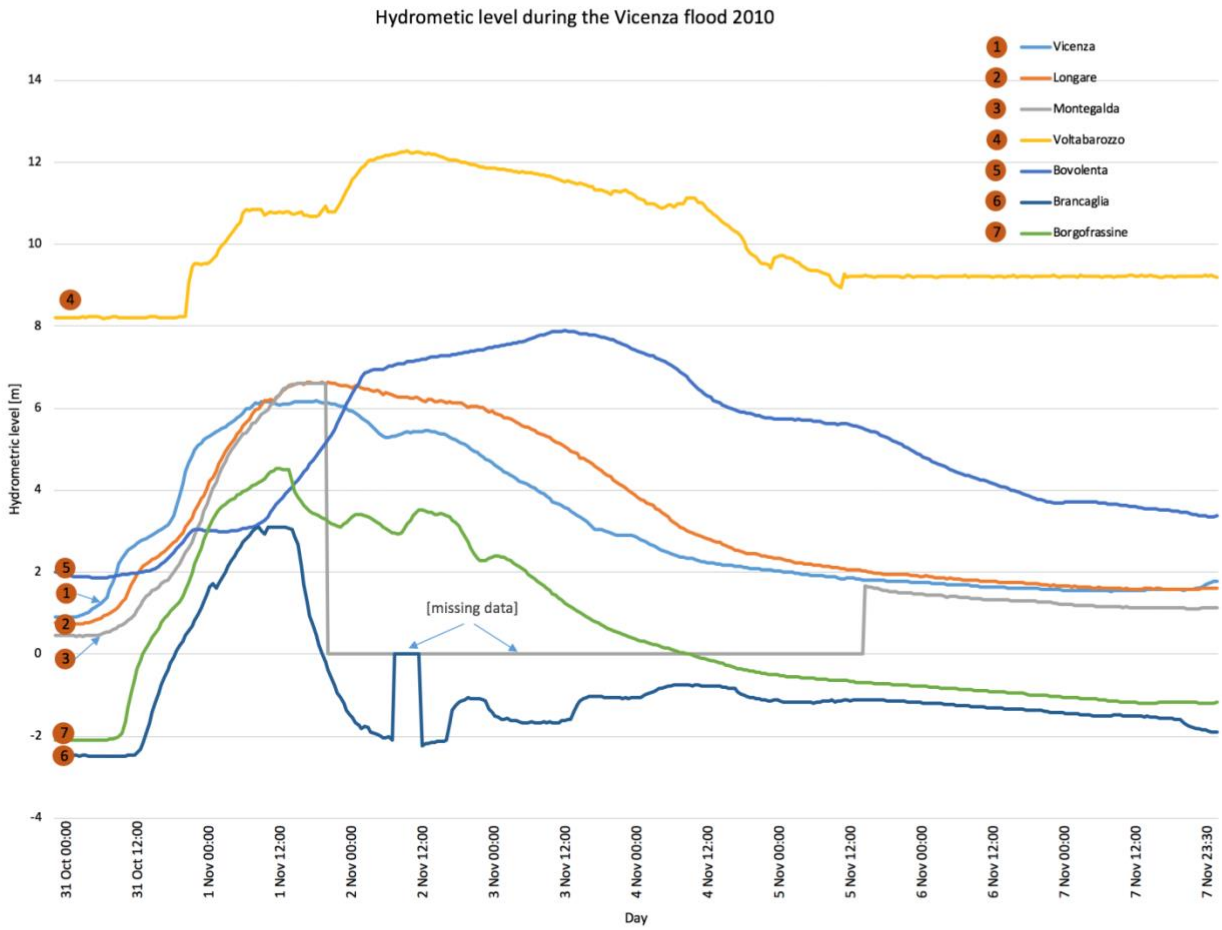

Figure 4 Measurements of hydrometers during the period of the investigated flood event. The flow of the Bacchiglione River (hydrometers 1 to 5) goes towards South-East, i.e. from hydrometer 1 to 5. The flow of the Frassine River (hydrometers 6 and 7) goes towards East, i.e. from hydrometer 6 to 7. In both cases, the measurements show the dynamic of the flood, which followed the stream of the river.

2. Questions about "detected flood polygon" Which is the min and max dimensions of the polygon that you consider with the same water level? In addition, the procedure to create polygons it seems not so simple "to use also for non-GIS and RS experts". To create a gradient of water level it should be a more easy solution? In the conclusion, you suggested "Another improvement may come from the method for creating the water elevation plane", eventually this improvement required much time to be included in this work?

At the end of section 2.1 we specify three steps of post-processing employed in the flood mapping methods. Among these, the second says; '*exclusion of clusters smaller than 10 pixels'*, which basically determines the minimum size of the polygons. Accordingly, being Sentinel-1 pixel size 10x10 m, this equals to exclude polygons with size smaller than $10*100m^2 = 1000\ m^2$.

Regarding the simplicity of the methodology, we do not believe that generating polygons from a raster image is a challenging task for anyone. Overall, we think that the method is very simple to apply; indeed, only a flood map in vector format and a DEM shall be provided as input, then the algorithm does it all.

It is not clear to us what the Reviewer means with "gradient of water level" and how, where, or in substitution to what we should apply it. Could the Reviewer please be more specific?

We believe that the suggested improvement might lead to an increased accuracy of the flood depth maps in specific circumstances. Nevertheless, it would still require a lot of time and effort to be properly developed, tested and validated, accordingly it is out-of-scope in the framework of this specific work.

Specific comments

Introduction: About flood mapping, methodology, water depth estimation, SAR flood mapping in an urban and vegetated area maybe consider also some recent works (e.g. Dasgupta et al., 2018; Giordan et al., 2018; Pierdicca et al., 2018)

We would cite the works suggested by the Reviewer along with some others: Horritt 2001; Matgen et al., 2007; Brisco et al., 2011; Henry et al., 2006; Cossu et al., 2009; Martinis et al., 2015; Chini et al., 2012; Dasgupta et al., 2018; Giordan et al., 2018; Nico et al., 2000; Pierdicca et al., 2018

Line 50: "SAR data at high spatial resolution are continuously acquired by many satellites": It should better to specify that nowadays, only Sentinel-1 provide free, global and constant acquisition while CSKM and TSX provide constant acquisition only on some areas (e.g., CSKM provide continuous data only for Italy and some main cities)

We would change the paragraph as: "*SAR data at high spatial resolution are continuously acquired by many satellites in low Earth orbits, such as the German TerraSAR-X (TSX), the Italian COSMO-SkyMed (CSK) and more recently the ICEYE and the European Space Agency (ESA)'s Sentinel-1 (S1) constellations. These sensors can provide images up to a resolution of a fraction of a meter (e.g., TSX, CSK) and are able to promptly monitor disaster within few hours from their occurrence (e.g., CSK in urgent mode activation). However, up to now only S1 provide free, global and constant acquisition. ICEYE acquires globally and constantly but its data are not freely accessible, as well as the images acquired by TSX and CSK, which in addition are not even acquired systematically at a global scale.*"

Figure 12: I suggest for the colour scale to use a different colour to point out the areas where the difference of water depth between SAR and model is negligible (e.g. +/- 10 cm).

To avoid confusion we decided to keep the same colour scale for all the images. We think that areas with +/- 10 cm difference are still evident. If requested we can modify the colour scale, but for consisteny we would prefer to maintain the same.

Figure 10 A and B): It should be better to discuss more the errors related to strong backscatter urban area i.e. the group of buildings in the North sector was probably flooded as results from the model, but not from SAR data, it is correct?

The group of buildings referred by the Reviewer may have been flooded, as appears on the DEM fill results, but we do not have results of the model in this area nor evidence from aerial photos/ground truth. We would add the following paragraph at line 432 to better explain the results: "*Buildings in the central-north side of the image are categorized as flooded by the DEM-fill method in contrast to the SAR-based maps. It is worth noting that SAR data does not allow to extract flooded areas between buildings, where a mechanism of double bounce occurs making the radar backscatter to increase rather than decrease. However, we have no evidence that this specific area was actually flooded.*"

Line 480 - 490 and Figure 13: add some more clear considerations about the overestimation of a hydraulic model and under-estimation of SAR: I suppose that some area that should be flooded according to model was protected by a breach and not flooded in truth; while the SAR underestimate flood in the area with buildings/vegetations and when the pass is after flood peak.

We would add the following sentence at line 486 to better explain the difference between the model and the SAR-based flood map: "*The reasons of this difference can be various. On the one hand, areas reported as flooded in the simulation could have been in truth protected by barriers not taken into consideration by the model, hence leading to an overestimation of the simulated flood extent. On the other hand, the SAR-based maps might experience some underestimation in the presence of urban and vegetated flooded areas (where the radar backscattering might increases due to specific multiple bouncing).*"

As concerns potential underestimation in the SAR-based maps due to observations available after the flood peak, this does not apply in this case since the model simulation was run for the exact same time of the SAR acquisition.

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Conclusion. Line 515-522: In my opinion, another factor is to take into account: A flood map should be representative of the maximum extension and water depth reached during the inundation stage. It is important to remind that SAR satellite or other images represent the flooded area and water depth at a certain date and time and, if they don't acquire at the moment of maximum flood peak, the flood maps contain underestimations. As consequence it should be necessary to take as reference the data more close to the flood peak time: For instance in this specific case, in the area of Vicenza, the aerial photo represent better the real flooded area, while in the case of Saletto is the SAR data that best fit the ground truth.
We thank the Reviewer for this comment. Accordingly, we would add at the end of line 522, the following paragraph: "*However, it must be taken into consideration that satellite observations allow to outline the flooded areas and estimate the water depth at the specific date and time of their acquisition, which are not necessarily corresponding to the maximum flood extent and water depth. If the images are acquired far from the flood peak (either before or after), the estimated extent and depth will underestimate the worst situation occurred during the event.*"

Line 534: "Another improvement may come from the method for creating the water elevation plane" see my considerations at point 2.
We replied at point 2.