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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Low cost, multiscale and multi-sensor application for flooded areas mapping" *by* Daniele Giordan et al.

S. Manfreda (Referee)

salvatore.manfreda@unibas.it

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The authors carried out a comprehensive study on the use and integration of data from multiple sensors for flood mapping. They used some approaches already tested in literature and others more innovative and experimental. In particular, they designed an approach using free or low cost data/sensors that was tested on a real case study considering both urbanized and not urbanized areas.

The work is certainly of interest for the readers of NHESS. Nevertheless, I have a number of comments that may help the authors in improving the final quality of the manuscript.

1) In order to provide enough information to replicate the experiment, I would suggest

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to include more details about the methods used for the classification of the satellite images (COSMO-Skymed, Aqua satellite co-flood image).

2) It is notable a relevant amount of manual operations, as stated in several sentences: - Section 3.1 Flood mapping at regional scale with satellite data "For every considered dataset, we produced a map of the flooded area. . . We use a visual-operator approach to map flooded areas as resulted more precise than automatic classifications especially in the case of post-flood images";

- 3.1.2 Multispectral satellite data, I) Medium-Low resolution satellite data: "For the identification of flooded areas, we make the following elaborations: a) False colour image made with combinations of 7-2-1 bands for a visual interpretation of flooded areas";

- 3.1.2 Multispectral satellite data, I) Medium-Low resolution satellite data: "Supervised maximum likelihood classification of co-flood image made with SAGA GIS. We manually defined the training areas with main land use typology visible on the image. . ."

- 3.1.2 Multispectral satellite data, II) Medium-high resolution satellite data: "To detect flooded area, we first made a visual interpretation using images (Sentinel-2 images) with different bands composition of post-flood data."

- 3.2.3 Ground-based ultra-high resolution images: "For the identification and mapping of water levels, the video is analysed and a frame sequence is extracted from it when the operator sees some marks lefts by water over facades"

- 4 Results, Flood mapping from low to medium-high resolutions with satellite data: "The flooded area limits were manually extrapolated considering satellite data and geomorphological features obtained using the hillshade model derived from 5-m DTM. . ."

- 4.1.2 Flood mapping with multispectral data, I) Multispectral low resolution, MODIS-Aqua: "MNDWI variation (MNDWIVAR) at 20 m of spatial resolution. . .. However, like for NDVI, the presence of many areas with positive variations outside the flooded sector

makes more accurate a manual interpretation"

- 4.1.2 Flood mapping with multispectral data, II) Multispectral medium-high resolution post-flood mapping Sentinel-2: "The images of Sentinel-2 were analysed by visual interpretation of RGB composite image and using two different indexes (NDVI - MNDVI) to identify flooded areas shown in figure 5.

Therefore, I am wondering if such an approach might still be considered low-cost and fast, considering the amount of work that needs to be performed by human operators. Also, the reliability and accuracy of the results would significantly depend on the ability and experience of the operator.

3) It is not possible to infer the performances of the methods/data investigated. Please, describe and provide results of any statistical analyses that you performed.

4) Probably, after 8 pages of Materials and Methods and 7 pages of Results, the article would benefit from an expanded discussion, where those data are interpreted. I would try to address the following questions: What is the overall advice (if exists) authors can give to readers for an efficient approach for flood inundation mapping? Since appears that some analyses provided results not accurate or too uncertain or under/overestimation too significant, is any of the tested methods and data less relevant than others? Can any of these methods/data be completely replaced by the information provided (with a higher accuracy) by other analysed methods/data?

Minor comments The paper contains a number of typing errors that requires a careful review of the English. Below some examples that I found while reading the manuscript.

Check the way citations are written in the manuscript. Sometimes "et al" is followed by no full stop and just the comma (Luino et al, 2009) sometimes a semicolon (Wang et al; 2012), sometimes nothing (Boni et al 2016). Other examples in lines 37-38 "Boni et al 2016; Mason et al 2014; Guy et al 2015; Refice et al 2014; Pulvirenti et al; 2011; Clement et al, 2017; Brivio et al; 2002".

Line 42: correct "authorirhyes"

Line 44: it should be "details" (plural) instead of "detail"

Lines 47-48: check subject-verb agreement "A partial solution could be the use of a Remotely Piloted Aerial System (RPAS), that are usually able". A RPAS system is singular. Line 81: check subject-verb agreement "The basin of Po and Tanaro rivers were"

Line 90: check subject-verb agreement "the actual plain (Fig. 1 B and Fig 1 C) correspond to"

Line 92: check english "The plain is marked by the terraces that delimit of actual Po valley..."

Lines 122: "pre-flood', 'co-flood' and 'pre/post-flood' data". I suggest you to remove pre-flood and just leave "co-flood' and 'pre/post-flood' data", since in the following lines you distinguish and explain these two categories.

Lines 125-127: "Using a multi-scale approach, we developed a methodology that considers the progressive use satellites and then high and ultra-high resolution systems for the acquisition of a dataset that can be used to support the identification of water level reached by the flood and occurred damages". I think an "of" is missing before "satellites". I also suggest authors to think about rephrasing or splitting this sentence in two.

Line 130: "quikly indication". Proper spelling is quickly. By the way, I think the adjective form "quick" is the appropriate one. Line 134 and 137: "Orthophoto" instead of "ortophoto".

Line 264: "the system can flight on demand during the flood of immediately after". "Or" instead of "of"

Line 332: "to assess" instead of "to assesses"

Line 363: "The MODIS-Aqua satellite takes an image. . .during the late morning of November 26, 2016. " "Took", instead of "takes".

Line 426: "mapped" instead of "mapp7ed"

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