Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-400-AC1, 2016
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Hydrology and Earth System Sciences
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Interactive comment

Interactive comment on "Using crowdsourced web content for informing water systems operations in snow-dominated catchments" *by* Matteo Giuliani et al.

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Received and published: 10 November 2016

We would like to thank the anonymous referee for her/his comments. A detailed response is reported below, where authors' replies are in blue.

This is an interesting paper that ultimately I would like to see published in Hydrology and Earth System Sciences journal. This manuscript proposes a procedure for automatically extracting snow-related information from heterogeneous sources. I really enjoyed reading the paper, which deal with the important and timely issue of notable interest and modernity especially for the HESS readership. The paper accurately presents the methods and results. I have just a couple of minor comments/suggestions

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for the authors to consider.
We thank the referee for the positive comment.

From the introduction and methods sections, the authors mainly focused in the description of the approach used to derive VSI information from webcams and people pictures. However, in the results sections only a figure is reported to discuss the benefits of such approach. I would like to see more analysis regarding the results achieved using the method reported in sections 2.1, 2.2 and 2.3. For example, it would be interesting to discuss issues in define skyline or to show a comparison between snow information extractions (of a certain point) using both web camera and user generated picture (if possible).
The results focus on quantifying the value of crowdsourced information in the operations of water systems, which is the main contribution of the paper. A detailed technical analysis of the image processing architecture is reported in Fedorov et al. (2015) including, for example, the comparison of the accuracy obtained with different feature extractors algorithms or the performance in the photo-to-terrain alignment (see tables below). To avoid replication, we did not include them in the paper and, following the reviewer suggestion, we will add a sentence to direct the reader interested in the first part of the procedure toward the other paper. Finally, we agree with the reviewer that a direct comparison between the information extracted from both a webcam and a user-generated photo would be absolutely interesting. Unfortunately, at this stage we have not overlapping data to perform such comparison. We added this analysis as a possible future research, which, hopefully, will be possible thanks to the continuous acquisition of new web content through our portal.

It is not clear to me how the information of VSI was used to estimate physical variable like ht in eq(10). Did the authors used any hydrological models? If yes, I think it would be appropriate to give a brief description in the methods section.
We did not use any hydrological model because we adopt a model free approach

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and directly pass the VSI information to the controller. This is due to the fact that a process informed translation of the index into a hydrological model would be extremely complex. The index is extracting information from a localized context and the upscaling to the whole basin would require a physical interpretation of the index, which is beyond the scope of this work. We will better clarify this point in the revised manuscript.

Finally, I believe authors should clearly define the limitations of this study (e.g. computational time of the imagine process and availability of public photo from people) in the conclusion section.

Following the referee's suggestion, also pointed out by the second referee, we will add a more balanced discussion about the requirements and limitations of the proposed approach. The paper represents a proof of concept on the possible use of public media for improving water resources monitoring and management. Our experiment relies on a small portion of the data we crawled and processed. In the revised manuscript, we will discuss the main factors which may limit our approach both in terms of computation power and data availability. For example, the generation of a 1500 px X 12000 px panoramic view requires approximately 1000 ms with a GeForce GTX 850M graphic card. The alignment of an image to the virtual panorama requires approximately 30.000 ms on an OpenStack virtual instance with 4 2.5GHz VCPUs and 8Gb of RAM. In our case, we split the 300 X 160 km region of the Italian and Switzerland Alps using a 5 X 5 km step grid. We analyzed all the photographs and webcam images acquired in the specified region over a 6 months' period (from December 1st, 2014 to May 31, 2015), for which the availability of photographs and webcams is the following one:

- Photographs: spatial coverage 38
- Webcams: spatial coverage 10

where the spatial coverage is defined as the fraction of grid cells containing at least one image over the considered observation period, while the temporal frequency is defined

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as the average number of images contained in a non-empty grid cell in the observation period.

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TABLE II: Results obtained by different feature extractors for the image classification problem (mountain vs. no-mountain).

feature	C	γ	accuracy	precision	recall
Dense SIFT	3.3	0.66	**95.1**	**94.0**	**96.3**
HOG2x2	3.3	0.033	94.7	93.9	95.5
SSIM	0.66	0.33	93.0	92.5	93.5
GIST	0.33	1	87.61	82.64	95.21

TABLE IV: Performance results of the photo-to-terrain alignment algorithm (by dataset categories and photograph content properties)

	$p^G_{3,1}$	$p^G_{3,3}$	$p^R_{3,3}$
All images	69.6%	81.8%	75.0%
Absence of clouds	72.4%	82.9%	77.6%
Presence of clouds	66.7%	80.6%	72.2%
Absence of nearby mountains	74.8%	89.3%	81.6%
Presence of nearby mountains	57.8%	64.4%	60.0%

Fig. 1. Comparison of the accuracy obtained with different feature extractors algorithms or the performance in the photo-to-terrain alignment (Fedorov et al., 2015).

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