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Manuscript hess-2020-188: *"Spatial distribution of tracers for optical sensing of stream surface flow"* by Pizarro et al.

We report a detailed response to each of the comments and suggestions below (text in red).

Reviewer 2

Obs. 1: The manuscript investigates on the seeding density role for image analysis algorithms (PTV and LSPIV) useful for surface velocity measurements. Moreover, authors propose a dimensionless index for evaluating performances of algorithms. The topic is surely interesting and the manuscript is well organised and easy to follow. In the last twenty years the attempt to use camera for estimating river surface velocity is becoming always more reliable and, in general, gauge-cams are promising instruments that soon will be widely adopted. However, there are still several bottlenecks that should be, and will be, soon solved either in the hardware and in the software behind this relatively new methodology. One of these, is the absence of benchmarks for evaluating and comparing performances of image analysis algorithms (PTV, LSPIV, OTV, etc.). This manuscript goes toward this direction providing a simple framework for analysing the seeding density role. So, I positively evaluate the manuscript since, about this research topic, is not easy, or better impossible, to have available reliable benchmark, so the idea of synthetic scenarios is welcome. Following this general assessment, I have some further comments to share with the authors.

Ans. 1: We would like to thank the anonymous Reviewer 2 for the positive feedback, suggestions, and further comments.

Obs. 2: Lines 30-35. I found reductive these lines for emphasising the usefulness of non-contact approaches. Such approaches allow to measure surface velocities (and so indirectly discharge) during a flood, that is not possible to observe with common methods. So, it represents really a crucial and significant advancement of knowledge.

Ans. 2: Thank you for pointing out this matter. We agree with reviewer 2, and the sentence will be slightly modified in the new version of this manuscript to highlight better the importance of using non-contact approaches at high flow conditions.

Obs. 3: Lines 49-50. Maybe the difference between PTV and LSPIV could be better described referring to the "eulerian" and "lagrangian" characterisation.

Ans. 3: The sentence will be modified to add this information to the main text.

Obs. 4: Line 51. Unfortunately, or fortunately, these are still not "widely" used.

Ans. 4: To the authors' knowledge, several researchers, practitioners, and institutions are starting to use image-based techniques to observe/estimate surface flow velocities and river stream flows remotely. Among them, initiatives in Italy, France, Switzerland, the UK, Australia, Japan, Chile, Peru, Argentina, and the USA are examples of it (see some references below). Therefore, and despite their use worldwide, uncertainty within the measurements is still an open issue motivating not only the sentence in question but also the research the authors are carrying out.

References:

1. https://flood-obs.com/
2. https://floodscale.irstea.fr/front-page-en
3. https://twitter.com/CdC_Cordoba
4. https://www.usgs.gov/mission-areas/water-resources/science/usgs-next-generation-water-observing-system-ngwos?utm_source=twitter&utm_medium=social&utm_term=f0750e58-49ba-48cb-a985-46a71dc3f83c&utm_content=&utm_campaign=usgs&qt-science_center_objects=0#qt-science_center_objects
5. https://discharge.ch/

Obs. 5: Line 127. How discharge and velocities were estimated or measured?

Ans. 5: Velocities were measured using a current meter (SEBA F1, SEBA Hydrometrie GmbH & Co, Kaufbeuren, Germany). The accuracy of measurements is within 2% of the measured values, corresponding to 0.001 and 0.013 m/s for the minimum and maximum velocities in question. River discharge was estimated according to ISO-748/1997, using the velocity-area method. The cross-section was divided into panels of equal width and, for each panel, the velocity was measured at 20%, 60% and 80% of the panel depth.

Reference:

1. International Standards Organization (ISO). Measurement of Liquid Flow in Open Channel—Velocity-Area Method; ISO 748; ISO: Geneva, Switzerland, 1997.

Obs. 6: Figure 4. I am very glad to see the figure 4 that clearly shows how the PTV outperforms LSPIV. It is a pity that authors (line 185) did not apply any post-processing on the results. Comparing PTVLab and PTVLab+post processing, results are significantly different, indeed the potentiality of PTV is in the opportunity in validating trajectories avoiding fake information. In any case, it is already clear from the results that PIV suffers more that PTV of the seeding density. Maybe the final percentage errors would be different for the two methods. I would mention in the conclusion or in the discussion that the difference between PTV and LSPIV is expected be higher in case of using post processing analyses.

Ans. 6: We are aware of possible post-processing methodologies. However, from the authors' point of view, many of them are subjective and user-dependent despite their logical concept. Therefore, we decided to standardise the analysis giving the same conditions for both techniques, namely PTV and PIV. In addition, one of the main goals of this research was the discovery of seeding characteristics

trends with the intention to minimise image-velocimetry errors. Post-processing methodologies would potentially hide them due to their filtering nature. Nevertheless, this matter is without a doubt, an issue to be considered for future research.