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Interactive comment on "Technical Note: Advances in flash flood monitoring using UAVs" *by* M. T. Perks et al.

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In this article, the surface velocity field of the Alyth Burn during a flash flood is reconstructed from images captured by a commercial quadrotor. Velocity estimation is based on a 5.6 second-footage captured at $25\,\mathrm{Hz}$ at an altitude of $50\,\mathrm{m}$. Images are geo-rectified by a posteriori optimizing the UAV location. Further, virtual velocity vectors are removed by minimizing the difference in the location of actual and projected ground control points. Clearly detectable features in images are tracked using the Kande-Lucas-Tomasi algorithm.

The article is interesting and supports the potential of using UAVs for real time monitoring in complex environments. Remarkably, the Authors demonstrated the feasibility of UAVs for flash flood monitoring through rather low cost equipment, which does not

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enable logging of navigation data. While future technological advancements will certainly allow for widespread diffusion of hi-tech platforms, governments and stakeholders could highly benefit from the proposed approach.

The technical note is worth publication in HESS. However, the Authors should consider the following points to improve the manuscript's scope and presentation.

1. The Materials and Methods Section should be simplified to improve on clarity. Paragraph 2.2 is sometimes difficult to read (the coordinates of GCPs and of the UAV starting position can be easily confused). Maybe a flow chart may help in better identifying the image processing steps.

2. Further explanation should be provided on areas presenting poor transformation accuracy (p.5 of Paragraph 2.2). Why were 48% of the original velocity vectors eliminated? How do you plan to improve on that?

3. Details on the video footage should be included. Was it captured while the UAV was remotely piloted or on autonomous navigation? Why didn't you consider flying in the hovering mode to reduce vibrations? How is the camera connected to the platform? Camera gimbals sensibly reduce UAVs vibrations. Image resolution should be included in the Materials and Methods. Also, the footage should be added as supplementary material (I tried to access it on www.angusforbes.co.uk but I was not successful).

4. In my opinion, limitations of the proposed approach lay in the following:

   - Numerous GCPs need to be surveyed in the aftermath of the event
   - Distinct features are necessary to geo-reference the images and apply the tracking algorithm

   The need for GCPs tends to limit the approach to gauged or easily-accessible areas. Conversely, ungauged natural and rather extended regions would be difficult

to monitor. On-site surveying hampers the use of UAVs in wide and impervious areas. How do you plan to compensate for GCPs surveying in such areas?

What is the degree of supervision required by the feature tracking procedure? Do users need to identify the features in images to start the tracking process? I agree with the Authors that Lagrangian-based algorithms may be beneficial in case of low seeding densities. However, they typically require higher supervision by users (a priori information on shape and size of the objects to be tracked). Finally, how long did it take to process the images and extract velocities? How do you plan (if you do) on automating the approach towards real-time analysis?

The article is clearly written and the bibliography is well selected. Since few minor typos can be found, a careful revision of the manuscript is needed.

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