General Comments:

The submitted manuscript deals with the 3-D reconstruction of clouds via the structure-from-motion technique using image data obtained from a downward-looking camera installed at a research aircraft. The goal is to provide 3-D cloud top geometry information and geolocation that can be used to improve retrievals by other remote sensing methods, e.g. derivation of cloud droplet radii from spaceborne hyper-spectral imagery. While airborne observation of clouds is a costly enterprise and delivers data only for the flight period, it provides a quite complete and still rare view on the cloud top geometry.

The article describes in detail the methodology and evaluation of the proposed airborne reconstruction, including camera calibration, feature tracking and 3-D reconstruction. Besides an empirical evaluation with an onboard lidar system, the article discusses related challenges of such an approach, such as synchronization with the aircrafts navigation system or the effect of cloud evolution and motion during the sequence of photographs. The article proves that the structure-from-motion technique can be successfully applied to obtain the 3-D cloud top geometry of clouds and should be published after dealing with the following remarks.

Specific Comments:

- For the purpose of evaluation, the article yields a case study of tracked features (Fig.2) and an illustration of the retrieved data (Fig.3). While Fig.3 shows that the method allows to detect cloud evolution (arrows), the missing spatial reference, height information and the large dataset makes a proper interpretation difficult.

It would be helpful if the reader would be able to connect the shown 3-D data with the cloud scene shown in in Fig.2. Maybe it is possible to exclude the more distant 3-D data and introduce some regions of interest, such as individual cloud turrets, that could be marked in Fig.2 and then used in Fig.3 to provide a direct connection. Also, the shown arrows could encode the mean height by an appropriate color code, as done in Fig. 5. This might have the advantage that the reader can estimate the cloud geometry directly.

- Fig.5 gives a nice overview of the techniques capabilities on a large scale. Two points of critique here: First, the figure encodes the height as color, but lacks a legend. Second, the figure shows the dataset over a quite large extent. It might help to add a detail view of a specific region of interest contained in the large-scale view, such as a local two-layer situation.

- Fig 6 and 7 may be combined into one figure as both intend to to show (among others) the challenge of a proper comparison between lidar and stereo data.

Technical Corrections / Suggestions:

- Page 1, line 5:
"...relatively simple installation on an aircraft...“

Maybe simple in case of a dedicated research aircraft, but most probably not in general.

- Page 1, line 7:
„However we will show that to some extent usable wind information can also be recovered.“

More precise (“to some extent”).

- Page 2, line 21:
„...a big advantage when observing moving and changing clouds.“

Maybe better: „…., so that cloud evolution and motion does not affect the 3-D reconstruction.“

- Page 3, line 16:
„For geometric calibration of the camera we use a common approach.“

Which approach? More precise.

- Page 8, line 6:
„After all filtering...“

Delete „all“.

- Page 8, line 8:
„Such a point cloud is shown in figure 5.“

Maybe just put the figure reference at the end of the previous sentence and delete this sentence („...
relative to a point on the earth's surface (figure 5).“)

- Page 8, line 8-10:
„This point cloud can then be used as a starting point...“

Maybe better: „The point cloud can then serve as reference for other distance measurement
techniques...“ (Which?) „ ...or allow for a 3-D surface reconstruction.“

- Page 9/10, line 20/1:
„Generally, there is a good agreement...“

Maybe better:
„The measured distances between the aircraft and clouds as obtained from the WALES lidar and the
stereo method show a good agreement...“ (typical errors?) „… .The automated comparison between
lidar and the stereo method, however, typically includes a significant number of outliers in multi-
layer cloud situations.“

- Page 10, line 27:
„...have been binned in 1 min bins...“

Maybe better: „….have been binned in time intervals of 1 minute…“