Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2016-417-RC3, 2017

Atmospheric Measurement Techniques Discussions

Interactive comment on "Solid hydrometeor classification and riming degree estimation from pictures collected with a Multi-Angle Snowflake Camera" *by* Christophe Praz et al.

Anonymous Referee #3

Received and published: 12 February 2017

Overall a well-conceived and well-written paper that uses machine learning to classify images from a Multi-Angle Snowflake Camera (MASC). Three sets of classification categories are used: 5 hydrometeor types, degree of riming, and whether a particle is melted or not.

A few areas need additional citations:

1) Page 2, Suggest adding reference to previous work on habit classification for optical probe data that used area ratio, the area of the particle divided by the area of the circle that circumscribes the maximum dimension of the particle. Relevant citations are Heymsfield and Parrish 1979; Heymsfield and Kajikawa 1987; Heymsfield and McFarquhar 1996; Heymsfield et al. 2002

2) Page 4, There is another relevant Nurzy′nska et al. paper on shape parameters that needs to be cited, Meteorol. Appl. 20: 257–265 (2013).

Clarifications:

Given the limited depth of field of the MASC cameras, many particles in MASC images are out of focus. This has ramifications for any automated image processing algorithm.

3) Please clarify how in focus (non-blurry) images were determined for both the training set and for the unlabeled MASC data. Do you use some objectively defined in-focus parameter? If so please define it and provide information on the distribution of this parameter for the training set and the unlabeled MASC data.

4) Please clarify what are the specific requirements for input images. Please include how sharp (in focus) do the MASC particle images need to be for the method to be reliable.

5) Please clarify, is the intention and/or requirement that this method is applied to triplets of in-focus images.

6) Regarding the training set (Section 3.2): What criteria were used to select images for the training set. Over how many storms and what range of environmental conditions.

Section 4.5 Comparison with existing classification method. The differences between the instrument output of the MASC (33 um spatial resolution gray scale image) and 2DVD (0.2 mm spatial resolution binary image) as well as large difference in sample size for each 5 min interval (at least 30 non-blurry MASC images to 300 2DVD particles) makes direct comparison problematic. Very close correspondence of classifications is not expected.

7) The small particle classification into ice or rain relies on a temperature measurement. Should temperature be added to the characteristics in the machine learning.

8) Another possible reason for differences is that often ice particles of different classi-

fications reach the surface simultaneously (Stark et al. 2013, MWR). It is possible that 30 MASC classified particles may not be representative of the 300 particles observed by the 2DVD.

9) Rather than showing only the one predominant classification for each 5 min period from 2DVD can the distribution of 1-min classifications be shown. This would provide a more direct comparison to distribution of classifications from MASC images.

10) Page 18, for “temporal dynamics” do you mean “temporal variability”?

I am less concerned than other reviewer about not using fall speed as part of classification. When multiple particles are in one image, the one MASC measured fall speed cannot be clearly attributed to any one or set of those particles. Hence even if future versions of the algorithm use fall speed, it will not be available for individual particles cropped from MASC images with multiple particles.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-417, 2017.