Atmos. Meas. Tech. Discuss., 8, C3566–C3569, 2015
www.atmos-meas-tech-discuss.net/8/C3566/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "From pixels to patches: a cloud classification method based on bag of micro-structures" *by* Q. Li et al.

Q. Li et al.

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Received and published: 27 October 2015

Dear Referee and editor,

Thank you for your comments concerning our manuscript entitled "From pixels to patches: a cloud classification method based on bag of micro-structures". Those comments are all valuable and very helpful for revising and improving our paper. We have studied comments carefully and have made correction which we hope meet with approval. The responses to the comments are as flowing:

General Comment

The authors describe and demonstrate a unique method, BoMS, to classify general

cloud types from total-sky cloud imager (TCI) data. Despite questions regarding the general classes used and the definition of textural measures, the methodology is fairly well described with results reasonably compared to other methods.

Specific Comments

1. Pg 1, Line 22: Clarify the sentence ". . . even contains errors sometimes." Are these "errors" or limitations?

Response: We regard the confusion between thin clouds and earth surface in satellite images as a type of error, and clarify this statement in the next sentence "For example, these images have too low resolution to capture detailed characteristics of local clouds; thin clouds and earth surface are frequently confused in satellite images because of their similar brightness and temperature (Ricciardelli et al., 2008)". As the reviewer points out, we now think it is more moderate to replace "errors" with "limitations".

2. Pg 4: Can textural features be used to represent a "patch" as well?

Response: The patch descriptor used in this work can be replaced by other textural features, such as GLCM, local binary patterns, SIFT etc, but these descriptors may result in different performance. In fact, BoMS is a framework for cloud classification, and its modules (such as patch descriptor, k-means, SVM) can be replaced by other equivalent methods.

3. Bottom of Pg 5: Clarify ". . .1000 independent images per cloud class." How was independence determined? Is the word "image" used here referring to a "patch" within an image?

Response: The word "independence" here means that the selected images do not come from a same sky circumstance, which is defined as a sequence of all-sky images captured in a period of no more than 30 minutes. The word"image" used here refers to an all-sky image, rather than a patch within an image.

4. Pg 6: Cloud classes: Is there no concern for distinguishing cloud altitude? Why is

Cc a cirriform type and not cumuliform? Similarly, wouldn't it be more correct to have Cs in the stratiform class?

Response: We did not consider cloud altitude, and focused on the structure or appearance of cloud images. In our dataset, the cloud images of Cc and Cs display more characteristics of cirriform; in additional, Cc and Cs belong to high clouds as Ci. So we put Cc, Cs and Ci together. Of course, we have to point out that it is far from a perfect solution, because"Linnean" system developed by Howard (1803) is used for surface observers, rather than automatic classification systems. We will explore the configuration of cloud classes according to automatic classification systems, applying some big data technologies, such as unsupervised learning, semi-supervised learning.

5. Bottom of Pg 8: Contrast and the other features can be described as textural features.

Response: Personally, we think contrast can be regarded as a textural feature. For example, contrast is defined an important characteristic in the famous Tamura texture model (Tamura 1978).

6. Bottom of Pg 10: How was the value of k determined for the k-means algorithm?

Response: It is a big challenge of k-means algorithm to automatically determine the parameter k. This parameter is often determined empirically (Huang et al., 2014). We discuss the influence of the parameter K in the section 4.3 of parameter analysis.

7. Did the authors consider feature selection to eliminate redundant and/or irrelevant information within the nine features or was that not a concern?

Response: We did not consider feature selection because of two factors. First, the dimension of the patch descriptor is low. Second, patch descriptors are used to learn the dictionary of micro-structures by k-means algorithm, and the redundancy (if it exist) between the components of a patch descriptor does little harm to the result of clustering.

8. Pg 15: Would other feature types (physical or spectral) assist in discriminating the mixture class from the other classes?

Response: Generally, some other features may be good at discriminating the mixture class from the other classes, but it need more research to find out suitable features. We will investigate this task in future work. To supplement, we have considered cloud coverage in patch descriptor together with the nine features, however the performance of ten features is worse than that of nine features. So we finally discarded this feature in the manuscript.

9. Top of Pg 16: Clarify "verify the leverage".

Response: We will replace "leverage" with "advantage".

10. Bottom of Pg 16: Clarify ". . .results are exciting. . ."

Response: We rewrite this sentence as "the accuracy for most values of patch size s is greater than 86%".

11. Pg 17: Provide units for both axes in Figure 7.

Response: Good suggestion. We will mark the X axis with "pixel" and the Y axis with "%".

12. Check English usage and grammar throughout manuscript.

Response: We will polish the manuscript with the help of a native speaker.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 10213, 2015.