**Atmospheric
Measurement
Techniques**
Open Access
Discussions

Interactive comment on "Bayesian cloud detection for MERIS, AATSR, and their combination" *by* A. Hollstein et al.

A. Hollstein et al.

andre.hollstein@fu-berlin.de

Received and published: 27 February 2015

Dear Referee,

we wish to express our thanks for you work in reviewing this paper. Your comments are very much appreciated and certainly allowed us to improve the quality of the paper.

Please find specific replies to your points in the text below.

With kind regards, A.Hollstein et al.

Referee Comment: The use of reflectance features can be problematic due to the large variation in the magnitude and spectral nature of the surface reflectance. By ignoring surface varia- tions, you essentially optimize for the global mean surface condition (as

C5006

determined in your training data). Does this explain the skill score pattern in Figure 5? Do you see a similar surface-type variation in the false alarm rates?

Authors Reply: In the presented approach, we search for suitable features among the available MERIS and AATSR channels. This includes "reflectance features" (i.e. atmospheric window channels), thermal channels (AATSR, 1.6,3.7,11,12 micrometer), and also radiance measurements located in atmospheric absorption bands (e.g. MERIS Oxygen-A band channels). Although surface reflectance spectra variations are not explicitly included (e.g. trough using external data such as land use maps, spectral libraries, etc.) in the estimation of the background probabilities, they are implicitly included in the background probabilities. The range of possible values of each feature (which can be a single reflectance value) determines the range of bins used for building histograms for the cloudy and non cloudy cases. For a given value of a feature, one can then determine its occurrence probability under cloudy and non-cloudy conditions. As such, there is no optimization for a global mean reflectance and surface variation is not ignored. The skill score pattern from Figure 5 compares a two feature classical Bayesian with the truth data derived from synergy cloud mask data. Reasons of lower reproducibility can be either that the specific Bayesian approach is simply not able to reproduce the truth data (Synergy cloud mask), or e.g. that the truth data is inconsistent, which leads to problems in those areas. While not being sufficient, the areas of low skill score are also areas in which the Synergy Cloud mask shows some problems (mountainous regions, snow and ice cover). We updated the discussion of Figure 5 to make these points more clear. We plan to address this issue in future research which will based on high quality, but lower quantity, manually classified data.

Referee Comment: I understand the pitfalls of relying on ancillary data for stratifying your features; it would seem that no stratification is a big assumption too.

Authors Reply: This paper focuses on the strongly independent Bayesian approach. This shall not imply that in general, auxiliary data should not be used, it was just beyond the scope of this paper. One reason are the properties of the discussed truth data

C5007

(synergy cloud mask), which is also not based on using external data. Exploring this approach makes is only reasonable for truth data of high quality, e.g. from manual classification or from active instruments. We updated the section of the conclusion accordingly.

Referee Comment: 4. Section 7.3: With the fine spatial resolution of these sensors, why no spatial features? They would seem to be more robust than spatial features

Authors Reply: Exploring spatial features was beyond the scope of this paper and were also not feasible with the available truth data. Most of the truth data (the section discusses the reproduction of independent algorithms) is based on the synergy algorithm, which does not include external data and uses no spatial features, and the same argument as above for the inclusion of external data applies here. One needs a large sample of high quality truth data to actually asses the added value of this approach. In this paper we discussed the general approach of Bayesian cloud masking. With truth data of sufficient quality, the discussed methods can be easily extended to spatial features (e.g. following the approach of Merchant et al. (2005)).

Referee Comment: 5. Brightness temperature differences (11-12 micron or 11-3.7 micron) are so common in cloud masks. Did these really not add anything to your feature set?

Authors Reply: The 3.7,11, and 12 micron channels are present in the top results for the Synergy data set, as well as for AATSR alone. We actually do not say that we can not construct a set of features using 11-12 or 11-3.7 which performs worse than the ones we present. We haven't just found none which includes them and perform better. We have also put no restriction on the search space to include these commonly used features. This picture might change if clear sky estimators for these channels were to be included. We updated the discussion of Table 1, 2, and 3 accordingly.

Referee Comment: 6. I think Chris Merchant's Bayesian Mask is also run on AATSR? What would that comparison look like?

C5008

Authors Reply: Within the Cloud CCI (and aerosol) project, it is planed to cross compare the various cloud masks. This is an ongoing task and results might be subject of a future puplication.

Referee Comment: 7. A cloud mask should be judged in the context of its application. What is the applica- tion here? For example, are the SST values computed from the clear-sky mask values of high quality? Is the global cloud amount from this product in line with those from the GEWEX Cloud Assessment?

Authors Reply: Certainly true. A cloud mask for CCI cloud and CCI aerosol can have quite different requirements. This work mainly aims at replacing the synergy cloud mask for the FAME-C (cloud retrieval) algorithms. From there, we aim at better classification for dust, snow, and ice. But again, this is subject to further research. Also, the generation of level 3 products with FAME-C is ongoing and subject to future research. Results from thy synergy cloud mask are in line with the GEWEX Cloud Assessment. We updated section 6 accordingly.

Referee Comment: a. What is the solar zenith angle limit? b. How is glint handled?

Authors Reply: The synergy data product is daytime only,we updated the manuscript accordingly. Glint is not separately discussed in the paper. The synergy dataset already includes a glint flag and such data was not further used.