

Interactive comment on “Global retrieval of ATSR cloud parameters and evaluation (GRAPE): dataset assessment” by A. M. Sayer et al.

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General comments:

The research paper “Global retrieval of ATSR cloud parameter and evaluation (GRAPE) data set assessment” describes the evaluation and assessment of a retrieval scheme for cloud properties. The topic meets the aim and scopes of the journal. The paper is well structured. It clearly describes all methods. Images and tables are in a good quality and support the text well. The article presents many interesting scientific studies and methods. In my opinion the article could be published as it is. I have only some short comments and questions, which could probably strengthen the paper if addressed. I would also like to point to one weak point, which cannot be fixed in the review process of this paper. The article is mainly based on a retrieval, which is not

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published yet. That’s why some of the presented results were often hard to judge and to interpret. Some details I would have been liked to address, especially in chapter 2 and 4, will be supposedly explained in the Poulsen et al. 2010 paper or should be addressed there.

Special comments:

1. Page 25626 bottom line: You use S_x as the covariance matrix of the a-priori x_a . This is not consistent to Rodgers where S_x is used for the solution error covariance. I would recommend to use S_a instead of S_x here and in equation (1).
2. For equation (1) I would recommend to add a short remark that also the forward model uncertainties are stored in S_y , and not only the measurement errors. This is supposedly explained more in detail in the algorithm paper.
3. Chapter 4 shows an interesting study. However, I am wondering how low the CER uncertainties for thin liquid clouds are in Fig5 and 6. Assuming that the information about CER comes mainly from the 1.6-micron channel and considering the typical Nakajima-King image, there is not much information about CER at thin clouds. Thus I would expect much higher values. The fact that CER uncertainty is bigger for thick clouds than for thin clouds is under these considerations hard to understand. However, this is a point, which cannot be discussed without details from the algorithm paper, where the measurement and forward model errors are specified.
4. Figure 2 shows the distribution of the cost for passed and failed convergence tests. Can the distinct land-sea distribution mainly explained by a higher likelihood of multi-layer clouds over oceans? This could be tested with CALIOP and CPR. However, I have some slight doubts about the use of the cost as a general quality parameter of the results, especially the use of fixed thresholds. I agree that the cost is a handy one-number estimate of the retrieval quality. But, it is also a function of S_y and S_a those may be very different for each pixel. I would assume that the global pattern in Fig.2 have no physical reasons, but shows the pattern of different set-up of the retrieval

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parameters. The unrealistic high low-cost partition over Antarctica may be an evidence for it.

5. It would be probably interesting to see if global maps for the solution uncertainty values (the diagonal elements of S_x) for all converged pixels show similar pattern. These uncertainties are much better to interpret than the cost because they have a physical unit and meaning for each state vector element. A high uncertainty in CTP is probably more a sign of multi-layer clouds than a high cost. The correlation between the errors of the state vector elements could be interesting as well. I would be, as an example, very interested in the question if the error in COD is correlated to the error in CTP.

6. Table 7: You recommended not to use multi-layer cloud water path. How can a user know whether a particular pixel is a multi-layer cloud or not?

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