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Atmospheric Measurement Techniques Discussions

Interactive comment on "Application of ground-based hyperspectral imaging to retrieve ice crystal shape and fields of cirrus optical thickness" *by* M. Schäfer et al.

Anonymous Referee #2

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In the paper measurements of a ground-based hyperspectral imaging spectrometer that have been obtained during the CARRIBA project are used to retrieve ice crystal shape and cirrus optical thickness. The instrument calibration as well as the retrieval method are described. Furthermore the sensitivity of the measurements with respect to surface albedo, effective radius, cloud height and ice crystal shape is investigated. The use of hyper-spectral imaging to retrieve ice cloud optical properties is a new promising approach, therefore I recommend to publish the paper in AMT after the revisions proposed below.

Major comments:

I believe that the authors of this study have not used all information which they obtain from the measurements. From the description of the retrieval method it is not clear whether several wavelength are used or whether only one wavelength is fitted to model simulations. The retrieval description is generally not very clear, the authors do not explain, how exactly the fitting to model simulations is done. The retrieval method should be described in more detail.

My major concern is the result of the sensitivity study with respect to effective radius. I can not believe that the resulting optical thickness should not depend on the assumed effective radius. Since optical wavelengths are used for the retrieval, the following relation is valid according to geometrical optics:

$$\tau \propto \frac{IWC}{R_{eff}} \tag{1}$$

Here IWC is the ice water content and R_{eff} the effective radius. IWC is constant (the real IWC in the cloud). If the assumed R_{eff} is two times larger than the real R_{eff}, this would mean that the retrieved optical thickness should be too small by a factor of 2. I recommend to investigate this issue thoroughly before the paper is published in AMT.

Minor comments:

l 83: Please explain "enhanced absorption"

l 307: What is the "Hey" parameterization? This is not mentioned in Yang et al. 2000.

l 327: Please specify the aerosol type more detailed. How is the "maritime aerosol type" defined?

l 382: Why is the 22 degree halo not visible in Fig.9 which includes the scattering angle of 22 degrees?

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Technical corrections:

l 198: perpendicular cloud ... -> insert speed

l 555: quit -> quite

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 1201, 2013.