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Atmospheric Measurement Techniques Discussions

Interactive comment on "Cloud discrimination in probability density functions of limb scattered sunlight measurements" *by* E. N. Normand et al.

Anonymous Referee #1

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This work by Normand et al. addresses cloud detection from measurements by the OSIRIS sensor in limb geometry. The topic is useful and within the scope of AMT. However the publication is mainly subject to improvements: (1) the introduction and the problem setting shall be rewritten, taking into account related work and explaining why are clouds in limb geometry difficult to detect; (2) the theory part must be expanded and clarified, especially with respect to aerosol contamination. If the method can not discriminate aerosols from clouds, then the paper title is misleading; (3) available public datasets (such as CALIPSO and SAGE) could be used for a direct comparison/validation (new figures would be much appreciated).

Specific comments:

Abstract, p 6492, l 10 and ff: the abstract should contain at least one figure about the results achieved in the study.

Sect 1, p 6492, l 20 and ff: the introduction mainly lacks in two aspects: a proper problem setting regarding cloud retrieval in limb geometry is missing and relevant references to previous works too are missing, even if do not address directly clouds. For instance MIPAS (Semhbi et al., Spang et al., 2012) SCIAMACHY (von Savigny et al. 2005, Rozanov et al 2011) where a multi-wavelength color index method is described (SCODA, Eichmann et al, 2010) and the new OMPS (aboard NPP). Additionally also occultation instruments can retrieve informations on clouds (SCIAMACHY again and GOMOS, for instance). When citing Sassen and Cho (p 6493), the grouping of cirrus clouds as function of tau sounds detached from the narrative of the paper.

Sect 2, p 6494 , l 23 and ff: which aerosol models are accounted for in SAKSTRAN? See point (Sect. 3.2) below.

Sect 2.1, Eq (1): I_1 is not defined. I assume it is the direct illumination term. It is not really clear why it should vanish, even if it's explained (line 13 and ff, page 6495) that's because light propagation is not aligned to the satellite line-of-sight. Does this really enforce that no direct sunlight is reaching the sensor?

Sect 2.1: despite the fact that SAKSTRAN is introduced as capable of accounting for multiple scattering and aerosols, this section introduces radiative transfer in single scattering approximation. Some question arise: what happens to the integration term of Eq.(1) (2nd of r.h.s.) when a cloud/aerosol layer is below the tangent point or when the tangent point resides within the scattering layer? Does the approximation still hold or is multiple scattering just proportional to N (number density), stated at line 12, page 6496)? Where does N come from? Is it an a-priori?

Sect. 3.2: the success of the method described in this paper relies on the threshold's choice between cloud/cloud-free conditions. At line 12 (p.6499) it is said that some residual scattering is still present and the mirroring of a gaussian distribution gets rid

of it. As reported by Rozanov et al 2011 (fig. 16), some aerosol models trespass a cloud/aerosol discrimination threshold. It is therefore reasonable to ask whether your method is not overestimating this residual scattering (therefore missing some clouds) or underestimating it (and contaminating the statistics with aerosol). The sentence “the position 2-sigma was found to be a reliable demarkation ...”(line 19, p 6499) has to be justified somehow quantitatively. SAKSTRAN is indeed capable to model both aerosol and clouds. Is it possible to assess this threshold’s sensitivity as function of aerosols, otherwise how can someone be sure that all the following results pertain to clouds only?

Fig.(3b): the second peak is monotonic w.r.t. ROI (height), that is the lower below the local tropopause, the higher the maximum. Why does this happen? Is this an indication of water cloud contamination of your PDF?

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 6491, 2013.