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Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparison of MODIS and VIIRS cloud properties with ARM ground-based observations over Finland" *by* Moa K. Sporre et al.

Anonymous Referee #1

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General Comments to the Authors

The authors present a study that compares ground- and satellite-based retrievals of cloud top heights (CTH) and liquid water path (LWP). The ground-based values are derived from ARM AMF2 instrumentation deployed in Hyytiälä, Finland while the satellite retrievals are taken from Terra and Aqua MODIS Collection 6 (C6) 1-km CTHs, C5.1 and C6 1-km LWPs, and Soumi-NPP VIIRS CTHs. The results contain no surprises for those familiar with such comparisons, except perhaps dramatically smaller differences between ground- and satellite-based LWPs when contrasted to earlier studies. One of the stated goals of the study was to investigate the impact of higher solar zenith angles (SZAs) on the satellite retrievals. The authors find a weak dependence for daytime

MODIS CTH retrievals but I suspect they are really viewing zenith angle dependencies due to the high latitude location. They also find a possible SZA dependence for MODIS C6 LWP. I found the paper to be generally very well written, clear and concise. The figures and tables are appropriate and contribute greatly towards understanding of the results. I am recommending the paper be published with minor revisions that I detail in the specific comments below.

Specific Comments

Line 50: Please mention that there are also fewer bands available for CTH generation on the VIIRS, which has no 15 μm CO2 absorption bands used in the MODIS CO2 slicing method. Line 80: Awkward sentence – I would say "Therefore, care must be taken . . .". Line 89: Aqua's equator crossing time is 13:30, not 10:30. Line 97: I would add that the 5-km CTP data is still available for C6, but the 1-km has been added. I would also state that the 1-km data has been used for the study as I don't recall that it is stated explicitly. Line 101: "altitude" should be "altitudes". I would change the next sentence to read something like this: "Clear sky radiances are subtracted from observed radiances and ratios of these differences are used to retrieve CTP." And the next sentence: ". . . where the ratio of the bands sensitive to clouds at the highest altitudes are tested first." Line 105: NCEP is "National Centers for Environmental Prediction". Line 114: Mention that the apparent lapse rates are only used over ocean scenes. Land scene processing has not changed in C6. Lines 121-122: "uncertainty" should be "uncertainties" and "is:" should be "are:". Line 130: Please define NWC and SAF. Line 133: Please use and define BTD (brightness temperature difference). Line 142: Use "only" instead of "merely". Line 191: I would write, "overpasses, of which 127 passed the . . .". Line 201: Reference needed for 72° SZA value. Line 204: Please state what "dominant" means (> 50% ?). Lines 214-217: These sentences are confusing and possibly incorrect. Could you clarify these? Lines 247-249: As both MODIS CTH methods involve IR data only, I suspect this artifact is really a function of viewing zenith angle (VZA), not SZA. SZA and VZA can be correlated at high latitudes. Perhaps these data come

from higher VZAs where the cloud amounts and CTHs can be inflated with respect to near-nadir values. Line 315: I think you mean overestimated CTHs for low-level clouds and not high-level clouds. Or is it underestimating high-level clouds? Please correct.

References There are three missing references: IPCC 2013, Petäjä 2013, and Liljegren 1999

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