Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-370-RC2, 2020

Atmospheric Measurement Techniques Discussions

Interactive comment on "Increasing the spatial resolution of cloud property retrievals from Meteosat SEVIRI by use of its high-resolution visible channel: implementation and examples" *by* Hartwig Deneke et al.

Anonymous Referee #2

Received and published: 21 December 2020

This paper describes a methodology to use the high-resolution visible (HRV) channel (1km resolution at nadir) on MSG SEVIRI to increase the spatial resolution of the standard cloud optical property retrievals (primarily optical thickness) from the 3km channels. The authors further show a brief comparison of optical thickness retrievals with those from Terra MODIS C6.1, and demonstrate the usefulness of the higher resolution retrievals in two applications, namely identification of convective initiation and calculations of surface solar irradiance. Both applications of SEVIRI cloud products are shown to improve with use of the HRV channel.

Printer-friendly version

Discussion paper

The focus of the paper isn't necessarily on the details of the approach itself, however, as these can be found in previous papers by the authors, nor on a thorough evaluation of the approach, which apparently can be found in a companion paper to this one. Rather, this paper simply seems geared towards demonstrating the potential of the HRV retrievals to improve applications of the SEVIRI cloud products. This is a useful goal. That said, the examples shown are more on an "operations" side rather than climate, so it's not clear how relevant such an approach will be beyond the lifetime of MSG given the approaching launch of MTG whose spatial resolution is an improvement even over the SEVIRI HRV. Moreover, while the authors claim applicability to the new advanced GEO imagers like GOES-R ABI and MTG FCI, it's not clear to me that a sophisticated approach like this one, essentially "pan-sharpening" coarser resolution narrowband VIS/NIR channels with a high resolution broader-band channel, is necessary since the high resolution VIS/NIR channels on those advanced imagers can likely be used directly to retrieve cloud optical properties. The authors do briefly mention facilitating a merged MSG/MTG climate data record in the last paragraph of the conclusion, but more in passing than anything else. In my opinion, the authors need to make a better case for the long-term usefulness of this approach, otherwise this may be viewed as just a novelty approach for MSG SEVIRI that might soon be obsolete. It's a well-written paper, though, and I think the case can be made, so I highly encourage the authors to give it some thought.

Comments

Page 2, line 18: Semantics here, but cloud products include more than just the optical properties listed.

Page 2, line 19: Please also add the more recent MODIS C6 paper (Platnick, S., Meyer, K. G., King, M. D., Wind, G., Amarasinghe, N., Marchant, B., et al. (2016). The MODIS Cloud Optical and Microphysical Products: Collection 6 Updates and Examples From Terra and Aqua. IEEE Transactions on Geoscience and Remote Sensing, 55(1), 502–525. http://doi.org/10.1109/TGRS.2016.2610522).

Page 2, line 20: In addition to biases and uncertainties, such effects can cause increased retrieval failures as well. See Cho, H.-M., Zhang, Z., Meyer, K., Lebsock, M., Platnick, S., Ackerman, A. S., et al. (2015). Frequency and causes of failed MODIS cloud property retrievals for liquid phase clouds over global oceans. Journal of Geophysical Research: Atmospheres, 120(9), 4132–4154. http://doi.org/10.1002/2015JD023161.

Page 2, lines 22-24: This mention of cloud droplet number concentration is unexpected here and not tied in to the rest of the paper. In fact, it's only mentioned here and somewhat offhand in the conclusion. It's thus a little irrelevant to this work.

Page 4, line 31: I assume the correction factors derived against MODIS account for spectral response differences?

Page 6, lines 21-22: Some more details on the phase algorithm would be nice here (e.g., how you get from the cloud types to thermodynamic phase), but it apparently doesn't play much role later in the paper so I'll leave it to the authors.

Page 6, lines 24-25: Since you're comparing retrievals to MODIS later on, the reader is left to assume that the single-scattering properties used here are consistent with the MODIS products. This of course is highly relevant to understanding the comparison. Please clarify.

Page 6, lines 28-29: Only radiometric uncertainty is accounted for? What about other error sources, such as ancillary data, forward models, etc.?

Page 7, line 32: I assume the second mention of CAMS in this sentence should actually refer to ECMWF, as in the previous sentence?

Fig. 5 and text on page 10, lines 21-29: Some sort of RGB would be useful to help interpret these optical thickness images. Also, do you mean nearest-neighbor sampling rather than interpolation? If interpolation, why is that necessary if you're only showing side-by-side image comparisons and scene statistics (histograms in Fig. 6) rather

than pixel-to-pixel comparisons? You might be smoothing the optical thickness field by interpolating, which may be a factor in the HRV retrievals seemingly being lower than MODIS (confirmed by the histograms in Fig. 6).

Page 10, lines 31-32: This is hard to tell from the color scheme in the histogram plot in Fig. 6, but it looks like the issue is only with too few optically thick clouds rather than too few optically thin.

Page 11, lines 3-8: The pixel sizes between MODIS and SEVIRI likely are different in this scene, though maybe not as different as you might think depending on where in the MODIS swath this region is – MODIS pixels grow to about 2x5km at the edge of swath. Also, you mention possible differences in algorithms, sensor calibration, and view geometry. Can you define what algorithm differences might cause retrieval differences? Sensor calibration differences are possible, though you mention earlier that SEVIRI observations have had correction factors applied that were derived against MODIS. Also, the angular differences may indeed be playing a role given the angular dependence of cloud reflection – what part of the scattering angle space are MODIS and SEVIRI sampling in this scene?

Page 11, lines 8-10: Could these differences in coverage be linked to differences in cloud mask results, with MODIS finding less clouds? A cloud mask plot would be illuminating. If not the cloud mask, then retrieval failures in MODIS are likely playing a role. You can verify this by looking at the Retrieval Failure Metric in the MOD06 files, which would also give you an estimate of what look-up table grid point optical thickness is closest to the out-of-solution space observation.

Page 11, line 18: I guess it isn't a surprise that effective radius retrievals do not improve, since, if I understand correctly, the only improvement would be due to the higher-resolution VIS/NIR reflectance changes aliasing into the effective radius retrievals due to the non-orthogonal solution space.

Page 12, lines 28-29: Why do you need to interpolate the standard retrievals to the HRV

grid for Fig. 8? This isn't a pixel-to-pixel comparison, so why not leave the retrievals at their native resolution for the statistics?

Page 12, lines 33-34: While the cloud optical thickness signature does appear earlier in the HRV retrievals, it's not clear in this discussion whether or not optical thickness is actually used in CI detection schemes. So it's hard to tell how relevant this improvement is.

Page 16, lines 3-5; lines 26-27: I don't think you would need this type of sophisticated approach for the GOES-R series, MTG FCI, or MODIS and VIIRS, since the highest resolution VIS/NIR channels can be used directly to retrieve cloud optical thickness, a different approach I think than that taken here.

Page 16, lines 27-30: This mention of climate applications makes the best case for the ongoing relevance of this sharpening approach, since I think it becomes obsolete with the new MTG FCI. The authors only showed operational applications that are undertaken in real time, rather than retrospective, so how useful this approach is in the future is unclear.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-370, 2020.

Printer-friendly version

Discussion paper