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Interactive Comment

# *Interactive comment on* "Operational climate monitoring from space: the EUMETSAT satellite application facility on climate monitoring (CM-SAF)" *by* J. Schulz et al.

**J. Schulz et al.**

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### General comments

We thank reviewer 2 for the very positive and constructive review. The paper has been revised attempting to take into account all the comments raised by reviewer 2.

### Answers to specific comments of reviewer 2

*Positive aspects of the work that need to be underscored are: -The systematic care for a homogenous and qualify calibration which, although very technical work, is the major step towards the production of long series. - The systematic care for evaluation* *of the final product which convey an 8220;error bar8221; to the end users - The strong willingness to back-process and reprocess the data as the calibration and algorithm improves to deliver a useful long series of geophysical retrieved parameters.*

*Miscellaneous points*

*-With respect to the validation of the cloud products, there are no mention of the possibility brought recently by the space borne lidar (GLASS, CALIOP,..) and radar (Cloudsat). Would it be possible for the author to comment on the use of other satellite instruments as a complementary way to evaluate their products?*

This is certainly a relevant comment and we have added a statement concerning the validation of CM-SAF cloud products employing the new instruments. On the basis of case studies, we compared the CM-SAF results with results derived from Moderate Resolution Imaging Spectrometer (MODIS) and from Cloud-Aerosol LIDAR with Orthogonal Polarization (CALIOP) observations. Results for cloud fraction from CM-SAF agree well with synoptic data and MODIS data over midlatitudes but underestimate the cloud coverage over the tropics and overestimate the cloudiness towards the edges of the visible earth disk.

Actually, CM-SAF is publishing a paper in Journal Applied Meteorology and Climatology on a comparison of CM-SAF cloud products to CALIOP observations. The comparisons to MODIS are operationally performed at CM-SAF and the results are published in the CM-SAF Annual Validation Report (accessible at www.cmsaf.eu).

*-Krigging is used in the ATOVS water vapour retrieval which is not 8220;classical 8221; for these filling gaps in the retrieval of this variable (see for instance NVAP approach). Could it be possible to comment on what this technique brings in with respect to simple average ? to assimilation for instance? Is the error of the Krigging small enough to*



ACPD

8, S9921–S9926, 2008

Interactive Comment

*constrain analyzed water vapour quantity like ERA40, NCEP-rel and II ?*

The spatial sampling of satellite-derived parameters is often performed on a regular latitude/longitude grid, sinusoidal, or other projections. The temporal gridding of CDRs is typically daily, monthly, and hourly. Commonly, each CDR-value is calculated by (arithmetic) averaging all single measurements falling in its spatiotemporal grid box. Error margins of such averaged quantities are often either not available or derived globally from validation studies only. Sampling information related to averaged values is usually not provided although available in principle. Thus, each averaged value is simply interpreted as the true mean value of the measured quantity within the spatiotemporal grid box.

A large natural variability will cause a large number of single measurements needed for a reliable estimation of the true mean value. The used objective analysis (Kriging) provides errors related to the actual variability, i.e., the number of independent satellite observations is more or less fixed (each overpass is considered as independent observation) and the resulting Kriging error is larger in places where the actual number of observations does represent this variability well.

If the derived errors are small enough to constrain model-based reanalysis is an interesting question but is not easy to answer. Currently, we provide error fields only related to the variability, retrieval errors are not accounted for because they are not available from the retrieval scheme. We expect that this would further increase the error. However, we plan for an extension of our error analysis to include retrieval errors. Additionally, we plan for comprehensive comparisons to reanalysis data especially considering the representation of variability in different regions.

*-The radiosondes are used for the validation of the precipitable water for which the uncertainty is not mentioned. What is the accuracy of the radiosondes for such*



ACPD

8, S9921–S9926, 2008

Interactive Comment

*products? Over Europe? Over Africa? Over the other part of the world? What about the RS biases?*

We agree that we were not very concise on this point. The quality of radiosonde observations considerably varies among the different stations. Different calibration procedures and various ages of radiosondes can influence the quality of the measurements. The latter issue can have a large effect on the bias of relative humidity observations as shown by Miloshevich et al. (2005). They further analyse the dry bias of relative humidity observations and found a temperature depend bias ranging from -4 to -10of ice saturation the bias largely increases. It is unclear which stations apply the proposed correction algorithm of Miloshevich et al. (2005) in their routine observations as this is not part of the available radiosonde meta data. A comparable correction procedure was proposed by Leiterer et al. (2005) and applied to radiosonde observations in Lindenberg, Germany. Lindenberg is part of the GCOS Reference Upper-Air Network (GRUAN), a subset of GUAN. GRUAN is required to measure temperature and humidity profiles with an accuracy of 0.1-0.2 K and 2radiosonde observations distributed over the GTS does not have this quality.

We added a similar statement in the updated manuscript.

Leiterer, U., H. Dier, D. Nagel, T. Naebert, D. Althausen, K. Franke, A. Kats, and F. Wagner, 2005: Correction method for RS80-A Humicap humidity profiles and their validation by Lidar backscattering profiles in tropical cirrus clouds. J. Atm. Oceanic Tech., 22, 18-29.

Miloshevich, L. M. Paukkunen, H. Vömel, and S. J. Oltmans, 2004: Development and validation of a time-lag correction for Vaisala radiosondes humidity measurements. J. Atm. Oceanic Tech., 21, 1305-1327.

*-The TOA flux are said to be useful at short time step to evaluate global models at the time step basis. I think this statement deserves some explanation because it is not ob-*



**ACPD**

8, S9921–S9926, 2008

Interactive Comment

*vious at all. Referring to some papers might be here well suited (e.g., Allan et al., 2007)*

The radiative fluxes at the top of the atmosphere depend mainly on the presence of clouds, while cloud information is not directly assimilated into atmospheric models. The comparison of the radiative fluxes as calculated by the model and as measured from satellites provides a quality control of the model cloud parameterizations and/or the model cloud radiative properties, see Allan et al., 2007. This explanation is added, including the reference to the Allan paper to the revised version.

*-It seems that no clear sky flux products nor CRF is build. Is this correct ? Can the authors expand a bit of the CRF (why they do not produce such a parameter? Etc8230;)*

The CRF at the top of the atmosphere is indeed an interesting product which is planned for inclusion in the CM-SAF product suite until 2012. It is a derived product based on the existing basic products of the radiative fluxes at the top of the atmosphere and of the cloud properties. First the basic products had to be well established before the derived product is tackled.

*-what about the validation of the OLR product ? How does it compare with other OLR products (CERES, NOAA-OLR,etc..)*

We compared GERB on Meteosat 8 with all active CERES instruments. There were four active CERES instruments up to March 2005, three active CERES instruments from March 2005 onwards. For the thermal emitted flux, also referred to as Outgoing Longwave Radiation (OLR), GERB is 1-2 CERES. For the reflected solar flux, GERB is 6 CERES. The latest analysis of the reflected solar radiance GERB CERES differences indicates that they are independent of scene type, therefore they can be



ACPD

8, S9921–S9926, 2008

considered as a basic calibration difference. For the CM-SAF radiative fluxes (both emitted thermal and reflected solar), the GERB calibration level is used. For the CM-SAF, the GERB and CERES radiances are within acceptable agreement, i.e., within postulated error margins. The validation results in 3.3.2 have been rephrased to indicate the comparison results with the CERES OLR more clearly. No comparison with the NOAA-OLR has been done.

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 8517, 2008.



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8, S9921–S9926, 2008

Interactive Comment