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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #3

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Comments on: Operational climate monitoring from space: The EUMETSAT satellite application facility on climate monitoring (CM-SAF) Author(s): J. Schulz, and THE CM-SAF TEAM

Reviewer

3 July 2008

1 Over all

Strictly this is not a scientific paper, but a presentation of some newly available data. That said, it is highly relevant to the atmospheric and geoscience community. And it have been a pleasure to read about all the added possibilities. It appears that this service provides a considerably lift of the quality, as well as of the spatial and/or temporal coverage of a long line of relevant parameters.

1.0.0.1 The paper, in general, reflects high quality and clearly demonstrates the authors vast experience with the subject, and thorough knowledge about the data presented in particular.

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Interactive Discussion

Discussion Paper

1.0.0.2 Given the large number of different satellite- and other data, going in to this SAF and the impressively many products coming out, it would help this reader if you could provide an graphical overview. Was it possible to generate a flowchart-like diagram of the information flow, from sensor, through various interdependent algorithms and sub-products, to the suite of released products.

1.0.0.3 Similarly, it would be nice if you could think up a way to illustrate the combined spatial-temporal coverage of the different products.

1.0.0.4 You talk a lot about 'CDRs', 'Reprocessed CDRs' and 'A third class of CDRs' in the beginning of the paper, but never returns to these concepts as you go through all the services. How are the various types of CDRs relevant, how are they varying across the services?

1.0.0.5 The structure of the paper is not immediately clear, e.g. both paragraph 3.1.2 and 3.2.1 are called 'Validation' and are immediately followed by subparagraph called 'ATOVS products'. Could this be restructured to create a more logical structure in the paper.

2 Abstract

> Products based on intercalibrated radiance data can also be used for climate variability analysis up to inter-annual scale.

Though explained later, in some detail, it is quite unclear at this point, how exactly this 'usability' emerges. Instrument drift might spring to mind, but is not mentioned. The

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fact that you reefer to these data being of a more trustworthy nature than the latter, is far from clear at this point.

3 Introduction

> Existing satellites, especially the operational meteorological satellites, now provide sufficiently long data series for climate analysis.

The term 'sufficiently long data series' is ambiguous. Please make a reference to where this is specified and justified in more exact details.

4 Background and objectives

> 8211; CDRs for operational climate monitoring are constructed from so called Environmental Data Records (EDR).

Though the connection emerges, gradually, from reading on, a short introduction to EDR, CDR, and related concepts would increase the readability of this section, and the rest of the paper.

> This should at least include inter satellite homogenisation and frozen algorithms for the production of the data set.

I assume 'frozen' means something like: Not to be changed? The word is used at least one other time in your 'sum-up and perspective' section towards the end of the paper.

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5 Products, retrieval schemes and validation

> 8211; Humidity products: Total (HTW) and layered (HLW) precipitable water, mean temperature, and relative humidity for 5 layers as well as specific humidity and temperature at the six layer boundaries (HSH).

It is not clear what 5 (and six) layers this refer to.

> Although cloud products and surface radiation fluxes are derived independently from AVHRR and SEVIRI radiances, merged products are optionally provided for selected radiation fluxes. A simple linear interpolation method is applied ...

Since these sensors are on different platforms (NOAA respectively MSG) what are the accuracy loss in this operation? To what extent are the georeferencing a challenge? What about the different spatial resolution, what methods are used to overlay the data in a reasonable manner?

5.1 Retrieval

> Since we also provide cloud-top temperature and cloud-top height there is some impact from analysis data of numerical weather prediction models ...

Who are 'we' and who are the others? What exactly impacts what here?

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5.2 Validation, e.i. 3.1.2

> Furthermore, the SEVIRI-based retrieval overestimates the cloudiness at large observation angles while the opposite effect is observed over the tropical belt where observations are made in near-nadir viewing mode.

Where (what latitude?) do the mode shift? What consequences do this have, in general, and in particularly in the region near the 'shift'?

5.3 ATOVS product, in 3.2

> The needed first guess for such an retrieval can be provided by a statistical regression retrieval or a NWP first guess field.

How sensitive is the profiles of temperature and mixing ratio to this 'initial guess', and what end-products and -services are effected by this inaccuracy?

5.4 ATOVS product and SSM/I product, both in 3.2

> An optimal interpolation method (Kriging) is applied that provides a spatial distribution of mean values and their errors.

> Kriging method is also used to combine the SSM/I measurements in an optimal way.

This is not clear. Kriging as a method, usually associated with geostatistics, to interpolate a value of a field at an unobserved location from observations of the fields value

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at nearby locations. It usually works with one field. Optimal Interpolation is a type of data assimilation (others being: Kalman filtering, 3D- and 4D-var) It is often used to adjust a field (often a model generated field), based on independent measurements at specific locations within the fields spatial coverage (often reference measurements). If you intent to, indirectly, say that IO and Kriging is mathematical identical a reference would bee needed.

5.5 ATOVS product, in 3.2.1

> Note that a comparison to radiosonde data is more or less equivalent to a comparison of the products performance over land surfaces. Over ocean better results are expected because also the microwave instruments contribute to the product whereas over land it is mainly a HIRS product supported by the first guess of the retrieval. Additionally, the comparison is also slightly biased to the northern hemisphere as 56% of the GUAN stations are located there. On the southern hemisphere about 10% of the stations are located near the coast of Antarctica which is a very difficult environment for the satellite product.

Basically the validation is only really possible over northern hemispheric land, and here the products are performing well. Alternatively to captive the graph 'Global comparison...' was it perhaps possible to separate the ocean and Antarctic measurements with different markers on the graph, to emphasis the quality of the product.

> As an example Fig. 5 shows a scatter plot for October 2004 indicating a very high correlation (0.94) between both data sets.

Two things: 1) 'correlation (0.94)' is a somewhat loose term. If that is the 'Pearson product-moment correlation coefficient', which accordingly is referred as 'r' on the

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graph, this might be noted. 2) 'between both data sets' is assumed to be read 'between the two data sets' or are there more than one comparison illustrated in this graph?

> There is a slight tendency of higher biases in the northern hemisphere winter months that might be caused by less cloud free measurements over land.

Are there less clouds over land, during the winter, than during the summer? Most likely yes, but a reference would be nice.

> The GME model input used as background and first guess constrains the retrieval results more strongly in the lowest atmosphere.

The word 'background' is unclear at this point... Is it 'filling in' where satellite data are absent?

5.6 Top of atmosphere radiation fluxes

Throughout this chapter the terms 'shortwave', 'longwave', 'narrow-' and 'broadband' are used. Could you please give a formal definition (cut off frequencies) for each of them. If it is the same throughout the text a formal introduction is preferable, otherwise the definition should appear whenever appropriate.

5.7 Top of atmosphere radiation fluxes / Retrieval

> Example products are shown in Fig. 6 where the monthly mean top of atmosphere thermal emitted flux and the solar reflected flux are given for June 2007.

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In several places, e.g. on the coast of Africa (lat. 0..10, lon. -15..10) it seems that reflected solar radiation over land ans ocean are about the same. In other places, e.g. around Saudi Arabia (lat. 10..30, lon. 30..60) the coast seem to have significant influence on the signal. Could you please elaborate a bit on this, is it pure coincidence, a real atmospheric phenomena or an artifact of the selected method?

5.8 Incoming solar radiation

> It uses the well-known relationship between the broadband atmospheric transmittance and the reflectance at the top of atmosphere

A reference would be appropriate.

> The relation between the solar irradiance and the top of atmosphere albedo is pre-calculated and saved in look-up tables for a manyfold of atmospheric states and surface albedos.

How manyfold? How many different 'states' and 'albedos' is the table entry characterized by? What are the criteria of these 'states'?

5.9 Downwelling longwave radiation

> The parametrization requires the temperature profile of the lowest layers of the atmosphere, ...

The temperature profile of, especially the lowest part, of the atmosphere is known for being dificult to estimate accurately from remote sensing. How is this accuracy here, Compared to other parts of your data, is that an insignificant problem?

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> The outgoing longwave flux at surface level is obtained from the Stefan-Boltzmann equation and a surface emissivity that depends on the surface type

How many different, and which, 'surface types' do this include.

5.10 Surface albedo

> Viewing and illumination conditions are corrected employing bidirectional reflectance distribution functions for different surface types.

Again. How many different, and which, 'surface types' do you include in your BDRF calculations.

5.11 Product examples

> Two other product examples, monthly mean results of September 2007 of the surface albedo and the surface radiation budget based on METEOSAT-9/SEVIRI observations are shown in Figs. 8 and 9, respectively.

Could you please, in the same good way, give examples of use for these products.

6 Summary and future perspectives

> Climate change and variation occur on different time scales and data sets useful for climate monitoring must therefore cover longer time series to un-

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> derstand these changes. The demands on the accuracy increase accordingly to the time scales considered. Today the existing CM-SAF data sets are suitable for monitoring diurnal and subseasonal to seasonal fluctuations of environmental variables which can be large.
>
> At the seasonal to interannual time scale the accuracy requirements increase dramatically because climate phenomena at this scale are initiated by very small changes in the observed parameters. At decennial to centennial time scales which are exclusively suitable for trend detection the accuracy of data sets must be one order of magnitude higher than compared to the needs of detecting interannual fluctuations.

This is a very important, and here very well explained, background for much of the other argumentation in this paper. Is it possibly to move this to the introduction, rather then have it in the perspectives.

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