climate change initiative

→ CMUG NEWSLETTER

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CMUG Highlights

The "Climate Modelling User Group" (CMUG) – a consortium of Met Office, MétéoFrance, ECMWF and MPI-M – established by the European Space Agency (ESA) within their Climate Change Initiative (CCI) programme, has made progress in delivering assessments of Essential Climate Variables (ECVs), as well as technical advice on the use of uncertainties and the role of reanalysis products in the production and assessment of Climate Data Records (CDRs). Visit the CMUG website at: http://www.esa-cmug-cci.org/ for the latest news.

In this issue:

"Terrestrial satellite records for climate studies: how long is long enough? A test case for the Sahel" – A. Loew (MPI-M)

Image from: http://www.listofimages.com

Satellite data records have now reached an appropriate length (>30 years) to allow for investigation into climate phenomena on decadal timescales. However, varying lengths or gaps within the data are likely to affect results obtained from the analysis of satellite data records. This study aims to address the impact of these issues on climate analysis, with a focus on the prolonged Sahelian drought and rainfall variability in recent decades.

Beginning in the 1960s and persisting until the end of the twentieth century, negative precipitation anomalies were observed over the Sahel, with an observed minimum around 1980. This drought has been the largest climate anomaly observed through the use of satellite observations.

However, until now no assessment has been performed to address the impacts of observational record length and the presence of missing data on long term trends inferred from satellite data. This study provides a first look at these issues with respect to the Sahelian drought.

Results and Conclusions

Overall, this study highlights a level of sensitivity to the length of data records and data gaps in trends and correlations derived from ECV data records over the Sahel region. This sensitivity may differ for other regional examples, depending on the occurrence and persistence of observed climate anomalies. By emphasizing the importance of each single observation for the purpose of climate studies, this work makes the case for continuous climate observations from space.

Through temporal linear correlation analysis of ECV satellite data products, including monthly mean observations of NDVI, surface albedo, precipitation and ocean indices, this study provides a different perspective on the robustness of analysis performed using satellite observations. It found that derived relationships between different ECVs are sensitive to small gaps in the data time series, which could either dampen or amplify calculated correlations between terrestrial ECVs and global SST indices for the Sahel region. The length of time period chosen for analysis also has a strong impact on long-term trends and interactions between ECVs, and therefore a definitive answer on the required length of an ECV record for any given region cannot be specified. The terrestrial ECVs chosen for analysis are shown to be of sufficient length to detect multidecadal trends in Sahelian NDVI and surface albedo dynamics, however the robustness of these trends is weak, and subsequent results from multidecadal trend analysis should be treated with caution.

Full paper is linked in the News section on the homepage of the CMUG website. Reference: Loew, A. (2013). Terrestrial satellite records for climate studies: how long is long enough? A test case for the Sahel. *Theor. Appl. Climatol.*, DOI 10.1007/s00704-013-0880-6.

Recent CMUG research results

Across ECV assessment – fire/soil moisture/land cover [Technical note D3.1_C]

This CMUG deliverable investigates the potential relationship between soil moisture, burned area and land cover for assessing the occurrence of fire, while using new satellite observational datasets. By using the MPI-M ESM land surface vegetation model (JSBACH), in conjunction with a fire model (SPITFIRE), the relationship between soil moisture and burned area (i.e. moisture and fuel availability limitations) derived from observational datasets are accurately reproduced in model simulations, providing a valuable tool for the evaluation of global fire models.

The use of uncertainties in models and reanalyses [Technical note D3.3]

A key requirement of new CDRs produced by the CCI is to include associated uncertainties with each observational measurement. This CMUG deliverable describes how these uncertainties will be used by the climate modelling and reanalysis communities to inform data providers how to include descriptions of uncertainties with their datasets. Information on climate model performance can be gained through assessing uncertainties in observational data to infer the plausibility of model results, such that model output lies within a range of observational uncertainty. This study highlights principal uses of observational uncertainties to constrain climate modelling and reanalysis products.

The role of reanalysis in the production and quality assessment of CDRs [Technical note D3.4]

This CMUG deliverable highlights the value of reanalysis products in the generation and assessment of CDRs (Climate Data Records) to be used for climate studies. By describing in detail the process of developing a reanalysis, this report stresses the key uses of reanalyses in the production of CDRs and climate modelling studies (i.e. used to produce auxiliary information or as CDRs themselves), as well as their associated limitations and uncertainties. The value of reanalysis as a tool for quality assessment of independent observational data is also highlighted, with emphasis on low-frequency (multi-year) variability.

ECMWF climate monitoring database facility [Technical note D3.5]

For this CMUG deliverable, the status of the Climate Monitoring Facility (CMF) developed within ECMWF is described, providing information on the relevance of the CMF in performing assessments of CCI products from the perspective of the reanalysis community, as well as details on user interfaces and implementation of visualisation tools. This report provides valuable insight to the workings of the first version of the CMF.

Reports listed above are available on the CMUG website: http://www.esa-cmug-cci.org

ECV assessment – Ozone/Aerosol/Soil Moisture [Technical note D3.1_D]

This report highlights the use of the Climate Monitoring Facility (CMF) developed by ECMWF to provide assessments of the CCI ozone, aerosol and soil moisture datasets. Monthly means of the different ECVs are compared with equivalent fields from several available reanalyses. An example of the use of the CMF for the time series of global mean total column ozone from the CCI dataset and 3 different reanalyses is shown in Fig. 1 where the MACC reanalyses are closer to the CCI data than the ERA-Interim or Japanese Reanalysis (JRA-25). After analysis of the three CCI datasets the following conclusions were made:

- There are 2 sudden discontinuities in the global total column ozone time series (spring 1997 and summer 2002) which early investigation suggests might be related to exceptional ozone changes at high latitudes.
- Assimilation of the CCI total column ozone and ozone profiles from the limb instruments could potentially improve the ozone field in the successor to ERA-Interim.
- The three CCI aerosol datasets assessed against reanalyses showed that the Swansea University aerosol optical depth product (AOD) gave the best overall agreement at the shortest wavelengths and over the oceans, while the FMI AOD at the longest wavelengths and over land.
- The level 3 CCI soil moisture was compared with ERA-Interim, ERA-Land and MERRA-Land. The merged CCI product had poor homogeneity in time because of changes in the observing system.
- The variability of the CCI soil moisture data in a grid square was much higher than in the reanalyses and strongly dependent on the instrument making the measurements.

More details of the assessments are provided in the report which will soon be available on the CMUG web site.

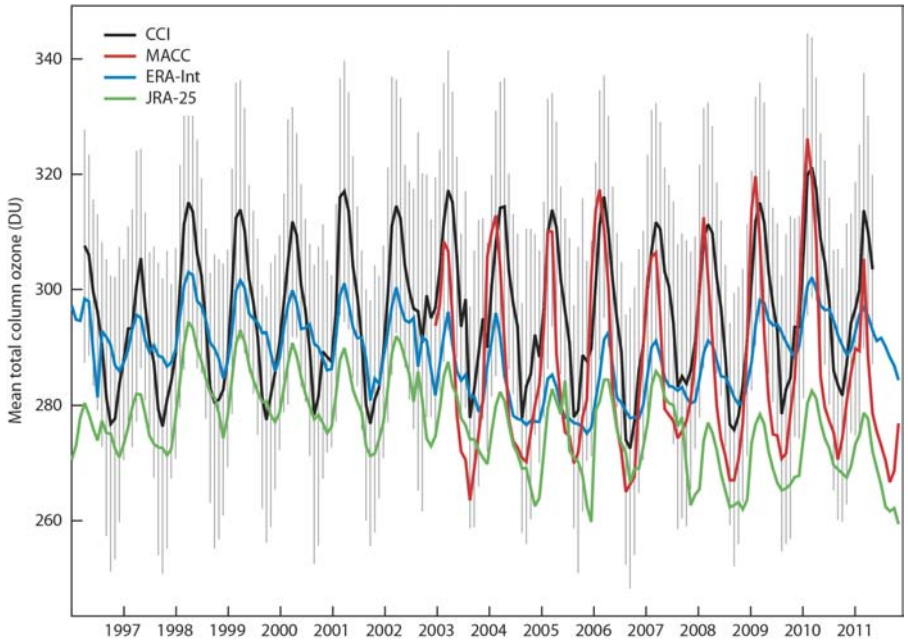

Fig 1: Time series of the global mean monthly mean TCO_3 from Ozone-CCI (black), ERA-Interim (blue), MACC (red) and JRA-25 (green). The vertical bars over-plotted to the CCI data are the standard deviations in a grid square. Data are in Dobson Units.

Third CCI CMUG Project Integration Meeting, 3-5 June 2013 at MPI-M, Hamburg, Germany.

In June 2013, the Max Planck Institute for Meteorology (MPI-M) – a CMUG consortium partner – hosted the third CCI CMUG project integration meeting for presentation of preliminary assessments of CCI datasets and high level forward scoping of CCI potential in the context of current and future challenges faced by climate research. The meeting included three key note science presentations, and provided CMUG the opportunity to present results of relevance to climate modellers and researchers from its work on precursor, preliminary and Phase 1 CCI datasets.

Meeting aims

The primary aims of the integration meeting were:

- To review CCI progress and current status
- To assess the preliminary CCI datasets
- To scope ideas for Phase 2 of CCI
- To consolidate links to external agents

Key note presentations

Three invited experts gave key note presentations on the science challenges that are currently facing climate research.

- David Lary (University of Texas) presented on Long Term Datasets: Talked about separating out representative uncertainty from instrument uncertainty. Use machine learning when our understanding is incomplete and there are no adequate or complete theoretical models
- Colin Jones (SMHI) spoke about Earth System Models (ESMs) and the role of observations in ESM simulations, with emphasis on the need for thorough understanding of Earth system processes for use in constraining climate models. The biggest uncertainty is the response of clouds to a changing climate.
- Sonia Seneviratne (ETH) presented on the importance of soil moisture as a key parameter in understanding the climate system, water cycle and carbon cycle.

Meeting content

The remainder of the three-day meeting focussed on updates from the ECV teams on achievements, and CMUG's dataset assessment activities. It was noted that CMUG evaluations of preliminary CCI datasets have highlighted areas of improvement in some cases, but also demonstrated potential application areas to climate models.

To allow for free form discussion and brainstorming, two parallel breakout groups were held, focusing on furthering the exploitation of CCI results. Within the Climate Research Group breakout session, it was noted that better links between CMUG and CRGs will improve Climate Data Records (CDRs) for climate research, that best practices for uncertainty assessment within datasets is vital, as well as the need for validation of ECVs using in-situ data.

Lastly, ESA presented on the status and preparations for Phase 2 of the CCI. It was stressed that climate assessments, and hence the work of CMUG, will be an integral part of each ECV proposal in Phase 2. With more data production planned for phase 2, interaction with CMUG will need to continue and strengthen, so as to reach a broader user community beyond research, such as climate services. The interface of the CCI datasets to the proposed Copernicus climate service will need to be defined in phase 2.

The MPI-M office in Hamburg, Germany: venue for the third CCI project integration meeting

Presenting CMUG results to the climate research community

CMUG research results relevant to the climate modelling and research community can be seen at the following events over coming months:

10-11 Sept 2013	ESA Living Planet	Edinburgh
16-20 Sept 2013	EUMETSAT and American Met. Soc	Vienna
15-16 Oct 2013	SPECS General Assembly (invitation only)	Netherlands

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