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DOCUMENT

Fifth CCI Colocation Meeting Report

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1 SCOPE

This document summarises the outcomes of the Fifth Colocation meeting of the ESA Climate Change Initiative, held at ESRIN, Frascati, Italy on the 20th to 22nd October 2014.

The colocation meeting brought together representatives of all fourteen CCI project teams as well as members from the new project, Ice Sheets Antarctica, starting in early 2015. The main focus of this colocation meeting was to assess the steps needed to make the ECVs operational. Therefore several of the Copernicus services were also invited as potential key users of CCI data.

The output of the colocation meeting is recorded within this report as a collective assessment of the status of the CCI and a series of key actions, as formulated by the colocation participants, drawing upon the collective expertise of all CCI project teams.

This report is intended to assist the CCI teams to pursue their projects and generate operational ECV data products in a consistent manner during Phase 2, as explicitly required by GCOS.

2 INTRODUCTION

The CCI programme objectives and scope are described in the document, "ESA Climate Change Initiative: Description [EOP-SEP/TN/0030-09/SP]".

The work to be carried out on each ECV is specified in the Statement of Work for the CCI, "ESA Climate Change Initiative Phase 2 Statement of Work" [CCI-PRGM-EOPS-SW-12-0012].

The project scope and team composition for each of these projects is described in the document "ESA CCI Projects Description" and key documents can be found on the CCI website: http://www.esa-cci.org.

At the time of the 5th Colocation meeting the following thirteen ECVs were in place:

GCOS ECV	CCI Project	Science Leader
A.4	Cloud_cci	Deutscher Wetterdienst (*R.Hollmann)*
A.7	Ozone_cci	BIRA-IASB (*M. Van Roozendael*)
A.8	Aerosol_cci	DLR / FMI (*T Holzer-Popp / G.De Leeuw*)
A.9	GHG_cci	U.Bremen IUP (*M.Buchwitz)*
O.1	Sea_Ice_cci	NERSC, *(S. Sandven)*
O.2	Sea_Level_cci	LEGOS-CNES (*A Cazenave*)
O.3	SST_cci	U. Edinburgh (*C Merchant*)
O.4	Ocean_Colour_cci	Plymouth Marine Laboratory (*S. Sathyendranath)*
T.2.1	Glaciers_cci	U. Zurich (*F.Paul)*
T.2.2	Ice_Sheets_cci Greenland	DTU Space *(R. Forsberg)*
T.5.1	Landcover_cci	Université Catholique de Louvain (*P.Defourney*)
T.9	Fire_cci	U. Alcala (*E.Chuvieco)*
T.10	Soil_Moisture_cci	TU Vienna *(W. Wagner)*

Through a separate ITT, the cross-cutting project, the 'Climate Modelling Users Group' was set up with the aim of ensuring integrated feedback between the ECV projects and the global climate modelling community. The CMUG provide a structured forum for guiding the ECV projects on the use of the data sets, discussing intercomparison methods, error characterisation, etc. and helping the projects to achieve the set performance targets for each ECV.

In 2015, one new project will start, outlined below. *Ice_Sheets_Antarctica_cci* came out of a scoping study undertaken in *Ice_Sheets_Greenland_cci*. It will kick off in the first quarter of 2015 and will work closely with *Ice_Sheets_Greenland_cci* – there will be overlap of partners in the two projects, back-to-back meetings as far as possible, and a joint Climate Research Group.

T.2.2	Ice_Sheets_cci Antarctica	University of Leeds *(A. Shepherd)*

Each CCI project team typically includes experts from ten or more research organizations, including a Science Leader and a Project Manager, and contains three sub-groups. The sub-groups are organised into: specialist scientific expertise in EO; a Climate Research Group, including climate modellers; and system engineering experts.

Each science leader will ensure the overall scientific integrity of the project throughout the next three years. The science leader will also ensure that each CCI project maintains effective working links to the appropriate international climate science programmes, initiatives and projects, and to other CCI project teams. Each science leader is directly supported by a project manager who ensures communication within the project team, maintenance of schedule, tracking of actions, deliverables and reporting to ESA.

The projects are at varying stages: most projects have completed Phase 1 of the programme and started Phase 2 in the first quarter of 2014. The exceptions, *Ice_Sheets_cci, Soil_Moisture_cci, Sea_Ice_cci* and *Fire_cci* all plan to complete Phase 1 by the end of 2014 and begin Phase 2 in early 2015. The CCI project deliverables for Phase 1 and Phase 2 have been specified in accordance with the "Guideline for the Generation of Satellite-based Datasets and Products meeting GCOS Requirements" (GCOS-129, March 2009). All completed documents and data products can be found on the project websites, accessible via the main CCI programme homepage.

3 UPDATE ON THE SENTINELS

3.1 Overview of the presentations

An overview of the Sentinels was given by ESA representatives: Ferran Gascon, Craig Donlon, and Bojan Bojkov. Sentinel data will provide consistent EO data, which is particularly important after the loss of Envisat but more than that, it will provide a step-change in the amount of data available at higher temporal, spatial and spectral resolutions. This will clearly be beneficial for the CCI projects, although it also represents a challenge in dealing with the large data volumes and the transition to incorporate the data into the ECVs.

Sentinel 1A was successfully launched on the 3rd April 2014 with the first data flow being provided to all users in October 2014. The Sentinel 1A satellite houses a C-band Synthetic Aperture Radar (SAR) instrument providing high spatial and temporal (6 days) resolution data aiding monitoring of sea ice, oil spills, marine winds and waves, land-use change, land deformation and helping in the response to emergencies such as floods and earthquakes, as well as providing information on sea surface roughness. Sentinel 1 will therefore have a large input into the data required by the CCI projects; it will deliver the type of data previously provided by ERS and ENVISAT. Sentinel 1B is due to be launched in early 2016.

Sentinel 2 will provide optical high-resolution data and is due to launch in spring 2015. Large amounts of work have been carried out to formulate algorithms to apply atmospheric corrections and co-registration. The data provided will aid water vapour mapping and aerosol thickness for CCI data products in Phase 2.

Sentinel 3 will provide data mainly for the ocean research but will have applications for the land too. Two satellites, the first launching at the end of 2015 and the second launching 18 months later, will primarily measure sea surface topography, sea and land surface temperature, and ocean and land surface colour. The data from Sentinel 3 will be of use across nearly all of the CCI projects.

Sentinel 5P will reduce the gap between Envisat and the launch of Sentinel 5, the main atmospheric monitoring mission. 5P will provide measurements on stratospheric ozone and surface UV radiation, air

quality and climate, and will fly in loose formation with the Suomi NPP satellite ensuring synergistic use of products from both satellites. It will provide data mainly for the Atmospheric CCI projects.

4 COPERNICUS SERVICES

4.1 Overview of presentations

Copernicus is a flagship European programme, providing the necessary data for operational monitoring of the environment and for civil security. Copernicus is preparing to provide services that will deliver essential information for six main domains: marine, land, atmosphere, emergency response, security and climate change. Essential Climate Variables represent a key data stream for the provision of the Copernicus services so the main services relevant to the CCI projects were invited to give an overview of their expectations for incorporating ECVs into the services and the structures in place for translating the data into information for users.

4.1.1 Copernicus Climate Change Services: CCCS

The plans for the Copernicus Climate Change (C3) service, to be run by ECMWF, were presented by Bernard Pinty, which included a provisional overview of the schedule for the integration of operational ECV data sets – such as those produced by CCI – into the service. Four stages of integration are envisioned, from proof of concept, to pre-operational and two stages of operation over the period of 2015 to 2021. The take up of ECVs from the CCI will depend on their quality, maturity and added value to the service.

4.1.2 Copernicus Atmosphere Monitoring Service: CAMS

The atmospheric service was presented by Richard Engelen and will be run by ECMWF; it starts in April 2015 and will build upon the Monitoring Atmospheric Composition and Climate (MACC) project series. The future of CAMS will be supported by the Sentinel satellites, in particular Sentinel 3, 4 and 5. Using the experience of the MACC projects, CAMS will embed their operations within ongoing research and development that is part of the CAM service, with Horizon 2020, among others, providing additional R&D.

4.1.3 Copernicus Marine Environment Monitoring Service

The Copernicus ocean service, presented by Pierre-Yves La Traon, will follow on from MyOcean and MyOcean 2, and will be run by Mercator Océan, starting March 2015. These previous projects have developed operational performance indicators to help move towards an operational service. CCI and MyOcean have been developed independently but MyOcean products have benefitted from algorithm improvements and new products produced within CCI. CCI projects have, in return, benefited from MyOcean infrastructure and expertise. Sentinel data will aid the MyOcean datasets with Sentinel 1 and 3 providing the most relevant input data. A stated aim was for a more formal coordination to be established between CCI Ocean ECVs and the Copernicus Marine Service and the Climate Service, in particular for the reprocessing of ocean ECVs.

4.1.4 Copernicus Global Land Service – GIO-GL

The Copernicus Land Monitoring Service, presented by Michael Cherlet, aim to provide essential terrestrial variables including biophysical variables (such as vegetation, water, energy), building on the work of the Geoland and Geoland2 precursor projects. Once operational, provision of biophysical variables will be available in near real time as part of the global monitoring service. Sentinel data will once again have a large influence on the data products, improving consistency and temporal resolution. When the operational programme starts, much of the R&D budget will be redirected towards the operations side and new research will not be funded within the programme.

4.2 Discussion

There was a small amount of discussion time after hearing from the Copernicus services. There was concern from the CCI project teams that there shouldn't be a linear transition from research to operations. All CCI project teams agreed that the research and operations aspects of providing services within Copernicus cannot be separated. A recommendation from one science leader was for operations to be embedded in research. However the message from most Copernicus services was that research was not going to be funded from within the service (the exception being the Atmospheric service) and that R&D would be provided by other means, such as Horizon 2020.

R1: A more formal coordination between CCI Ocean ECVs and the Copernicus Marine Service and Climate Service should be established. In particular for the reprocessing of ocean ECVs.

5 RELATED CCI ACTIVITIES

5.1 CEOS Database and ECV Inventory

CEOS aims to support climate monitoring and has followed the GCOS Implementation Plan in regards to both structure and timings. Version 1 of the ECV Inventory has approximately 220 ECV records, however, this probably only represents about 20% of the actual ECV records available. The objective is to compile the ESA CCI records within the ECV Inventory and ensure they are complete and of a high quality. There are currently only 27 ESA CCI records within the ECV Inventory. Future plans are for an ECV Inventory application within the CEOS database – search and discovery will be available.

R2: Continued efforts are needed to add the other ESA CCI ECVs to the CEOS Inventory.

5.2 CHARMe

The CHARMe project aims to share climate knowledge through commentary metadata and linked data. Creating a repository of commentary information stored in the CHARMe node will allow information regarding the data to be read and entered through websites or Web Services. The aim is to add CHARMe to existing websites used in the community and link information to other sources through it. This is based on the websites and datasets using the Data Object Identifier and would therefore require all CCI ECVs to have an associated DOI.

5.3 Quality Assurance for Essential Climate Variables

This 4 year funded project led by KNMI aims to develop a prototype of an internationally accepted QA framework that provides free and open access to quality information along with traceable processing steps for deriving uncertainties associated with data records used for climate services. The NPL (National Physical Laboratory) are taking the lead in contacting data users and conducting a survey for QA in satellite-derived CDRs. They highlighted that QA information including product uncertainty and processing traceability is often required but it is not easily or readily available. The project's goal is to develop rigorous quality assurance methodologies for satellite-derived ECV products and produce consistent QA compliant data products, which will help support the Copernicus Climate Change Service.

R3: CCI projects to engage with QA4ECV to provide survey responses and feedback.

5.4 Tracking the use of the ECV datasets

In order to enable the ECV datasets to become operational it is important to understand the user requirements and those who are accessing the data and the intended purposes. Analysing registration information is an ideal way of tracking the use of the data. To aid data access for a long period, the datasets

should be submitted to a DOI organisation, such as the CCI Data Portal, once up and running, or the Climate Model Data Services (CDS) who currently store NASE climate datasets. This will allow traceability and accessibility to the data and metadata, which is well established in the publishing community, enabling the user to gain more trust in the dataset. A data DOI is also needed for publishing the data in a journal and could therefore have implications for future publications and increase user uptake, such as in the IPCC reports.

R4: Recommend having Digital Object Identifiers (DOIs) for the ESA CCI ECV datasets, although this will not be suitable for everyone. ESA could be the DOI-issuing organisation through the portal.

6 STEPS TOWARDS MAKING THE CCI ECVS OPERATIONAL

6.1 System Engineering Perspective

All CCI projects have been working on making the Phase 1 processing chains robust, well documented and able to carry out regular (re-)processing.

For transition of operational ECVs into the Copernicus services, the CCI projects consider there is a need for a continuous (re-)processing plan benefitting from ongoing R&D developments. There is a balance between the quality of the system and quality of the output. The scientific developments need to ensure they keep aligned with what the users want (Copernicus is not the only user of ECVs) and produce the best quality data with documentation and traceability of the data processing. Key criteria from a system engineering point of view: *version control, (re-)processing capability, documentation, robustness, redundancy, automation & repeatability, minimum human interactions, regular production cycles.*

Quality Control and validation of the data sets: algorithm validation should be incorporated as part of the development cycle. Operational quality control should include input and output verification, validation of the generated products before release, which requires validation scientists and reference data but this calls for additional operational funding.

A change from (re-)processing of completed archives to continuous production (data driven) is advised for CCCS operations. This will also be required if the final data product is a multi-year analysis. Discussions on how to process the new, incoming data so it remains consistent with the archive data are needed. New data could affect the overall historical data and will require re-processing of the entire dataset.

There is currently no sharp distinction between the R&D activities and operational activities in CCI; the system engineering perspective is that controlled change always has to be an integral part of ECV production. Most CCI projects plan to retain control over operation but some projects use operational infrastructure including CEMS, DFD, Calvalus. Need to clarify the sources of funding: mixed funding from Copernicus Climate Change Service, H2020 and ESA CCI2?

Recommendations for CCI-2 should be to focus on: R&D, along similar lines to H2020 and the need to ensure a good link to operational services.

R5: Develop a continuous processing plan benefitting from ongoing R&D developments, keeping in line with user requirements.

R6: Develop plan to systemise Quality Control throughout the process, including validation of the datasets before release.

6.2 Data perspective

Have you assembled a full FCDR from the starting date up to the present? CCI has made a big effort in generating FCDRs but this is still a big challenge. This is an incremental process needing sustained effort and cross ECV collaborations.

Is there systematic access to all the data you need (for FCRD and validation?)

There is collaboration between some projects and space agencies. Need further formalisation for collaboration between some projects to access all the data needed. Access to third party missions is now also required.

Is traceability to SI units implemented?

It's not clear across the programme, some teams have good methodologies in place to do this while others don't.

Do teams need fiducial reference data?

There is a need for reference measurements to be in place to ensure the long-term record of the product performance; especially if satellites change or there is a gap. Each team needs to know what their fiducial reference measurements are, where applicable, to know which datasets are suitable for producing time series and data analysis. May not apply to all ECVs though, e.g. land cover.

How are you managing your archives/access to the data you need as inputs?

Hosted processing solutions are required for CCI – especially in the Sentinel era – as is the need to bring the algorithms to the data, not the data to the users. Tools to manage the archives are also required.

R7: Cross ECV coordination at CCI programme level is requested to help implement traceability to SI units.

R8: Recommend more formal collaborations between CCI projects and space agencies to access all the data required.

R9: To the extent possible, each team should establish the Fiducial Reference Markers for their products.

6.3 Climate Science and other users perspectives

What does operational mean – from the project perspective? Key criteria:

- Meeting service level agreements
- Complying with the URD
- Meeting accuracy goals
- ECV-specific conditions.

Discussion: does the number of users count as a key criteria? Some ECVs think this is important, while others have just one key user. Similarly, having a DOI for the ECVs is important but not listed as a key criteria as it doesn't apply to all projects. Outreach in the media was considered important to gain support generally for the research but also not essential.

What are the key criteria for the CCI ECVs becoming operational – from the project perspective?

- Potential impact/added-value of the variable. A list of the 'added value' or selling points for each project was compiled.
- Well-defined data sets and procedures for quality control, delivery, reviewing and updating (similar to the Bates Maturity Index).
- Ease of access.
- Sustainability: strong science, stable and supportive international cooperation network, storing data in repositories.
- Automatic processing lines.

Each team should assess the current status with regard to the criteria. Once this has been carried out then need to define the main steps necessary to become operational and the time scale involved.

7 UNCERTAINTY SESSION

7.1 Aerosol uncertainties and AEROSAT

A wide range of methods are currently used to assess uncertainty in aerosol retrievals. However, some algorithms neglect important spatial and temporal correlations within the errors. An estimate of uncertainty is required by users and for validation. One issue that was noted was that the reputation of remote sensing data among users must be improved. Currently, there is virtually no reference data of aerosol type available for validation, which therefore affects the quality of the CCI data. It was suggested that it is better to overestimate uncertainties within the data to help convey the reliability to users.

7.2 Uncertainty in SST and FIDUCEO

The SST_cci datasets provide uncertainty data for each pixel value at each spatial and temporal resolution. Uncertainty is affected by numerous factors including noise propagation throughout the retrieval process. A new project has been put together to overcome some of these issues. The Fidelity and Uncertainty in Climate Data Records from Earth Observation (FIDUCEO):

- A 4 year project under H2020 with 10 partners
- Will learn to do well-characterised uncertainties in Climate Data Records (CDRs)
- Techniques, toolbox and training for tracing uncertainty from detector to geophysical product.

7.3 Cloud uncertainty treatment

All Cloud_cci algorithms use Optimal Estimation to propagate uncertainty to pixel level from significant sources of uncertainty, including random and systematic uncertainty. Not all sources of uncertainty are currently addressed, however; efforts have been made to minimise potential sources. Uncertainty also arises from assumptions used during processing, for example for cloud vertical structure. A new group under the ICWG (International Cloud Working Group) has been formed to address uncertainty and validation. Need to be clear how we communicate uncertainty and produce consistent uncertainty and validation techniques across CCI products – not all users want detailed information, lots want just one value.

7.4 Validation of precision estimates and characterisation: Ozone_cci

It is difficult to calculate error estimates due to a constantly changing atmosphere. Error estimates are based on the propagation of instrumental and other uncertainties through the inversion algorithm but are less than perfect due to the different approximations used. Standard error of the mean does not fully characterise the Level 3 data uncertainty. Hidden uncertainty can also arise from insufficient or inhomogeneous sampling and if not considered can result in inaccurate average estimates and potentially spurious features.

7.5 Confidence envelope of the global MSL time series from Jason-1 and Jason-2

Knowledge of the errors impacting mean sea level computation is needed in order to respond to users requirements. Linking errors between two datasets is complex and various approaches to calculate pixel level uncertainties are used. One approach allows the computation of an instantaneous uncertainty envelope. The errors remain relatively stable over time however they are affected by strong La Nina and El Nino episodes (e.g. 2011, 2013).

8 RESEARCH TOPICS IN CCI

8.1 Uncertainty

Within the CCI there are a number of activities on uncertainty - a paper on the state of the art in uncertainty management for satellite data products is currently in progress. A workshop on uncertainties is planned for users of SST data using an interactive approach to educate both data producers and users.
In terms of producing uncertainty information in the CCI, it isn't always possible to sample the entire variable space in situ and is often the case that retrievals cannot be compared to equivalent observations. Sometimes 'we don't know' is a viable option.
In providing uncertainty information to users, it was thought that uncertainty needs to be given for every level of output product but be provided in a manner that users can understand and use – i.e. showing the natural variability and noise. Product formats should not be defined for a single user – could we provide a portal through which a user can choose variables?

R10: An integrated approach to uncertainties needs to be developed in the CCI programme with the users.

8.2 Sea Level Budget

The Sea Level, SST, Glaciers, Sea Ice and two Ice Sheet CCI projects (Greenland and Antarctic) aim to use their ECV data sets to investigate the closure of the global sea level budget. An outline for a potential project was drawn up at the meeting; the plan is to incorporate measurements of sea level rise from ice loss from the Greenland and Antarctic Ice Sheets (GRACE, altimetry), glacier ice loss, thermal expansion, as well as ocean mass trends and polar sea level rise. This should allow a comprehensive estimate of the sea level budget to be made and enable the potential for regional sea level rise estimates and fingerprinting.

R11: A workshop is planned with the CCI projects mentioned at ISSI for February 2015.

8.3 Carbon Cycle

Now that the products are more mature, the CCI projects are looking to increase collaborations between soil moisture, land cover (vegetation activity), fire, GHG and ocean colour. Between these projects a number of interactions can be investigated: the vegetation cycle on land, including soil humidity, land cover with NDVI, GHGs to space. Or wetland areas: soil humidity, land cover, GHG (methane). Trends can also be investigated with the longer time series, as well as fluxes, e.g. soil moisture, fire, methane. Incorporating phytoplankton data and information on carbon over the ocean will enhance the collaborations. To proceed, the ECV components need to be consistent so they can be assimilated in to e.g. CCDAS. Potential ideas for the future include using CEMS to analyse the data, report on improvements/interactions for carbon and ocean fluxes, potential use of MACC CO_2 animations.

R12: The Carbon Cycle group is to meet again to move their ideas forward.

8.4 Model-data comparison

The session covered the general ways of comparing models and observations and how they can be applied to CCI data:

- Model fields vs. observations: this has been done to a small extent but is at an early stage and there may be potential to improve this feedback.
- Reanalysis vs. observations/assimilation: need to look at how bias could be estimated.
- Model assessments and benchmarking: sampling biases are an issue, need a solution for this.

CMUG are still assessing how best to use the uncertainty information provided by the CCI projects but want to improve this over Phase 2 of the programme. Delivery of ensemble products to represent uncertainties could be an option for Obs4MIP and CMIP comparisons. CMUG are doing some controlled assessments of

CCI data where the uncertainty information may be useful to help disentangle which effects improve/degrade the model output when using CCI data.
Within model-data comparisons there is a known issue with the integration of new data sets – the model is often tuned to the previous data set, making the new one appear worse. In terms of processing data from models, the data sets can be very large – infrastructures like CEMS or DKRZ who offer capabilities to perform computing on site are essential and should be made more use of by the CRGs.

R13: CMUG and CRGs to look in to how best to exploit the uncertainty information in the CCI data.

9 STATUS OF THE CCI PROGRAMME

9.1 CCI Phase 2

The objectives of the CCI Phase 2 are to respond to the GCOS requirements for the UNFCCC and to strengthen the European research community within the IPCC assessments. The number of peer-reviewed papers from the CCI now exceeds 175 and provides a good basis on which to support the IPCC report. The ESA CCI is providing fully error characterised climate datasets from 89 contributing national entities.

9.2 The CCI Postdoctoral scheme 2014

As part of the ESA Living Planet Fellowship a call was put out for proposals for 2 year funded postdoctoral position at a host institution. The postdoctoral fellowship applications have now closed and successful candidates have been selected and informed. Nine proposals have been selected which compliment the CCI programmatic theme focusing on exploiting ECV products, cross-ECV and multiple ECV use and enhancing interactions between CCI members and other Earth Science laboratories, research centres and universities. Due to the success of the call in 2014, a new call will be made in 2015.

9.3 CCI Data Portal

To aid the climate user community, a single point of harmonised, reliable access to the CCI ECV data products will be provided via an online data portal. This will be consistent with and complementary to other key initiatives such as the European Copernicus Climate Change Service and the international Global Climate Observing System (GCOS). The first version of the data portal is expected in approximately May 2015. The aim is to provide CCI central data archive and metadata catalogue. Alongside the data portal, a data toolbox will also be developed, aiding online visualisations of the data. The CCI data portal ITT has been issued as of September 2014 with proposals being selected by mid-December. The project will kick off at the beginning of 2015, while the CCI toolbox ITT will be issued in early 2015.

9.4 CCI Visualisation Tool

Two versions of the CCI Visualisation Tool are currently being developed with the CCI data. The first is the Exhibition version, run from a laptop for display at exhibitions and conferences that has been developed over the past 18 months; the second is a more informative version accessible via iPad, aimed at explaining the CCI to a wider audience. Both versions will allow the data to be viewed and explored, with some ability to compare datasets. These Visualisation Tools will then be ported to a Windows platform.

9.5 Science Leaders' Feedback

Remote Sensing Environment special issue on CCI has one paper still to be included before completion; Gerrit and Chris to write the introduction soon and publication is expected in 2015.

Upcoming opportunities for CCI projects: Horizon 2020 call on extended use of Sentinel data in March.

Maturity of CCI data sets: self assessment using the maturity matrix from the Core-Climax project is expected to be used in CCCS, the System Maturity Matrix (the ECV production system) and the Application

Performance Matrix (performance of ECV for an application) developed by Core-Climax are well accepted. These to be applied to CCI data sets?

Projects and CMUG: CMUG have planned model-data comparisons using CCI data sets.

Now Land_cover_cci have released their dataset, there should be some investigation into the degree of consistency of the land/water/ice classification across the CCI and masking across different projects.

R14: CMUG can provide external evaluation of a CCI maturity matrix.

R15: Summarize the reports of CMUG to synthesise the different results into a summary per ECV.

R16: The science leaders confirmed their recommendation to use the Land Cover dataset during processing where possible, and assess consistency with other CCI data sets.

9.6 Report back on Level 1 data

CCI projects ingest a lot of level 1 satellite data and use a retrieval scheme to generate Level 2 ECVs (and level 3 as well). During validation and evaluation of Level 2/Level 3 data it is possible to attribute changes in the product quality to imperfect Level 1 data. Feedback on Level 1 data (and some Level 2 data) used within the CCI, including the implications for ECV production, and what known steps have been taken to rectify any problems, has been collected from five CCI projects so far. There are requirements for further inter-calibration.

Communication: projects reported their good experience with colleagues embedded in the project and the corresponding Quality Working group to receive the latest updates/versions. It was noted that the official information path from ESA on updates and issues with Level-1 was not timely.

Should have a formal process in place for obtaining third party mission data. This will no doubt need a long lead-time if it is to be agreed properly between the space agencies to enable any funding decisions to be take place. Also may need to consider doing something similar for Level 2 data.

R17: Complete the survey of CCI project needs and issues with Level 1 data.

R18: (also see R8) The need for good access to Level 1 data for climate purposes (within the CCI) should be written up in a formal document, to be presented at WGClimate for discussion between the space agencies.

10 NEW PROJECTS

10.1 Soil Moisture Phase 2

The Version 2 dataset was released in July 2014 using merged active, passive and combined active-passive data covering 1978 to 2013 with calculated soil moisture anomalies. The soil moisture CCI data set now has over 1300 users worldwide.

Proposed measures for Phase 2 include: to go open source, working on collaborative cloud platforms, institutionalised collaborations, shared resources. Phase 2 is to be implemented through the Earth Observation Data Centre for Water Resources Monitoring, where the science leader will now be based. From

the perspective of soil moisture, there is a need to encompass new ways of collaborating with academia, the public sector and industry to engage the expertise to cover all aspects of climate data services.

In Phase 2 new missions will be integrated (SMOS, MetOp-B, FengYun-3B), plus SMAP will be launching in January 2015, providing on-going data to the soil moisture datasets. The focus will also be on improving the Level 2 algorithms and the merging of Level 2 products, as well as the generation of a CCI ECV soil moisture root zone product.

10.2 Sea Ice Phase 2

Within Phase 2 for Sea Ice Concentration the project plan to extend the time series back to 1978 and up to present day. Improvements will be made to the spatial resolution, accuracy and hopefully stability. Need to improve uncertainty of SIC in Antarctic above and below the Antarctic Peninsula and also around the ice edge (between Svalbard and Greenland) in the Arctic.
For Sea Ice Thickness (SIT) they plan to extend the time series back to 1993 using ERS-1/2 and CryoSat-2 and up to the present day while hopefully improving the accuracy. The plan is to undertake an assessment of the stability, develop a consistent multi-mission sea-ice freeboard processor, optimise freeboard to thickness conversion, develop an Antarctic SIT product, and develop an operational system for SIT ECV production.

There is a possibility of producing Sea Ice Drift as an ECV – plan to obtain and analyse user requirements, inter-compare algorithms in a Round-Robin exercise and document the best of these for a future ECV.

It is hoped that the CCI data sets will be able to contribute to current science questions in the polar regions such as: what impact changing sea ice (reduced extent and thickness) has on the climate at lower altitudes; why is the Antarctic sea ice extent increasing; the interaction between marine terminating glaciers and sea ice; the effect of dynamic topography in the Arctic Ocean on ocean circulation and sea ice motion; cloud cover effects on melting/freezing; and marine ecosystems dependency on sea ice.

10.3 Ice Sheets Greenland Phase 2

Phase 1 has produced four products: Ice Velocity, Surface Elevation Change (SEC), Grounding Line Location and Calving Front Locations for 20+ main outlet glaciers from 1991 to present. Phase 2 plans to: provide seamless SEC from 1991 – 2017; improve the ice sheet-wide velocity mapping using Sentinel-1 data covering 2014 – 2017; produce a time series of velocity measurements from 1991 to the present, on 7 main glaciers; and integrate GRACE-derived mass balance as a new ECV.

10.4 Ice Sheets Antarctica Phase 2

Ice Sheets Antarctica will kick off in early 2015. The scoping study undertaken within the original Ice Sheets project has already been completed and user requirements identified, allocating the most important products to be created. The highest priority products will be: mass balance, surface elevation change, ice velocity and grounding line location. The ice velocity will initially be calculated for the West Antarctic Ice Sheet and the Ice Streams (20). Similarly, the Groundling line location will be calculated for 5 – 10 ice streams. This project will run in parallel with the Greenland ice Sheets project with a joint Climate Research Group and will be beneficial for both projects with regards to, e.g. algorithm formulation.