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1 CCI PROGRAMME STATUS

Scope

This document presents the status of the ESA “Climate Change Initiative” (CCI), in January 2011. The intended audience is anyone, anywhere in the world, who wants to know about, get involved, or cooperate with, the ESA CCI.

Overall Programme Status

Overall programme activities are well advanced, as planned. The programme is forging new dialogue and extensive working links between the international EO and climate research communities.

ECV Projects Status

All approved CCI projects are now underway, with the latest (glaciers_cci) starting in December 2010. Because the nine ECV projects were kicked-off in a staggered fashion from July to December, the project teams are working to produce early first drafts of key deliverable documents, especially those needed by CMUG, which is interfacing to all nine ECV projects in parallel.

At this initial stage of the programme, all CCI projects are focussing on gathering user requirements, defining the detailed requirements for EO and in-situ data. They are also preparing subsequent activities on algorithms, validation, uncertainty characterization and confrontation of data with models.

A “CCI Project Guidelines” document, with the recommendations agreed by all ten project teams at the CCI collocation meeting was issued in November. This is a key programme-level mechanism for facilitating dialogue between different project teams, and for assuring consistency across projects. All teams are currently taking this on board in their project plans.

Detailed reports on each of the nine ECV projects, and on CMUG, covering the above issues, are given in sections 2-12.

User Requirements

The primary user requirements for CCI are those of GCOS. Each CCI team has to determine the extent to which current EO data can meet these requirements. They will then focus their efforts onto those technical aspects for which ESA and European mission data can be of maximum scientific benefit.

It is already evident from initial user consultations that, underlying the “canonical” GCOS requirements, there is a diversity of subsidiary requirements that reflect the priorities of different climate research fields. For example, research groups interested in detecting or re-analysing trends in the climate record may give priority to long-term consistent global records, whereas climate modelers may place higher priority on medium-term, regional data sets, optimized for process studies and model development.

At this stage the CCI teams are concerned simply with gathering, and understanding, the most comprehensive a set requirements from representative user organizations. Next, they will have to

decide which subset of these detailed requirements they can address within CCI – and which they cannot. This decision will lay the basis for optimizing the scientific impacts of the programme, and will enable more effective scientific cooperation with their international counterparts.

The decision process will involve trade-offs and iterations with users and between teams. The driving criterion is the requirement to maximise the impact of ESA mission data on climate research, in the context of the coordinated international response to GCOS. This means, in practise, that CCI teams will focus on aspects where they can make significant and unique progress, and will rely on other missions and other programmes to deliver in areas they can better address. Each CCI team will document the detailed outcome of these trade-offs in their Product Specification Documents.

Thus, the CCI user requirements documents and product specifications documents will provide fundamental inputs to international coordination, within Europe and also globally through CEOS. These documents will be published on-line to inform the scientific community, provided to GCOS to support the satellite supplement update, and provided to CEOS to facilitate coordinated action.

Data Requirements

The CCI projects will generate consistent, global, long-term, and in some cases gridded, Level-3 and Level-4 ECV data products.

This requires a very large volume of input Level 1 data from many different EO missions and sensors, for time-periods of 20-30 years (in GCOS terminology: “Fundamental Climate Data Records”). Level 2 products from ERS and Envisat and from some 38 non-ESA missions will be used, mainly for product inter-comparisons.

The 10 CCI projects require Level 1 data products from the ERS and Envisat missions (~ 72 TByte) and about 25 non-ESA missions (~ 135 TByte) including satellites from NASA, NOAA, JAXA, CNES, DLR and EUMETSAT.

Every CCI project makes use of data from one or more ERS / ENVISAT sensors. The most demanding in terms of data volume are the ocean_colour_cci and fire_disturbance_cci projects, which require the complete MERIS L1 RR data archive from the 2010 reprocessing (~ 22 TByte). The biggest data volume required from non-ESA missions is 95 TByte of EOS-Aqua MODIS data for ocean_colour_cci. Subsets of this data will also be used by cloud_cci.

Further to the collocation meeting, the project teams with the support from ESA, produced a CCI Data Requirements Document, combining the data requirements of all teams. This is the basis for coordination between the CCI programme and the operational ESA ground segment. It will also form the basis for coordination with other data providers: EUMETSAT has already contributed to the data requirements definition process. NASA has indicated willingness to provide the required data sets, but requests that copying for multiple projects is handled within Europe.

Each CCI team is refining their detailed requirements in a project-specific “Data Access Requirements Document” (DARD).

The CCI projects also require major access to high-quality, well characterized in-situ data sets for validation and for error characterization. Each project is accessing this data via team members and international partners who have access to existing validation sites, data bases and monitoring networks.

ECMWF, as part of CMUG, is also providing the project teams a gateway to access reanalysis fields that they may require.

Earth Observation Data Quality

Data quality, sensor cal/val issues are central to the GCOS requirements, and critical to the success of CCI. The CCI is addressing issues of consistency between data from different missions, rather than focussing exclusively on the issues of a single sensor. Each CCI project must therefore rely upon the reprocessing to Level1B - including system corrections and cal/val - as performed within the dedicated ground segment of each individual sensor.

For ESA missions and sensors used in CCI, data quality and cal/val issues are closely coordinated with the existing Quality Working Groups (QWG) for each ESA sensor. CCI teams need to be fully informed, in advance, of the status of corrections being implemented in the next version of each relevant ground segment L1B processor. In parallel, the CCI teams will be developing post-processing algorithms and applying them to the currently available L1B data products. When validated in CCI, these post-processing algorithms can be provided back to the relevant QWG for potential implementation within future upgrades to the operational ground segment.

In practice this interaction is being implemented by (many) expert CCI project partners who are also key members of the corresponding quality working groups. Details for each project and sensor are given in Annex 1. A similar approach is being followed for non-ESA missions.

The overall CCI data requirements, for timely, iterative, and consistent re-processing of complete mission archives, meeting climate-specific data quality and cal/val needs, and for an open and responsive algorithmic feedback loop involving the science community, constitute a set of highly demanding, but widely representative, authoritative and fully traceable requirements, of high relevance for ESA “Long Term Data Preservation” and for the GMES Space Component.

International Coordination for CCI

CEOS Agencies decided at their 24th Plenary Meeting in Rio de Janeiro, 12-15 October 2010, to set-up a dedicated CEOS Working Group on Climate. The terms of reference are those that resulted from the ad-hoc meeting, previously convened at ESA Climate Office in Harwell. The CEOS Plenary entrusted chairmanship of this new group to EC/JRC.

The Executive is now liaising closely with the WGClimate chair and members to ensure that CCI contributes immediately to this coordinated effort – and vice-versa. The initial outputs from CCI projects have already uncovered a number of key issues that WG-Climate can positively impact – notably on data access and data consistency.

The coordination with EUMETSAT has facilitated this progress. A bi-lateral coordination meeting on climate was held during November, to take overall stock of both organizations climate-related developments, and prepare future coordination within Europe, and also globally via CEOS.

The Executive participated to the UNFCCC COP-16 in Cancun Mexico, to promote EO and enlarge awareness of the satellite component of the Global Climate Observing System. ESA maintained a booth throughout the COP and convened side-event on CCI, in which three CCI science leaders presented their ECVs. COP-16 participants and negotiators visiting the ESA booth and side-event all pointed, without exception, to continuous global observations and a free and open data policy, as being essential both for climate science and for climate policy.

In its deposition to the COP, GCOS indicated that Space Agencies are making significant progress on the satellite component of the Global Climate Observing System. CCI was cited as an exemplary case, and the representative of the Belgian EU Presidency drew public attention to the major contribution Europe is making with GMES.

In contrast, the chair of Global Ocean Observing System had to report that, despite progress during the last decade, implementation of the in-situ component of GOOS has stalled in recent years, and risks decline, unless adequate investments are made.

Scientific Consultations for CCI

The second meeting of the Climate Science Advisory Body was held at ESRIN on 19 November 2010. The CSAB welcomed the progress made on CCI to date, in particular the interactions between the EO science and international climate research communities.

EUMESAT kindly presented their climate-related activities to CSAB, to give insight into the coherence of ESA and EUMETSAT's complementary undertakings.

CSAB strongly encouraged the executive to maintain its efforts to initiate a CCI project on sea-ice, and expressed a favourable view on the possibility of also starting complementary work on other ECVs (Ice sheets and Soil Moisture).

CSAB provided valuable advice on a range of scientific issues that have emerged during initial stages of the programme. The importance of maintaining open consultation and responsiveness to the evolving priorities of the international climate research community, as exemplified by WCRP and IPCC, was underlined. The central role of climate re-analysis as a tool to enable climate scientists to exploit massive global EO archives was highlighted. The CSAB members confirmed their willingness to continue advising the CCI programme manager, particularly as regards the future evolution of CCI. CSAB advice to ESA on CCI is reported in Annex 1.

Programme Outreach

The ESA Executive and CCI project teams conducted a coordinated suite of outreach actions towards the international science community, policy makers, and general public, to coincide with COP-16 in Cancun.

Most of the CCI teams brought on-line their dedicated ECV project web-sites and produced newsletters which the executive made available at Cancun. A Euronews feature on CCI (the "Climate Puzzle"), featuring scientists from two of the CCI projects, was broadcast three times daily throughout the first week of December. This valuable outreach tool is available in multiple-languages and can be downloaded on-line at:

http://www.esa.int/SPECIALS/Euronews/SEM7SLNWXGG_0.html

Four web news stories on EO and Climate were published on the ESA portal during COP-16

Coordinated Activities

The first procurement plan for the ESA Strategic initiative (STRIN) includes provision for 50% co-funding of the sea_ice_cci project, which will be re-issued for tender.

The STRIN procurement plan also provides 100% funding to initiate two new actions on two ECVs that are not currently being addressed within CCI: Soil Moisture, and Ice Sheets. ESA is presently arranging user consultation meetings with the relevant user communities, and is working to initiate these projects on a time-scale that would enable the successful teams to participate to the next CCI collocation meeting, at the end of Q3 2011.

Next Steps

In the coming six months:

- The 10 CCI user requirements documents will be completed and put on the web
- The Data Requirements will be finalized and a delivery plan for ESA data implemented
- The CCI teams will prepare first versions of their ECV product specifications
- CMUG will convene a first meeting of climate scientists from all CCI teams
- CCI teams will provide inputs for the update and review of GCOS Satellite Supplement
- The ESA Executive will pursue European coordination on climate with EUMETSAT & EC
- The ESA Executive will contribute actively and channel CCI output to CEOS WG Climate
- The ITT for sea-ice ECV will be re-issued
- User consultations on soil moisture and ice-sheets will be convened, and ITTs prepared

2 Cloud_cci (GCOS A.4)

Project Initiation

Cloud_cci started on 1st September 2010. All due deliverables are on schedule.

Collocation Outcome

The cloud_cci project team has taken the collocation guidelines into account and updated the project plan accordingly. Collocation was a starting point for discussions with other CCI projects which were followed-up during the project kick-off and first progress meetings. For cloud_cci it is important to align with the other CCI projects, as clouds affect many of their retrievals. Cloud_cci will contribute directly to aerosol_cci and tasks of the two projects have been closely coordinated. A representative of the cloud_cci team will participate in the aerosol_cci workshop in January 2011. Coordination with the sst_cci project on AVHRR calibration is ongoing in parallel.

User Requirements Gathering

User Requirements have been gathered in an iterative process asking potential users directly and taking into account requirements which are widely accepted in the cloud climatology community. The climate research group provided input to the user requirements taking into account the upcoming IPCC scenario calculation from regional climate models. The Climate Modelling Users Group (CMUG) contributed in asking for a higher (w.r.t. GCOS) temporal resolution for an application area of process studies in climate models. During the discussion it became evident that cloud_cci can not meet the CMUG expectations, as they are complementary to the GCOS goal of long time-series of cloud properties. In order to harmonize and cross-coordinate, the cloud_cci user requirements document has been reviewed by all other CCI projects.

Cloud CCI received specific requirements from the following CCI projects: aerosols, land cover, sea surface temperature, ocean colour and fire. The other CCI projects, which do not use the same sensors as cloud_cci, have not yet raised specific cloud-related requirements.

Data Requirements Definition

The project is focusing on data from the following instruments to generate a cloud ECV data set for the years 2007-2009:

- MODIS on Aqua and Terra
- AVHRR on METOP and the NOAA satellite series
- AATSR and MERIS on ENVISAT

In-situ data will be used for validation. Active measurements of atmospheric vertical structure from the A-train instruments Calipso and Cloudsat will be the main validation source. The team has identified data versions required (latest preferred) is now gathering for the round robin. Two MODIS groups have shown interest to participate in the round robin. The MODIS calibration team is interacting with team members dealing with (A)ATSR and AVHRR. Developments on calibration have identified issues such as orbital drift and navigation errors. Investigations of the impacts and possible corrections are underway.

Algorithms, Validation, Uncertainties, Models

The round robin is currently being prepared. Suitable days and selected overpasses have been identified which are collocated with the reference system (A-Train active instruments). Selected surface sites have been chosen (ARM–sites and Cloudnet data) for individual comparisons. It is planned to download the data and thus secure them as validation source.

The project is implementing the definition of uncertainty agreed at the collocation meeting and will embed this information in its products. The uncertainty characterization of course depends on the final definition of the products which is one of the next project tasks. The climate modeling team has identified periods of interest and geo-locations of pseudo stations where the regional climate models will provide specific outputs for evaluation.

International Partners and Projects

The team has contacted MODIS groups at GSFC and LaRC to ensure timely data provision and encourage participation in the round robin. Contacts have been made with scientists from NOAA/University of Wisconsin working on improving the GAC AVHRR FCDR. Interactions with CMUG have been focused on user requirements related to clouds.

Contact with EUMETSAT exists de-facto. The science leader will attend several GCOS/WMO meetings establishing a direct link to WMO and its subsidiary bodies including GCOS. In October the science leader attended the WMO SCOPE CM Executive Panel meeting in Asheville (NOAA (NCDC)) where he presented the cloud_cci project.

Project Outreach

The Cloud CCI website is now online (www.esa-cloud-cci.org). The first cloud_cci newsletter was issued in time for the COP-16 Cancun conference. Team members attended the EUMETSAT conference on satellite meteorology and the AGU fall meeting.

Future Activity

In January the science leader will participate to GCOS/WMO workshops to review the GCOS requirements. This provides an opportunity to provide immediate feed back on the user requirements gathered to date, as a contribution to GCOS. Subsequently in April, at EGU in Vienna, the cloud_cci and aerosol_cci teams are jointly organizing a dedicated session on aerosol-cloud interaction, to engage the broad climate science community.

The round robin exercise is the next major project milestone. Five groups (as of December 2010) responsible for different algorithms are already participating. Based on the results of the round robin, a task list of improvements needed for the community cloud retrieval will be compiled. In parallel, development of the community retrieval framework will start.

The next project meeting is planned for 01-02 March 2011. The main focus will be the round robin exercise.

3 Ozone_cci (GCOS A.7)

Project Initiation

The Ozone_cci project formally kicked off on September 1st, 2010 and a first gathering of the whole consortium was organised in Brussels on 7-8 September 2010, one week before the first collocation meeting in ESRIN. The first Progress Meeting (PM1) was organised via teleconference on 29 November. Activities have started as planned in all teams.

No major problem has been encountered so far. Deliverables are on schedule, with the exception of the DARD (Data Requirements) that has been postponed to February 2011 in agreement with the Agency. The project risk analysis has identified the need to secure the availability of some key satellite level-1 data sets. The team has communicated this information to the Agency for further action.

Collocation Outcome

The CCI Project Guidelines have been distributed to the Ozone_cci consortium and an action has been assigned to the whole team to evaluate these guidelines and translate them into applicable rules for the Ozone_cci. This issue will be monitored until the next Progress Meeting in January 2011.

More specifically, a first practical outcome of the collocation meeting has been to initiate a discussion on the content of the Round-Robin protocol for Ozone_cci. This protocol which includes criteria on error characterisation and algorithm performance assessment will be documented in the Product Validation Plan (PVP). Particular guidelines applicable to nadir ozone profile and MIPAS retrievals will be agreed and separately documented in the PVP. Discussion on the need for interaction with other CCI projects has started. The main interaction will be with CMUG. A more in-depth interaction with the cloud_cci project might become relevant at a later stage of the project.

Another practical outcome collocation was the establishment of the Systems Engineering Working Group (SEWG) aimed at coordinating the engineering tasks of all the CCI systems.

User Requirements Gathering

The ozone_cci user community is represented by the project's Climate Research Group (CRG) which links to the broader ozone and climate research communities. For the User Requirements definition, initial information has been collected from GCOS, CMUG and CF conventions. The CRG partners are defining requirements that are specific to a number of identified key research topics. A draft URD has been compiled. The relation of specific ozone_cci requirements with generic GCOS and CMUG requirements is being analysed. For example, the particular research application(s) that would require a 1 km resolution in the ozone vertical distribution will be identified and the impact on generic and particular requirements will be discussed. Overall the ozone_cci URD is based on application-specific requirements instead of the usual target/threshold distinction. It is felt that this approach is more adequate and closer to User needs.

Data Requirements Definition

The schedule of the DARD has been slightly delayed in order to synchronise it with the URD. EO and in-situ requirements are well identified and for most cases, no major issue on accessibility has been identified.

Particular emphasis has been put on the absolute necessity to get timely access to version 6 of the GOMOS data. This requirement has been explicitly communicated to the Agency, and steps taken to ensure that the necessary data sets will be available by April 2011.

Likewise, the criticality of timely delivery of reprocessed SCIAMACHY and GOME level-1 data sets has been raised. A complete data procurement plan will be issued together with the DARD. Following the outcome of collocation, the team has nominated DLR as data manager for the project, to act as primary contact point for all data-related issues.

The ozone_cci team interacts with the instrument data Quality Working Group via team members that also participate to the relevant (ESA and non-ESA) QWGs for SCIA., GOMOS, MIPAS and GOME-2.

The release of GOMOS version 6 Level 1 and Level 2 products, due in April 2011, is critically important for the ozone_cci project, since it should include good error characterisation. The ozone_cci team has raised issues on the quality of the latest MIPAS Level 1 reprocessed data (needed by all teams for the MIPAS round-robin). These are currently being investigated.

Algorithms, Validation, Uncertainties, Models

All algorithm developments have started as planned.

On *total ozone*, a multi-sensor direct-fitting scientific prototype applicable to GOME, SCIAMACHY and GOME-2 has been set up and preliminary work is ongoing on merging tools. In the nadir ozone profile team, a tool has been developed for fast verification of algorithm improvements using a selection of ozone sondes. This will be used as an input for the nadir ozone profiling round-robin.

In *the limb sub-group*, a lead moderation has been agreed, which will lead to a share of responsibilities on error budget and data characterization, data merging strategies, and satellite-satellite validation. The group has circulated a data and error characterization questionnaire within the consortium to collect information on the different sensors. The analysis will lead to a consistent approach for error analysis in the ozone_cci project, in accordance with the CCI project guidelines.

On the MIPAS round-robin exercise, cross-validation of MIPAS ozone level 2 data retrieved with ESA Version 5 and IMK/IAA version 4 processors has started. A list of potential criteria for the selection of the "best" algorithm is in progress and will be documented in the PVP.

Discussions with CMUG have begun on planning, exchange of model data products between different CCI-projects, and use of the ERA-interim data for evaluation of numerical models and so-called 'nudging' simulations.

International Partners and Projects

Within the team a lower level coordination group has been established within the relatively large limb sub-group. This approach will allow for optimal use of resources on the limb-related tasks. Taking advantage complementary activity funded by the Canadian Space Agency, the limb group has been reinforced by the inclusion of a new partner from U. Saskatchewan who will provide essential expertise on the TPM OSIRIS instrument.

Contacts have been made to establish links with an ongoing parallel ozone ECV work in US.

The second ozone_cci progress meeting will be held in conjunction with meeting of the SPARC/IOC/WMO initiative on Past Changes in the Vertical Distribution of Ozone on 25-27 January 2011 at WMO, Geneva. This will provide opportunities for further interaction with the international ozone community.

Project Outreach

The ozone_cci Science Leader has presented the project at several conferences where links were established with other initiatives in the ozone research field, notably:

- ESA/SPARC scientific consultation workshop on SPARC Science Requirements, Zürich, Switzerland, 20-21 October 2010

The first Ozone_cci newsletter was published on 5 November 2010 and the ozone_cci website went online on 25 November 2010 (<http://www.esa-ozone-cci.org>).

The internal part of the website, based on a wiki, is also ready for use (http://www.esa-ozone-cci.org/Private/index.php/Main_Page). Usernames and passwords have been sent out to all project participants end of November 2010. All project documents are available through the internal part of the website (page named documents). Support and advice will be made available on request to help project partners in getting familiar with the wiki system.

Future Activity

The next quarter will concentrate on finalizing of the URD and DARD documents, as well as on the preparation of the PSD (Product Specifications) and PVP. Algorithm developments will continue and round-robin exercises on nadir ozone profiles and MIPAS will be prepared. The Round-Robin data base will be prepared and a first draft version of the ATBD will be issued. The analysis of the questionnaire on error and data characterization will be pursued.

The O3_cci User Requirements Document will be publicly presented at the SPACE/IOC/WMO meeting on vertical ozone distributions in January.

4 Aerosol_cci (GCOS A.8)

Project Initiation

The collocation showed high interest in collaboration with other teams. Collaboration was subsequently initiated with the cloud-cci team (aerosol-cloud indirect effect) and other CCI teams (ocean colour, land cover, fire disturbance, ozone), where close scientific interaction is needed to assure consistency of the ECV products and / or rely on aerosol definitions worked out by our team for correction purposes of aerosol perturbations.

The guidelines from the collocation are currently being assessed by the project team; some of them, impacting current or recent activities, have been or are currently implemented.

User Requirements Gathering

A thorough analysis of the user requirements for aerosol ECV products builds the basis for the specification, development / improvement and evaluation of the products. Starting with GCOS requirements, a dialogue with the aerosol climate modelling user community has been initiated relying on the AEROCOM international aerosol model inter-comparison.

An invitation to contribute to the user requirements was published on the project website. The collection of user requirements will be kept transparent and will document for each user input the origin and intended application. The first version of the User Requirements Document (URD) is currently under finalisation.

Data Requirements Definition

The Data Access Requirements Document (DARD) was issued in November. A section on requirements for ECMWF auxiliary data was added after interaction with CMUG.

Good links with sensor data Quality Working Groups (QWGs) are assured by consortium partners with expertise on specific sensors. They participate to relevant QWGs, RAL (AATSR), HYGEOS (MERIS), U. Bremen (SCIAMACHY, GOME), GOMOS (FMI), U. Lille (POLDER), KNMI (OMI, GOME).

Data quality issues are being investigated within aerosol_cci algorithm developments. Where necessary, prototype corrections to Level-1 input data that do not yet exist in the standard processors (both ESA and non-ESA) may be included in the aerosol_cci retrieval algorithms. When fully validated, improved algorithm specifications can then be fed back, via each QWG, for potential inclusion in upgrades of the operational processors.

Algorithms, Validation, Uncertainties, Models

The first major step of the project is quantify and better understand differences, strengths and weaknesses of the available algorithms by a round robin exercise and dedicated case studies. This will be the basis for consolidation and improvement of the algorithms towards prototype algorithms using elements for “community algorithms” and exploiting combined or synergetic products where

appropriate. A detailed work plan for several iterations of algorithm improvements (common aerosol optical properties, improved / harmonized surface reflectance treatment per sensor, improved / harmonized cloud masking per sensor, harmonized use of auxiliary data) during phase 1 was worked out at the first progress meeting.

A first algorithm workshop on aerosol optical models used in the various retrievals was held aside of the AEROCOM workshop on 27 September in Oxford. Participants included the NASA scientist responsible for the MISR retrievals. This enabled a detailed exchange with the aerosol_cci team on the definitions of aerosol optical properties in their respective algorithms and which improvements are foreseen.

Based on this a working group elaborated a harmonized aerosol optical model setup for algorithm inter-comparison and consistency which was discussed and agreed upon by the team during the first progress meeting in early November; a technical note will be provided to other CCI teams in near future.

Use of the most recent and consistent calibration for ATSR instruments was also discussed at the first progress meeting. RAL provided a technical note summarizing the most recent recommendations of the Cal/Val group to be followed by all retrievals.

The first progress meeting, hosted by MetNo on 8-9 November 2010, focused on draft user requirements, planning for the various test datasets in phase 1, and validation metrics. A major outcome was a decision on common aerosol models (based on preparatory work by the working group established at the end of the respective workshop) to be used for the round robin exercise.

International Partners and Projects

A thorough analysis of the user requirements for aerosol ECV products builds the basis for the specification, development / improvement and evaluation of the products. Starting with GCOS requirements a dialogue with the aerosol climate modeling user community has been initiated relying on the AEROCOM international aerosol model inter-comparison.

At the AEROCOM workshop an initial presentation of the aerosol CCI user requirements was made. The aerosol_cci project was presented at the CEOS-ACC-6 meeting on 9 September in Oxford.

Project Outreach

The aerosol_cci web portal (hosted by wdc.dlr.de) is online and filled with static contents; a private section for project internal exchange of documents has been activated and is started to be used. The template content management system provided by ESA was very helpful and enabled a fast setup of the website.

The first Aerosol CCI newsletter was published in November 2010. This newsletter presents the project objectives and work plan, the project team, and the invitation to contribute to the user requirements dialogue and discussion.

Future Activity

Two workshops are being prepared on treatment of surface reflectance / BRDF and clouds on 18-20 January 2011 at DLR. Other CCI teams (clouds, ocean colour, land cover) and external experts (MODIS team, EUMETSAT) have been invited to participate.

All aerosol_cci project deliverables for the coming period are well advanced and will be provided as scheduled.

5 Ghg_cci (GCOS A.9)

Project Initiation

The ghg_cci project was kicked-off on 01 Sept. 2010.

The first Progress Meeting was held on 4-5 Nov. 2010 at IUP, Bremen. Key scientific issues were intensively discussed. This included the latest status of the CO₂ and CH₄ retrievals using various sensors, notably SCIAMACHY/ENVISAT and TANSO/GOSAT, but also MIPAS, AIRS, IASI and ACE-FTS. Issues raised include, inter-comparisons, validation (using primarily TCCON but also NDACC; how to best use the highly accurate long-term in-situ observations of the WMO and AGAGE networks), calibration (priorities for SCIAMACHY Level 1 improvements), and user aspects (focus: status of CH₄ inverse modeling of surface fluxes using SCIAMACHY and GOSAT; status of CO₂ modeling and initial comparisons with GOSAT).

The Agency stressed to the team that the selection procedure for the final algorithms to be used for ECV generation must be defined early in the project. A corresponding document is in preparation.

Significant progress has already been made on the retrievals of dry air column-averaged mole fraction of CO₂ and CH₄, i.e., XCO₂ and XCH₄, using SCIAMACHY and TANSO, which are the core ECV data products.

The GOSAT project team in Japan has been contacted regarding public presentation of GOSAT results from ghg-CCI. The GOSAT team has confirmed but requested to be kept informed. Although no critical problems have yet been encountered, some problems have arisen with the download of GOSAT data from the GOSAT Third Party Mission (TPM) archive. The Agency has taken action to resolve the matter.

Collocation Outcome

The ghg_cci team is presently assessing how the CCI project guidelines from the collocation meeting will be implemented within this project.

User Requirements Gathering

Initial user requirements for the ghg_cci project have been formulated for the regional CO₂ and CH₄ surface flux applications. The user requirements are based on peer-reviewed publications, other documents where user requirements have been formulated and user consultation focusing on users which are involved in the European MACC project. A close cooperation between ghg_cci and MACC/GHG has been established for this purpose.

A first draft of the User Requirements Document (URD) was circulated at end November 2010 to all ghg_cci team members and to ESA. Feedback will be used to generate an updated version of the URD. This draft will be made publicly available on the ghg_cci project web site. All comments will be used to generate the final version which will be publicly available end of February 2011.

Data Requirements Definition

The primary data sources being used to generate CO₂ and CH₄ ECV products are: SCIAMACHY on ENVISAT and TANSO on GOSAT. In addition, for mid/upper tropospheric and stratospheric observations of CO₂ and CH₄, data from IASI, AIRS, MIPAS, ACE-FTS and SCIAMACHY occultation are incorporated.

All required input data were identified in the EO Satellite Data Requirements document prepared for CCI collocation. Details will be documented in the ghg_cci Data Access Requirements Document.

The ghg_cci team interacts with SCIA instrument data Quality Working Group via team members that are also QWG members. For GOSAT/TANSO quality issues the ozone_cci team interacts via project members who are also PIs on the JAXA research announcement. For OCO, data quality issues are addressed through direct links to the NASA ACOS team.

Algorithms, Validation, Uncertainties, Models

No major problems have yet been identified, and the project priorities remain as planned. Access to all relevant validation data is assured as the relevant European PIs are project partners and delivery of non-European data is assured via Letters of Support. Independent validation is assured by the independent Validation Team

Selection criteria for the Round Robin are being defined (a document is in preparation). Uncertainties will be characterized by various means such as simulations and comparison with high quality independent reference data (mainly ground-based FTS TCCON retrievals).

Detailed comparisons with models have been conducted (see publications below) and more comparisons will be done in the future. The ghg_cci Climate Research Group (CRD) has given important feedback. For example, the latest SCIAMACHY methane data set has been successfully used for inverse modeling (results can be seen on the MACC website).

Involvement of international partners and projects

A strong link has been established with the EU project MACC (Monitoring Atmospheric Composition and Climate) and further strengthened during the reporting period. MACC is considered to be a key user for the GHG data set to be generated within ghg_cci. Several GHG-CCI team members participated at the MACC 2nd General Assembly at Météo-France, Toulouse, 18-22 October 2010, and gave presentations during the MACC/GHG splinter meeting and the MACC plenary meeting. Key ghg_cci team members also participate in the proposal writing for MACC-II.

Cooperation with many other international projects and partners has also been further strengthened during the reporting period. Examples are projects such as EU FP7 CityZen and ESA Alanis/Methane, and partners such as NASA and NOAA. For example, a close cooperation exists with the NASA ACOS team focussing on GOSAT retrievals and with NOAA via pre-publication discussions with on draft manuscripts presenting new scientific results.

Project Outreach

Ghg_cci team members are already delivering on a key requirement of both CCI and GCOS – to publish relevant results in peer-reviewed journals - as follows:

- Reuter, M. et al: *Retrieval of atmospheric CO₂ with enhanced accuracy and precision from SCIAMACHY: Validation with FTS measurements and comparison with model results*, J. Geophys. Res. (in press), 2010.
- Schneising, O., et al. *Long-term analysis of carbon dioxide and methane column-averaged mole fractions retrieved from SCIAMACHY*, Atmos. Chem. Phys. Discuss.10, 27479-27522, 2010.
- Butz, A. et al. *CH₄ retrievals from space-based solar backscatter measurements: performance evaluation against simulated aerosol and cirrus loaded scenes*, J. Geophys. Res. (in press), doi:10.1029/2010JD014514, 2010.
- Frankenberg, C. et al: *Global column-averaged methane mixing ratios from 2003-2009 as derived from SCIAMACHY: Trends and variability*, J. Geophys. Res. (in press), 2010.

Ghg_cci team members presented at the 2nd “Carbon from Space” workshop, which took place 6-8 Sep. 2010, at Worcester College, Oxford, UK. The ghg_cci project was also presented at the CEOS ACC-6 meeting, 9. Sep. 2010, and at the ESA-iLEAPS-EGU – Earth Observation for Land-Atmosphere Interaction Science Conference 3-5 Nov 2010 at ESRIN.

The team provided inputs to the JAXA-produced video for the GEO-VII Plenary and Beijing Ministerial, 3-5 November 2010 in Beijing. This included animations of global CO₂ and CH₄ from SCIAMACHY over 2003-2009. The video can be viewed at: ftp://ftp.earthobservations.org/EXCHANGE/2010_Ministerial_Videos/.

Ghg_cci team members contributed to the successful CarbonSat mission proposal for the Eighth Earth Explorer. This shows cross-fertilization between scientific exploitation of existing missions (ghg_cci) and the development of innovative future missions (Carbosat).

The first ghg_cci project newsletter was prepared for the ESA booth at the 2010 UN Climate Change Conference in Cancun, Mexico. The Newsletter will also be made available via the ghg_cci project website. Preparations to establish a project website have been undertaken during the reporting period. The ESA recommended content management system has been installed and new hardware has been ordered as required to circumvent issues related to the IUP firewall. The ghg_cci website (<http://www.esa-ghg-cci.org>) was launched in December 2010.

Future Activity

Focus will be on further improving retrieval algorithms, data processing, and analysis of the resulting data products. According to current planning, the first improvement phase should be finalized in month 8. During month 9, data processing will take place, followed by a detailed analysis of the resulting data products including detailed comparisons of the data products generated with the various competing retrieval algorithms. The results of this first improvement-processing-comparison cycle will be available end of month 11.

The first issue of several key projects will be completed URD, DARD and PSD and drafting will begin on PVP, ATBD, and AIECAR (Algorithm Inter-comparison and Error Characterization and Analysis Report). The Round_Robin data base will be compiled, including validation data. Available satellite retrievals will be part of the Round Robin Data Package (RRDP). Abstracts on ghg_cci will be submitted to the EGU 2011 conference in Vienna and the International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-7) in Edinburgh.

6 Sea_level_cci (GCOS 0.2)

Project Initiation

Initial activities have concentrated on requirements analysis, the capture of user feedback and critical gap analysis, with development of the User Requirements Document taking a longer time than foreseen. Preparatory activities and task work commenced in the Earth Observation Group, with algorithm development and integration tasks started.

Collocation Outcome

The first collocation meeting was fruitful as it offered the opportunity to meet other CCI projects and define common objectives. The sea level ECV does not have direct linkage with other ECV projects, but potential synergy has been identified with the SST ECV as it concerns ECV product assessment and this may help to verify the consistency between the sea level and the SST long term variation. The guidelines proposed during the collocation have since been followed, in particular the combination of requirements arising from the CMUG and individual projects.

Discussion also included strategy for CCI system architecture. An efficient and cost effective operational system is important, particularly since existing sea level variable system already exists. A system engineering working group (wiki and mailing list) for the sharing of system analysis technical notes, has since been established.

User Requirements Gathering

Consulted users included the CMUG partners, national and international agencies, individual research institutes and university departments. The synthesis of this user consultation and review of the requirements from the GCOS, WCRP and GOSS programs have been consolidated and reported in the User Requirements Document, delivered on December 6th 2010.

An interesting outcome of the user feedback was the identification of different application areas for which the usefulness of a variable is required. The sea_level_cci team has a different understanding of the role of the Sea Level ECV variable for each type of application as compared to that which was stated by the CMUG. They will address this further in discussion with the CMUG. This relates, in particular to the fact that CMUG has not identified the explicit need for sea-level in re-analysis, model development and validation applications, but only for model initialisation.

As concluded in the report, analysis of the contributions, and in particular those coming from the GCOS, the ocean topography community and the CMUG, clearly indicate the need to refine the GCOS requirements. In particular, there is a clear need to distinguish requirements by type of climate applications of ocean surface topography signal, such as (i) global mean sea level long term evolution, (ii) regional mean sea level and (iii) mesoscale and coastal signal.

Data Requirements Definition

33 types of data are necessary to run the algorithms and perform inter-comparison and selection tasks. These comprise of satellite and ancillary data from 6 altimeter missions (ERS-1, ERS-2, Envisat, Jason-1, Jason-2, T/P, GFO) plus in situ data. Most of these are easily retrievable, but others carry risk as they may be lost, unavailable as public data, or unavailable due to their reprocessing schedule.

The team has excellent working links for data quality aspects of TOPEX POSEIDON and JASON. Many project team members are already deeply involved in the RA2 Quality Working Group. CLS and GFZ are also involved in the REAPER project (Reprocessing of Altimeter Products for ERS).

Since re-processed ERS RA data will not be available in time for the sea_level_cci Round Robin exercise, the team is working first with available ENVISAT RA2 data.

Algorithms, Validation, Uncertainties, Models

Interaction with the CMUG is crucial to understand the needs of the climate modeling community and to setting a direct link with climate centres. The collocation was an opportunity to make preliminary contact that will be subsequently reinforced thanks to the planned meetings with CMUG.

Work packages tackling algorithm matters, including orbit calculation, instrument processing, high latitude issues and tide corrections, have been run in parallel. This has included, for instance, work on identification of data needs for Point Target Response algorithm cross-comparison and new model implementation for orbit determination.

International partners and projects

The sea level consortium was already highly involved in climate applications and services prior to the CCI, notably via contributions to the IPCC AR4 report. In particular, sea level trends estimation has been delivered on a regular basis to intergovernmental bodies such as CEOS (Committee on Earth Observation Satellites), OOPC (Ocean Observing Panel for Climate) and EEA (European Environmental Agency). Additionally, the project has a direct link with GCOS, CLIVAR, and GODAE Ocean View, via the personal involvement of key consortium personnel.

An objective is to promote the use of the Sea Level ECV within the climate modeling community, beginning with the four CMUG centres, namely ECMWF, Hadley Centre, Meteo-France, and MPI. Engagement with the community is ensured by there being sea level consortium involvement, by CLS in particular, with the MyOcean project, for which sea level is a key assimilated variable of near real time and re-analysis products.

Project Outreach

The project was presented in the plenary session at the Ocean Surface Topography Science Team (OST-ST) meeting in Lisbon (Portugal).

The science leader featured in the Euronews broadcast on CCI and presented at the ESA side event in at COP16 in Cancun. The sea-level CCI web site (www.esa-sealevel-cci.org) went on-line in early November 2010, and includes the first project CCI newsletter.

Future Activity

In 2011 Q1, the development of improved algorithms will intensify. A meeting with all partners is foreseen on January 20th 2011, including one day dedicated to the work package comprising algorithm development, inter-comparison and selection. Splinter meetings will be organized with each partner on specific topics. Also, new partners may join the Sea Level CCI consortium on coastal and tide subjects.

With regards to deliverables, the Product Specification Document is expected in Q1 2011. Specification of data sources, storage/sizing, performance, reprocessing and other constraints necessary for the System Requirements Document will also take place.

7 SST_cci (GCOS 0.3)

Project Initiation

The sst_cci project was kicked-off in mid-August 2010, with a full team meeting in Edinburgh (UK). They have continued to meet at regular intervals by teleconference, and will meet again in early January 2011 in Exeter (UK).

Since the KO, the User Requirements Document (URD), draft Product Specification Document (PSD) and a draft Data Access requirements Document (DARD), have all been delivered on schedule. Work is continuing to create a new multi-match-up Dataset (MMD).

No major problems have been encountered and the project is on schedule.

Collocation Outcome

All recommendations arising from the first CCI collocation meeting have been implemented by the project team. Co-ordination with the CMUG team remains essential, and co-ordination with other CCI teams is important.

User Requirements Gathering

The UK Met Office, within the team's Climate Research Group, has led the requirements capture activities. Over 100 potential users responded to an online survey developed by the team. The respondents represent a range of disciplines, including coastal oceanography, climate research, climate variability studies, regional modeling and seasonal modeling. Their responses allowed the SST Climate Research Group to identify 34 key requirements which will guide the specification of future SST products.

The survey responses revealed that climate users require future SST products to have smaller, better quantified uncertainties. The results also highlighted inadequate characterisation of uncertainties as a problem in current SST records. .

In some areas, findings go beyond the earlier climate-user requirements specified by GCOS panels. For example, respondents see the need for systematic uncertainties in SST data to be less than 0.1 K across spatial scales of 100 km.

Data Requirements Definition

A draft Data Access Requirements Document (DARD) has been produced. The 39 data sources include Satellite data (11 sources), Ancillary data (4), In situ data (4), Inter-comparison data (15), and non-SST CCI datasets (5). The primary ESA dataset for SST_CCI is ATSR Level 1 data.

The team is confident that the required ATSR data from 1990-2010 is available, and expects the required 2011-2012 data to be also available. Work has been ongoing to confirm the quality and availability of other datasets. .

The main concern has been the AVHRR GAC archive. A quality concern was identified within this dataset – an error was found and resolved in discussions with NOAA. The concern now is to acquire good data in time for the round-robin exercise.

The team interacts closely with the AATSR quality working group via a member who sits on the AATSR QWG: information is exchanged on all aspects of AATSR quality freely between QWG and CCI.

Algorithms, Validation, Uncertainties, Models

Validation resources were identified in the proposal, and the availability and quality of SST_CCI validation data is described in the DARD (draft).

The team's proposed V2 Optimal Estimation (OE2) approach will, if successful, provide a significant benefit to climate applications for the 1991-2010 long-term SST, namely independence of observation from in situ measurements.

A satisfactory approach to the characterization of uncertainty has been reached. The original plan to use the Nalli emissivity model is under review, based on new information that it may offer no improvement (and may even be inferior) to the Masuda approach used by the ARC project (one of the foundations of SST_CCI).

An initial meeting with CMUG has been scheduled. Informal interactions with CMUG will be facilitated by the fact that members of the CMUG and the SST CRG are based at the UK Met Office premises in Exeter.

International Partners and Projects

The project team is interacting with a number of external entities, including NOAA NCDC (AVHRR GAC) and RSS (AMSRE, TMI). Other important interactions are with CMS (AVHRR, SEVIRI), ECMWF, OSI-SAF and MyOcean. Contacts have been maintained by site visits, by teleconferencing and by email.

The Science Leader is currently collating the project team's views on SST user requirements, which will be forwarded to GCOS for consideration in their 2011 update.

Project Outreach

The project team produced a website (www.esa-sst-cci.org) and a Newsletter during the previous reporting period. As part of an experiment in transparency, the Science Leader is blogging his discussions with team partners as the research proceeds. See <http://sst-cci.blogspot.com>.

Future Activity

During the next quarter, the team will focus on updating the URD, PSD and DARD. Drafts of the PVP and round robin databases will be produced.

The University of Edinburgh will host the GHRSSST conference in July 2011.

8 Ocean_colour_cci (GCOS 0.4)

Project Initiation

The ocean_colour_cci project formally started on 1st August 2010 and held its technical Kick-Off meeting in Plymouth UK on 30th August and 1st September. To date no major problems have been identified and the team is on track to deliver the first batch of deliverables at the end of January 2011.

Collocation Outcome

The collocation meeting proved constructive and the team actively interacted with the other CCI teams. The Sea Surface Temperature team provided details on their requirements capture process which was very useful to the OC CCI team. The collocation guidelines have been circulated to the team and no major issues have been identified, though the CCI programme is still early in the project lifecycle. Feedback has been given on the Cloud CCI team's user requirements which have a direct impact on Ocean Colour. Technical coordination with the Cloud, SST and Aerosol teams remains high on the project's agenda, with the team supporting the Aerosol working group workshop at DLR in January (18th - 20th). The team joined and has made several contributions to the CCI Software Engineering working group.

User Requirements Gathering

Ocean Colour radiometry has a large and still growing user base. They fall into two categories: climate and ecosystem modellers, and those who use the data directly to study long-term (decadal scale) variability in the data, in relation to modulations in the forcing fields. The climate modellers use ocean colour data for validation of model outputs on the distribution of phytoplankton in the ocean. Primary production, information on major phytoplankton functional types, and data on the inherent optical properties of the ocean are also being used increasingly for climate research. The polling of the users has revealed that the requirements vary with application. A challenge would be to meet the diverse requirements of the different user communities. The survey has also revealed that all users place high value on reliable error estimates on a pixel-by-pixel basis.

Data Requirements Definition

The data requirements for the ocean_colour_cci project are well specified and will be fully described in the Data Access Requirements Document to be delivered in January 2011.

The objective of reprocessing the complete time series for all relevant sensors (MERIS, MODIS, SeaWiFS and, possibly, CZCS) means that the total quantity of data to be eventually gathered together and distributed is very large - on the order of 200TB.

Matching in-situ datasets (e.g. MOBY) are also being collected as they become available to the project - in particular, access to MERMAID is currently being pursued. To cope with delays due to data transfer time or access negotiations, the team is adopting an incremental approach. There will be an initial dataset for algorithm development and evaluation with a first release in January 2011. Subsequent releases may follow evaluation of user requirements and developer feedback as more data become available.

As part of beginning the investigation of level 1B data quality, links are being established with the MERIS Quality Working Group. NASA is involved, with a direct link to the group responsible for calibrating NASA data, which was represented at the ocean-colour_cci kick-off meeting. Other experts have been contacted.

The first step in improving level 1B quality is to establish and fully document the current status of known issues. This then allows the development of an error budget and identification of possible improvements to trial. To further this aim, a knowledge exchange meeting with the MERIS QWG is scheduled for March 2011.

Algorithms, Validation, Uncertainties, Models

Ocean-colour CCI has a strong research component in which various types of existing algorithms will be further developed, before the inter-comparisons take place. The round-robin evaluation and algorithm validation will be supervised by experts who are not directly involved in algorithm development. Two independent methods will be used to characterize uncertainties. Discussions have been started with CMUG, to define better the interactions between CMUG and OC-CCI, and the leader of CMUG will visit PML in January 2011.

International Partners and Projects

In addition to European partners, ocean_colour_cci has identified partners in the USA (NASA, NOAA, Naval Research Laboratory), Japan (Hokkaido University) and Canada (Bedford Institute of Oceanography). Additional international expertise is sought through interaction with the International Ocean Colour Coordination Group.

Project Outreach

The ocean_colour_cci project team presented at the Agency's LTDP (Long Term Data Preservation) Workshop on User Needs. The need to store all data with detailed rich metadata for an unlimited time-span and to keep data accessible for public access was highlighted.

The science leader presented the ocean_colour_cci project to IOCCG in November.

Validation statistics have been updated for MODIS-A and SeaWiFS by JRC using the main AERONET-OC sites for remote sensing reflectance, and the whole AERONET data base for aerosol optical thickness. These updated validation results for remote sensing reflectance of MERIS, MODIS-A and SeaWiFS for the AAOT site are given in: Zibordi, G., Holben, B., Mélin, F., D'Alimonte, D., Berthon, J.-F., Slutsker, I., Giles, D.: AERONET-OC: An overview. Can. J. Remote Sens., in press.

The project website (<http://www.esa-oceancolour-cci.org>) is now online and content is regularly updated.

The first project newsletter was published and distributed by the Agency at COP16 in Cancun.

Future Activity

The focus of the team for the next period is on the main batch of deliverables at the end of January 2011, this includes the User Requirements Document (URD), Data Access Requirements Document (DARD), Product Specification Document (PSD), Product validation Plan (PVP), Database for Task 2 (DB2T) and the Algorithm Theoretical Baseline Document (ATBD). The status of these will be reviewed in detail at the next project progress meeting on 12th -13th January in ESRIN.

The team is arranging project attendance and representation at the IOCCG 15th – 17th February Dartington, UK, the MERIS QWG 4th March, ACRI, France, the MVT Meeting 8th-10th March, JRC, Italy, the ECV-CMUG interaction meeting on 14th -16th March, ECMWF, Reading, UK, the GMES Sentinel Session at EGU, Vienna, Austria on 3rd – 8th April 2011, MARCDAT-III 2nd -6th May 2011, Frascati, Italy and the 2011 EUMETSAT Meteorological Satellite Conference, Oslo, Norway on 5-9 September 2011.

9 Glaciers_cci (GCOS T2.1)

Project Initiation and Collocation Outcome

The Glaciers_cci project was kicked-off on 3 November 2010.

The first working month 1 of the project was December 2010. The first deliverable (the URD) is on track and will be available in a first draft version by end January 2011.

The CCI Project Guidelines have not yet been implemented but are considered as a highly valuable document shaping the work and clarifying several details. The slightly different nature of the Glaciers_cci project is recognized in the guidelines and it should be well possible to follow the advice. The overlap of the Glaciers_cci with other CCI projects is only small (in all domains) but does exist for the Landcover_cci. It is planned to provide the high-resolution (30 m) glacier maps from all over the world as a validation data set to the Landcover_cci. Coordination with the activities in this project should be done in the first half of 2012.

User Requirements

The main users of the glaciers_cci data products are the key science bodies World Glacier Monitoring Service (WGMS) and GLIMS of the global terrestrial network for glaciers (GTN-G), glaciologists and hydrologists that model and wish to analyse sea-level rise of climate change impacts on glaciers, run-off and water resources.

The climate modeling community has only recently started to consider glaciers and icecaps as a boundary condition. They cannot yet assimilate these data directly. The specifications in the CMUG URD for the Glaciers_cci have been modified to better reflect this ECV and avoid confusion with products for the two ice sheets.

Data Requirements and International Partners

For the main sensors Landsat TM/ETM+ data availability is still fine (free download of orthorectified GeoTiffs from the glovis.usgs.gov website) and has been recently improved towards a more accurate geometric processing of scenes from Landsat MSS.

As ALOS Palsar will no longer be freely available (effective as of March 2011) a larger data request for the Himalaya region has been forwarded to the Agency in advance. The work on the algorithms etc. will start in 2011. One climate research partner (IAC-ETH) is now involved in utilizing the products from the precursor project GlobGlacier over the Himalaya for assimilation in the Regional Climate Model REMO. Good contacts to ICIMOD and the ongoing glacier inventory work in the Himalayas have been established.

The possible publication of a regular GLIMS bulletin (analogue to the WGMS Glacier mass balance bulletin) has been discussed with key science bodies and CRG members GLIMS and WGMS. The idea is to increase the visibility of the GLIMS database and provide a detailed reference for the included data sets.

Project Outreach

The science leader attended the first lead author meeting for the IPCC Working Group 1 (WGI) fifth assessment report (AR5) in November and helped to develop the outline and zero-order draft for the glaciers and icecaps subsection in the Cryosphere Chapter. It is expected that some early results from the Glaciers_cci and its precursor project GlobGlacier can make a major contribution to the AR5.

Furthermore, on 13 December, the science leader gave a presentation on ‘Glacier changes in the Alps and elsewhere in the world’ in the seminar on Climate and Environmental Physics at the University of Bern that was hosted by T. Stocker, the co-chair of the AR5. At this occasion it was possible to provide first hand information on global glacier changes as seen from space directly to the IPCC WGI Co-Chair.

Furthermore two new sessions at the EGU General Assembly have been organized that are related to the creation and completion of the global glacier inventory which will hopefully be attended by many researchers. On 14 December, Shiyin Liu from the Chinese Academy of Sciences presented at GIUZ an overview of the work on the second Chinese glacier inventory that is largely based on Landsat data from 2004-2010.

Future Activity

In the coming weeks the team will prepare the draft of the first deliverables, and perform a user request in regard to the points to be clarified for the future work in glaciers_cci (e.g. current status of work, remaining key regions, overlaps, specific challenges). The work on the product specification document will start in February 2011.

10 Landcover_cci (GCOS T.5.1)

Project Initiation

A successful kick-off meeting was held at the Université Catholique de Louvain (UCL) on August 24-25. The meeting achieved to establish a first and fruitful dialog between the climate modellers and the EO communities. It also allowed preparing the consortium for the co-location meeting and defining the main guidelines of the user requirement analysis, which is, up to now, one of the main achievements of the project. Indeed, a broad user consultation mechanism was set-up in order to actively involve different climate modelling groups by setting out different surveys. It enabled to draw a clear set of recommendations for the land cover products.

Based on this detailed list of user requirements, the land_cover_cci project is under way, without major problems. All the deliverables due for the first milestone are planned to be delivered on schedule. The land cover products specifications are currently being defined and a complete list of required datasets has been established.

Pre-processing researches have focused on the development of improved cloud classification and on the implementation of new aerosol retrieval and atmospheric correction. On the classification side, the GlobCover chain has been reactivated and some tests are performed to classify water and urban areas using SAR datasets.

Collocation Outcome

In general, the work carried under the project has benefited from the guidelines resulting from the CCI collocation meeting, as they help structuring and standardize the outputs. In particular, these guidelines contributed to make significant progress in the communication tasks, with the publication of the first newsletter and the creation of the Land_Cover_CCI website. The collocation meeting also allowed initiating efficient interactions with other CCI teams (such as the Fire_CCI team received the MERIS FRS data sets from 2005 to 2009 from the LandCover_CCI consortium and the Aerosol_CCI team about the treatment of surface and cloud masking procedure).

User Requirements Gathering

During the course of the last three months, a user requirements analysis was conducted to derive the specifications for a new global land cover product to address the needs of key-users from the climate modeling community. As part of this analysis, a broad user consultation mechanism was set-up, to include different user groups as follows: (1) a group of key-users, most of them also participating in CMUG, (2) associated climate users who are involved in the development of key climate model and applications and (3) the broad land cover data community, as reflected in the scientific literature and represented by users of the ESA GlobCover product.

This consultation showed that, although the range of requirements coming from the climate modeling community is broad and growing, there is a good match between requirements coming from different user groups and the high-level requirements from GCOS, CMUG and relevant

international bodies. A summary of the outcome was sent to the users who participated in the consultation for additional feedback. This was generally positively received.

Data Requirements Definition

All data (both satellite and auxiliary data) needed as input for the project have been identified. For EO data, two sensors are specifically targeted: SPOT-VEGETATION (from 1998 till now) and MERIS (2001-present for reduced resolution; 2005-present for full resolution). MODIS time series could also be used to fill in gaps in the data and/or products according to the classification results. The use of NOAA AVHRR dataset is an option. All these dataset as well as their processing version and availability have been documented in the “Data Access Requirement Document”.

Most datasets needed for pre-processing and classification have been acquired. Some discussions are still open on the type of SPOT-VEGETATION products to use (P-products or S1 daily syntheses) and currently, both products are planned to be tested. The amount of SAR data required will be defined after six months, when the results of preliminary urban and water classifications will be available.

The land_cover_cci team links directly to the MERIS QWG via a team partner (Brockmann Consultants) who is also member of the QWG. The high precision radiometric quality MERIS (as required from Ocean Colour) significantly exceeds the requirements for land cover classification and mapping.

As regards geo-location accuracy, the land_cover_cci team have already indicated, at the outset of the project, that their task would be considerably simplified if the Amorgoss geo-location package, which is currently a stand-alone post-processing tool, could be fully integrated into the MERIS_FRS and MERIS_RR operational processors.

Algorithms, Validation, Uncertainties, Models

Pre-processing work has already been completed on the acquired dataset. In particular, the issues of cloud and snow detection (which were critical in the previous GlobCover project) have been tackled. The consistency between time series is also carefully considered. In this respect, the use of SPOT-VEGETATION P products could be relevant since it would ensure similar pre-processing on all the input dataset. This possibility will be examined in the next 3 months.

From the classification point of view, the GlobCover classification chain has been reactivated and run over the 10-year SPOT-VEGETATION dataset. Specific research is under way to ensure consistency over time between land cover products. In addition, the potential of SAR dataset is being analyzed through preliminary water and urban classifications over some test areas.

In parallel, JRC has specified the high spatial resolution imagery needed for validation. SPOT images are being acquired via a Cat-1 proposal approved in October 2010.

International Partners and Projects

The land_cover_cci team is taking full advantage of the extensive international partnerships and large international user based, previously built up by the GlobCover project. In particular the second land_cover_cci progress meeting is being organized back-to-back with the GlobCover2009 final

presentation at JRC in Q2. Land Cover experts involved in the GlobCover2009 validation will also discuss the land_cover_cci validation. These meeting will involve representative of GOFC/GOLD LC, FAO and EEA.

Project work to date has engaged the international contacts of all eight consortium members. In particular, the user requirements definition (Wageningen University) engaged climate modellers from Max Planck Institute for Meteorology, Met Office Hadley Centre, and the Laboratoire des Sciences, du Climat et de l'Environnement.

Interactions exist (or are planned) with CMUG, GOFC-GOLD (for validation) and FAO (on the land cover product legend definition).

Project Outreach

On the communication side, the land_cover_cci team has produced its first Newsletter, providing a general description of the project organization and objectives and distributed during the 2010 United Nations Climate Change Conference. In parallel, the website has been made operational. It is regularly updated with useful and relevant information for interested parties.

Future Activity

During the next quarter the most critical work to be accomplished will consist of the finalization of the pre-processing and classification algorithms. This stage will be critical in the decision to continue with SAR data for water bodies and urban areas classification. Important work will also consist of the launch of the round robin exercise for algorithms selection. The second milestone of the project should be reached at the beginning of February 2011, for which several deliverables (URD, DARD, PSD, PVP, ATBDv0) will have to be finalized and successfully submitted to ESA.

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11 Fire_cci (GCOS T.9)

Project Initiation

The fire_cci project started on 1st September. A kick-off meeting was held in Alcalá de Henares (Spain) 9th-10th of September. Nine of the ten project partners attended. The key aspects were the definition of the study sites and the user requirement analysis. Within two weeks of this meeting the draft user questionnaire was completed and a final decision reached on sites. Coordinates of the sites and priority of temporal series were sent to DLR to start ordering the input data for the project.

Some initial inconsistencies between the project management plan and the payment schedule for some deliverables were identified. These were resolved by adjusting the contents and due dates of the relevant deliverables, mostly ATBDs.

Collocation Outcome

Key team members (UAH, GAF, DLR, JUL and GMV) attend the first collocation meeting in 15th - 17th September 2010 in ESRIN.

The collocation recommendations have been taken into account in activities already started, namely in the project website, user requirements, validation guidelines and system engineering. Commonalities with other ECVs were found. As a result, interaction with the cloud_cci team was established to define common requirements. Collaboration with other teams on validation and system engineering is progressing.

User Requirements Gathering

Immediately after the kick-off meeting the gathering of user requirements was started by Forschungszentrum Jülich. Forty-seven fire-related scientists and modelers answered the user questionnaire, which has been available on the Jülich and fire_cci project websites for 1.5 months.

The user requirements document was delivered in draft version as planned and is now under initial review by the participants, and by the Climate Modeling User Group (CMUG). It will also be provided to GCOS as an input of the review of their requirements for the essential climate variable (ECV) fire disturbance.

The key message from the user questionnaire has been a more realistic vision of the GCOS requirements for Fire Disturbance, both in terms of accuracy and precision, reflecting current technical limitations. This user consultation also shows that metadata and access formats must also be adapted for the needs of the modeling community.

Data Requirements Definition

All data that will be used for development of Burned Area products have been identified including sources and estimates of data storage amounts necessary. The main sensors to be used in the project are (A)ATSR (1995-2009), MERIS (2002 to 2009) and SPOT VEGETATION (1998 to 2009).

The project team submitted a Category-1 proposal to ESA for (A)ATSR, MERIS on 21 October. A Category-1 proposal was also submitted to SPOT for the VEGETATION data on 20 October. Given the very large amount of MERIS data required (MERIS_RR ~22TB, MERIS FRS (~60TB, 2005-2009), MERIS FRS (~10TB, 2002-2004) and that the MERIS archive is currently undergoing a 3rd re-processing) the ESA Category-1 proposal required analysis but was accepted finally on 21 December 2010.

To ensure the data are available as early as possible the MERIS dataset generated for the CoastColour DUE project are being transferred to the fire_cci team on LTO tapes. MERIS-FRS data for the period July 2002-December 2004 are being processed by UK-MM-PAF and will be supplied as soon as they are available.

An existing archive of (A)ATSR images (processor versions STEP/1.3, v6.01) already available at GMV premises from the GlobAerosol project, was sent to DLR for pre-processing. This covers part of the time series (from 1995 to 2007). These data will progressively be replaced by the up-to-date processed data (v6.03) for consistency with Cloud, Aerosol and SST cci projects. The AATSR data for January 2008-December 2009 will be downloaded from the MERCI interface.

This is the most critical problem that the project currently faces. The original internal schedule foresaw that the pre-processed data would be available to algorithm developers within the first three months of the project, which assumed that data would be sent to DLR for pre-processing immediately after contract signature.

In terms of required data for validation and the Round-Robin exercise, an extended set of Landsat images were downloaded from the USGS historical archive. They have been complemented with other Landsat archives (INPE in Brazil, ISA Portugal, CSIR South Africa). Software is being developed to automatically extract fire perimeters from Landsat images. A protocol is being defined to document all sites and facilitate their public access in the future.

The fire_cci consortium has close connections to existing members of the QWG for AATSR through previous projects (GlobAerosol especially). Coordination with the cloud_cci and aerosol_cci projects will be organised to ensure that data issues for CCI will be raised at the next AATSR QWG. Interaction with the MERIS QWG will operate by coordination with the land_cover_cci project to ensure a consistent approach for MERIS quality over land.

Algorithms, Validation, Uncertainties, Models

The user requirements analysis stimulated fruitful collaboration with climate modelers, as did the definition of project sites, which took into account fire emission characteristics. Potential adaptation of global vegetation models to regional conditions is being studied in collaboration between UAH, MPI and LSCE, by improving input parameters on fire regimes and human-fire relations.

International Partners and Projects

Contacts with the GOFC-GOLD Fire Implementation team office have been established, to assure international cooperation between fire_cci and other projects generating burned area information. A technical workshop on algorithm developing will be organized in 2011, and a dedicated validation workshop in 2012. The Fire Implementation Team will also participate in the round-robin exercise.

Contacts with the CEOS Validation group have also been established to find common protocols for definition of validation methods and documentation of validation sites.

Project Outreach

The fire_cci project website (www.esa-fire-cci.org) has been set up following the guidelines agreed on in the collocation meeting. An 8-page newsletter has been provided for dissemination in the COP-16 Cancun convention. The scientific leader presented the project on an ESA side event during this convention.

Future Activity

The main activities in the next quarter will be the completion of key deliverables for the first phase of the project: URD, DARD and PSD, as well as the completion of data acquisition and pre-processing and development and improvement of the burned area algorithms for MERIS (FRS and RR), (A)ATSR and SPOT VEGETATION.

12 Climate Modelling Users Group

Project Status

CMUG has made good progress in interacting with all CCI project teams, maintaining the project work plan: only one deliverable has been delayed as a result of the staggered start-up of the other nine projects.

Interaction with Climate Modelling Community

CMUG scientists attended the following international meetings of the climate research community, in four cases with a dedicated CMUG presentation:

- **WCRP Working on Climate Models (WGCM)** meeting in Exeter (4-6 Oct), where CMUG was presented in the session on “Observations & Model Evaluation” (see <http://www.clivar.org/organization/wgcm/wgcm-14/wgcm14.php>).
- CMUG established links with **WCRP Observation & Assimilation Panel (WOAP)**, and with NASA regarding their plan to process satellite Climate Data Records on the Earth System Grid (ESG) of which the British Atmospheric Data Centre is a node. There were discussion on common format and standards of data sets, and validation of CMIP5 simulations, acknowledging that CCI datasets will not be ready in time for CMIP-5 or IPCC AR5 assessment, but will be of use for later assessments.
- **MACC Assembly**, in Toulouse (18-22 October) where CMUG interacted with the chemical modeling community.
- **ESA Long Term Data Preservation** in ESRIN (18-22 October), where CMUG made a presentation on data requirements for reanalysis including CMUG.
- **EGU ILeaps, ESRIN** (3-5 November), where CMUG made a presentation on fire products.
- **Globvapour meeting** in Mainz (9-10 November): CMUG interacted with the cloud_cci partners.
- **UNFCCC COP-16 in Cancun**: CMUG presented during the ESA side event.
- **AGU** in San-Francisco (13-17 December): CMUG interacted with modellers as part of the session on “Climate Processes and other research applications enabled by satellite sounders, imagers and profilers”.

Meeting reports are available on the CMUG internal web site and summarise the level of interaction, information gained, or benefit to CMUG in links established (e.g. links with GlobVapour, WOAP and NASA). Work on linking CMUG to relevant EC FP7 climate research projects continued, with a link established to the CARBONES (carbon cycle modeling) project, and other approaches followed up. Establishing links with EC climate research projects allows CMUG to reach and interact with specialised climate modellers (mostly climate application modellers) who stand to benefit from ECV products.

The CMUG questionnaire for gathering user requirements from the CMC was updated, and is currently being circulated around IS-ENES to canvass their collective view.

Review comments giving the CMUG view on the GCOS draft document for *Systematic observation requirements for satellite based products for climate* were submitted.

Interaction with other CCI projects

CMUG attended the Kick-Off meetings for the aerosol_cci and land_cover_cci projects, and tabled a document at the cloud_cci project meeting which was followed up in November. There were also discussions with the fire, SST, and Ocean Colour projects about gathering and analysing user requirements, in which CMUG advice contributed to the preparation of their URD questionnaires.

Communicating information to the other CCI projects was achieved by updating the CMUG website with an ECMWF data products information page, and by setting up a Wiki site and email groups for the CCI project leaders and data contacts. However, there is a clear need to identify a more official mechanism for interaction in order to get the final version of deliverables and provide officially the technical note.

Deliverables

The *Requirement baseline document* was revised after further iteration and inclusion of an annex with the format provided by ESA. This will be updated in 2011 with input from the IS-ENES project. The only delay occurred in the preparation of the *Technical note on CCI user requirements and specification*, since the required inputs from CCI projects were not delivered to CMUG. Informal drafts of CCI URDs from some CCI projects have been sent to CMUG for comment and from this it is anticipated that the CCI URDs will be formally available in January.

Project Outreach

CMUG contributed to the EuroNews feature on CCI with an interview from the team member at MPI-M and by the presentation for the CMUG team leader at the ESA side event in Cancun. Met Office gave a presentation at COP-16 in Cancun. The CMUG website was updated with more general information and the CMUG newsletter was distributed through the website and at meetings.

Future Activity

A key CMUG event next quarter is the interaction meeting with the ECV projects which will be hosted at ECMWF 14-16 March. ECV project leaders have confirmed they can attend (or will send a substitute). A strategy document for the meeting describing the aims, desired outcomes, draft programme, and planning timeline is currently being worked on. The aims of the meeting are to:

- Ensure the CCI project URDs consistently capture the user needs expressed by GCOS, CMUG, and the needs of their individual Climate Research Groups
- Discuss ECV product specifications
- Develop / finalise the CCI projects data needs for ECMWF reanalysis data
- Start discussion on ECV validation data sets
- Discuss how to handle uncertainties on level-3 products
- CCI teams & CMUG will discuss how to show that products are climate-quality
- CCI teams & CMUG will together discuss how they will collectively address the integrated perspective for consistency between the ECVs

The CMUG analysis of CCI project URDs will be delivered early in the next quarter. In February 2011 the Agency and CMUG will assess how to best accommodate the staggered start of the CCI projects.

CMUG will revise its communication plan to maximise the effectiveness of outreach at conferences and through publications. This includes a CMUG brochure focusing on results so far, and future goals of the project, to be produced early in 2011 for the climate modeling community. The scientific exploitation plan and report respectively will also be provided in February. CMUG will update its project plan accordingly before end Q1 2011.

Key conferences next quarter include IS-ENES, GCOS-AOPC, and GEWEX. At the IS-ENES, which is in February 2011, a CMUG presentation is already included in the programme.

13 ESA Climate Science Advisory Body (CSAB)

CSAB Advice to ESA (2nd Meeting)

The Climate Science Advisory Body (CSAB) established by ESA held its second meeting at ESRIN in Frascati on 19 November 2010. The meeting was attended by Paul Mason (GCOS), Ghassem Asrar (WCRP), Jean-Louis Fellous (JCOMM and COSPAR), Erland Källén (ECMWF) and Massimo Menenti (ESAC) as members of CSAB. Also present was Jörg Schulz (EUMETSAT).

The CSAB was updated on recent significant programmatic events in Earth Observation since its first meeting, including orbit change of Envisat, and launch and operation of the three Explorer missions GOCE, SMOS and CryoSat-2.

A CCI status report was presented, and the outcomes of the first Collocation meeting relating to user requirements, data requirements and standards, and data-model confrontation were discussed. The concept of a “CCI science agenda” was subject to an extensive discussion.

The CSAB further discussed the next steps, beyond the initial set of ten ECVs, including a new call for the Sea Ice ECV, for which no satisfactory proposal was received in response to the first call. In particular, the CSAB was informed on new opportunities to develop two new ECVs, namely Ice Sheets mass balance and Soil moisture.

The CSAB was informed on recent developments in international scientific cooperation on climate, including activities in the framework of WCRP, ICSU, CEOS, GCOS, and UNFCCC, as well as within EUMETSAT, and welcomed the active role and partnership of ESA in these various contexts.

An overview of the ESA EO communication activities related to Climate Change and examples of CCI Newsletters were provided to the CSAB.

The CSAB discussed the evolution and future of CCI and the possible advisory role. In summary, the following advice was formulated and agreed upon by CSAB members.

1. CSAB recommends the CCI to make best possible use of and benefit from the opportunities offered by the **data from the Explorer missions**. ESA has a unique position to demonstrate the concept of research and operational missions through the convergence of these complementary capabilities to meet its climate observation requirements.
2. CSAB endorses the aim of encouraging the CCI teams to engage in community building through the production of an overall “**CCI science agenda**”. CSAB will be pleased to assist the science team leaders in furthering this concept and developing this document.

3. CSAB supports the next steps proposed by the CCI Programme, including releasing again the call for tender of the **Sea Ice ECV** and separately developing **Ice Sheets and Soil Moisture ECVs**, based on funding opportunities complementary to CCI.
4. CSAB considers the foreseen **ERS-2 final operation on a 3-day repeat orbit** before decommissioning of the satellite as extremely useful and productive from a CCI perspective and supports its implementation for as long a period as possible, given other relevant ESA constraints and regulations.
5. CSAB discussed the importance and need for sufficient **computational capabilities for processing and reprocessing** of the ECVs, as a part of the long term data preservation, and the improvement of ESA sponsored data sets.
6. CSAB expressed the desire to receive regular, **timely information about CCI progress**; it reaffirmed its willingness to be involved into the CCI science agenda; to this end CSAB put forward the suggestion of holding a one-day meeting with ECV science team leaders.
7. CSAB expressed interest in the **ESA communication policy on climate**, with the recommendation to adhere to a strictly scientific position in addressing CCI-related information; and recruiting active engagement of the science teams in developing news worthy and exciting press briefs/releases.

CSAB identified the opportunity for **CCI Programme to work closely with CEOS Climate Task Team** to ensure timely and efficient access to international partners'