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1 SCOPE

The purpose of this document is to provide an easy to read description of the first projects being initiated within the "Climate Change Initiative" (CCI).

The intended audience is all participants to the first CCI collocation meeting 15th-17th September 2010 at ESA ERSIN, Frascati, Italy. This document is circulated to all participants in advance of the meeting, to inform them of the scope and team composition of all CCI projects.

The aim is to facilitate discussion and cooperation between project teams, during and after collocation.

2 INTRODUCTION

This first tender of the CCI programme has resulted in the projects for the following ten ECVs:

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.2	Sea_Level_cci	LEGO-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.5.1	Landcover_cci	Université Catholique de Louvain (*P.Defourny*)
T.9	Fire_cci	U. Alcala (*E.Chuvieco*)

Each project team typically includes experts from ten or more research organizations. Each team has a sub-group with specialist scientific expertise in EO, a sub-group specialised in climate research and modelling, and a sub-group of system engineering experts.

Each team has a science leader, who 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 will ensure communication within the project team, maintenance of schedule, tracking of actions, deliverables and reporting to ESA.

All ten projects will work in parallel on the following tasks during the next three years

- Requirements Analysis and Product Specification
- Algorithm Development, inter-comparison and Selection
- System Prototyping and ECV production
- Final Product Validation and User Assessment
- System Specifications
- Project Management

A Climate Modelling Users Group (**CMUG**) has also been set up. CMUG aims to provide an integrated, working-level gateway from CCI to the international climate modelling community.

The schedules of all ECV projects and CMUG share common milestones. These meeting points have been planned to facilitate periodic information exchanges, mutual reviews and scientific coordination: between the project teams, with CMUG, with the executive, and in due course, with international partners.

Each team will deliver a standard set of documents which, after internal review by the project team and after acceptance by the Agency, will be made publicly available, as a way of stimulating feedback and facilitating cooperation with other scientific teams.

Each CCI project team will set-up a project web site with all information needed to ensure coordination and consistency with related projects. Each web site will provide open access to project documents and data products.

The CCI project deliverables (data, quality, cal/val, documentation, review, open access) have been specified in accordance with the “Guideline for the Generation of Satellite-based Datasets and Products meeting GCOS Requirements” (GCOS-129 March 2009).

Herafter follows, for each CCI project, including CMUG, a description of project scope, team composition and starting date.

3 CLOUD_CCI [GCOS A.4]

Project team

The Science lead of the Cloud-cci project is ensured by the German Meterological Service DWD, (R. Hollmann). DWD also provides Project Management. Thus close coordination is assured with the Eumetsat Satellite Application Facility on Climate Monitoring (CM-SAF) hosted by DWD.

The EO-Science team includes research teams from DWD, FU Berlin, U. Bremen, DLR, KNMI, Oxford U, RAL, and the U. Valencia. They combine expertise on instrument calibration, cloud retrievals, cloud climate analysts, cloud processes and climate modelling.

The climate research group includes SHMI for cloud climate modelling, and CNRS-LMD for processes and trends. The team includes a lead author of the IPCC AR5 report.

System Engineering is lead by DWD which ensures that the project will build on the CM-SAF experience in system engineering and operations for climate processing.

The primary users of the Cloud_cci products will be radiative forcing scientists and modellers, engaged primarily via the Global Energy and Water Cycle Experiment (GEWEX) Radiation Panel. The participation of the GEWEX cloud assessment group leader (CNRS_LMD) in this project assures this linkage.

Project Scope

The Cloud_cci project directly addresses the GCOS clouds radiative properties (Product A4) requirements with existing satellite datasets. Adjustments to the GCOS requirements are:

- reduced temporal resolution from 3 hour observing cycle product to 6 hours
- enhanced geographical resolution of 100km to 0.05 degree.

These variations from the exact target requirements of GCOS result from consultation with the climate research and modelling communities. This will be further refined in the initial stage of the project and provided as feed-back on requirements to GCOS.

The Cloud_cci project will deliver the following outputs:

- **inter calibrated radiance data sets** for ESA and non-ESA instruments through international collaboration.

- **a coherent physical retrieval framework** for the GCOS cloud property ECVs cloud cover, cloud top height and temperature, liquid and ice water path. This can be considered as an open community retrieval framework that will be publicly available and usable by all scientists and include per pixel uncertainty estimates.

- **cloud properties** generated using (A)ATSR-AVHRR-MERIS-MODIS sensors

- **a common wavelength approach and advanced optimal estimation algorithm**. This will initially provide 3 years of data (2007-2009) and potentially a time-series going back to 1982 with AVHRR and ending in 2012 with Envisat and the NASA sensors.

- **a merged AATSR-MERIS cloud parameters product**, extending the ESA "MERIS/AATSR Synergy Algorithms for Cloud Screening, Aerosols and Atmospheric Correction" project outcome. This time-series, although limited to AATSR/MERIS, will provide a comparison dataset for the first product and can potentially be extended in the Sentinel-3 era up to 2025.

In addition to the classical validation of the cloud products, comprehensive error budget simulations will be performed to obtain an overall algorithmic uncertainty dependent on the parameters, such as aerosols, snow, multi-layered clouds, etc., influencing the retrievals. These findings will be documented in detail in a separate project deliverable.

The Cloud_cci project will contribute significantly to the GCOS Product A.4 using cross-calibrated European and other sensor data in the development of a fully characterized climate quality cloud ECV.

Cooperation

The project team has established links with numerous external institutions and initiatives. These include cloud/aerosol modelling groups in Germany, UK, USA, notably NASA and NOAA for instrument calibration and retrieval algorithms, and the WMO SCOPE-CM and GSICS activities on clouds.

The team plans international cooperation through visiting scientists, and specifically targets collaboration with instrument teams from the USA for inter-calibration of non-European sensors and for inter-comparison of algorithms. Three such exchanges have been identified for the first 12 months: with the NOASS/NESDIS/STAR PATMOS-x team; with the NASA MODIS cloud team; and the with climate research team from the University of Wisconsin.

Project Start

The planned kick-off date is September 1.

4 OZONE_CCI [GCOS A.7]

Project Team

The scientific leadership of the Ozone-cci project is assured by the Belgian Institute for Space Aeronomy (M.van Roozendael). BIRA also provides project management.

The team includes the German Space Center (DLR), Royal Netherlands Meteorological Institute (KNMI), University Bremen (IUP), Karlsruhe Institute of technology (IMK), Rutherford Appelton Laboratory (RAL), Aristotle University of Thessaloniki (AUTH), University of Athens (NKUA), University of Cambridge (UCAM), Laboratoire Atmospheres, Milieux, Observations Spatiale (LATMOS), Finnish Meteorological Institute (FMI), Royal Meteorological Institute of Belgium, and the Federal Office of Meteorology and Climatology MeteoSwiss.

The EO Science team includes European ozone experts with experience on total ozone and ozone profile retrievals from space and ground-based measurements. covering the UV/VIS and IR wavelength range and different measurement techniques (nadir and limb viewing). The Validation group includes BIRA/IASB, AUTH, NKUA, KMI, MeteoSwiss, IUP, KIT, FMI, and LATMOS.

The Climate Research Group includes leading European Ozone Climate modellers (DLR/Model E39C-Q, KNMI/Model TM, and UCAM/ Model UCAM). The teams incorporates very good linkages to IPPC, SPARC, and WMO/UNEP. The consortium includes as well several members of the Internaional Ozone Commission. The System Engineering group includes expertise from DLR and KNMI.

Project Scope

The project addresses the GCOS requirements for the Atmospheric Ozone ECV.

The Ozone_cci project aims to produce and validate a consolidated long-term ozone series to match the GCOS requirements, thereby reducing uncertainties in present estimates of ozone trends and of ozone-induced radiative forcing. This will be derived from multiple satellite instruments, focussing mainly, but not exclusively, on European sensors. Activities will concentrate on three types of Ozone data product:

- **Total ozone:** The L2 retrieval algorithm baseline is the GOME DATA PROCESSOR (GDP) 5, which will also be applied to SCIAMACHY and GOME-2 data. OMI data will be included in the merged data set (using the NASA OMTO3product). This data set will cover the period 1995 until now

- **Low resolution ozone profiles from nadir sounders:** The KNMI baseline L2 algorithm is the new OPERA-OMI synchronised algorithm and the RAL baseline algorithm is a two-step algorithm optimised for tropospheric ozone. The Round-Robin selection exercise will take the best of the two approaches. The GOME, SCIAMACHY, GOME-2, and OMI

sensors will be included in the prototype ECV parameter generation. The first prototype data set will consist of a minimum of two contiguous years

- **Higher resolution ozone concentration profiles derived in the upper troposphere and in the stratosphere using limb and occultation types of instruments:** The limb profile data product will be generated by merging data from three different sensors: MIPAS, GOMOS, and SCIAMACHY. For GOMOS, this will rely on the ESA operational data product. For SCIAMACHY it will be based an advanced (IUP) scientific product which provides a better altitude coverage than the operational product. For MIPAS several competing algorithms will be inter-compared. Detailed error characterization will be performed for all three sensors. The Envisat data will be extended by TPM missions (Odin, ACE). The first prototype data set will cover at least two contiguous years.

Cooperation

For validation against ground-based observations, the Ozone-cci project will rely on established and well maintained data series acquired by instruments affiliated with WMO's Global Atmosphere Watch (GAW) and its contributing networks, namely the Network for the Detection of Atmospheric Composition Change (NDACC) and Southern Hemisphere Additional Ozone-sonde programme (SHADOZ).

Total ozone validation will be based on data records from Dobson and Brewer UV spectrophotometers and from NDACC-certified UV-Vis DOAS spectrometers. Ozone profile validation will be based on long-term data records from NDACC-certified lidars, ozone sondes and microwave radiometers. Satellite-to-satellite inter-comparison (zonal mean time series, climatologies, variability) will be performed with non-ESA sensor data (HALOE, SAGE, MLS/Aura, SABER, SBUVs).

Project Start

The planned project start is September 01.

5 AEROSOL_CCI [GCOS A.8]

Project team

The scientific leadership of this project is shared by DLR (T. Holzer-Popp) and FMI (G. de Leeuw). Project management is also assured by DLR. Team membership includes: FMI (FIN), BIRA(B), CNRS/ICARE (F), MPI-Met (D), MetNo (N), NILU (N), PSI (CH), KNMI (NL), RAL (UK), U. Oxford (UK), U. Bremen (D), U. Swansea (UK), and HYGEOS (F).

This team combines wide experience in aerosol retrieval from a broad range of European instruments, strong expertise in validation with *in-situ* data, and close links with recent and on-going aerosol projects in Europe, such as MACC, PASODOBLE, EUCAARI, *etc.*

This EO Science Team brings together remote sensing aerosol expertise, particularly for ATSR, MERIS, POLDER, OMI, SCIAMACHY, GOME, GOMOS, CALIOP, MODIS, as well as experts in the use of AERONET and ground based *in-situ* data for validation.

The link with climate science users is ensured by via the international aerosol modeling inter-comparison project "AEROCOM". AEROCOM represents the international community integrating global modelling of aerosols for climate science. It comprises fifteen major aerosol modeling groups from around the world, and includes models from seven European groups (LSCE, MPI, U. Oslo, U. L'Aquila, LOA, DLR, U. Utrecht). Contributing authors of the IPCC WG1 AR4 atmospheric radiative forcing chapter are participating

The system engineering team draws on the expertise of three operational data centres (DLR, RAL, CNRS/ICARE) on the development and maintenance of scientific and operational retrieval algorithms for instruments such as (A)ATSR, MERIS, POLDER, SCIAMACHY, GOME.

Project Scope

The GCOS requirement is for an aerosol optical depth with an absolute accuracy of 0.01 at 1×1 km^2 and daily resolution, with a stability of 0.005 per decade. Current accuracies of the best satellite aerosol retrievals are in the range of about 0.05 over sea and 0.1 over land, but only at lower resolutions of about 10×10 km^2 and integrated over weekly to monthly time periods.

The stability of the available aerosol data sets has not yet been well characterized, but is likely to be far from meeting GCOS's requirement. While the GCOS requirement cannot yet be met at 1 km and daily resolution, lower resolution monthly products over the ocean may begin to approach the requirement, and may be sufficient for the purposes of the climate modelling users, given that global aerosol model resolutions are not usually finer than 100×100 km^2.

Given the recent availability of state-of-the-art global aerosol data sets covering long multi-annual time series (*e.g.* DUE GlobAerosol), and the development within Europe of mature competing

algorithms for several instruments, the Aerosol_cci project will aim to consolidate the available European expertise to significantly improve aerosol retrieval algorithms towards achieving the accuracy requirements set by GCOS. Specifically, the project will identify instrument-specific best-practice approaches, and investigate the potential for merging complementary information from different instruments. A major element will be the detailed analysis of critical methods (*e.g.* cloud screening, surface reflectance, aerosol microphysical model) through intensive inter-comparison, validation and scientific exchange between the participating EO experts. By concentrating on exhaustive multi-mission algorithm development and testing on single test years, Aerosol_cci will address the sources of aerosol retrieval uncertainty, quantifying their impact, and combining the best performing methods into best-practice community retrieval algorithms.

The project will produce the following set of global aerosol products covering either 2008 or 1997, depending on the input data availability:

- a consistent multi-spectral aerosol optical depth and aerosol type probability for AATSR and ATSR-2
- a multi-spectral aerosol optical depth and aerosol type probability for MERIS
- a multi-spectral aerosol optical depth and aerosol type probability for POLDER
- a synergetic multi-spectral aerosol optical depth and aerosol type probability (starting with SCIAMACHY + AATSR and extension to GOME-2 + AVHRR/3 and GOME + ATSR-2)
- a consistent UV absorbing aerosol index for OMI, SCIAMACHY and GOME together with averaging kernels for assimilation in models
- a stratospheric extinction profile gridded product at 2.5° x 10° for GOMOS (incl. testing on SCIAMACHY)
- merged multi-spectral aerosol optical depth and aerosol type products combining several of the above AOD products with appropriate error-weighting and optimally tuned to user requirements
- a global “climatology” (for the reference year) of aerosol type probability

Each product will, as required by the modellers, include pixel-wise error information derived via rigorous propagation of uncertainties due to input data and retrieval models.

The products and their error characteristics will be validated globally against ground based AERONET data, supported by *in-situ* aerosol composition measurements. User evaluation will be obtained primarily from ingesting the aerosol products into the AEROCOM systems used by the aerosol community for model inter-comparison, and collecting feedback on the inter-comparison with users' own model results. The AEROCOM participants provide a direct link to global model inter-comparison projects such as CMIP5, and ultimately to the IPCC assessments. The GMES MACC project has expressed strong interest, and has agreed to provide requirements and to evaluate the Aerosol_cci products.

Project Start

The Aerosol_cci project will be kicked off at ESRIN on 26 July 2010.

6 GHG_CCI [GCOS A.9]

Project Team

The Scientific leadership of the GHG_cci project team is assured by University of Bremen, IUP (M.Buchwitz). Project management is assured by U.Leicester.

The team brings together expertise on GHG retrieval from satellite measurements from the Belgium Institute for Space Aeronomy (BIRA/IASB), Deutsches Zentrum für Luft- und Raumfahrt **(**DLR), Joint Research Centre (JRC), Karlsruhe Institute of Technology (KIT), Laboratoire de Meteorologie Dynamique (LMD), Laboratoire des Sciences du Climat et l'Environnement (LSCE), Netherlands Institute for Space Research (SRON), Swiss Federal Laboratories for Materials Science and Technology (EMPA) and U. Leicester (ULE)

The FP7-funded GMES project MACC is an important user of GHG_cci results: Whereas GHG_cci will develop improved algorithms to enhance the quality of satellite retrievals, MACC focuses on (inverse) modelling and assimilation, and needs high quality satellite data as input. Therfore, the MACC modelling groups (ECMWF, JRC, LSCE) will assess the usefulness of the GHG_cci data sets by model comparisons and assimilation, and will provide feedback to the retrieval groups.

Project Scope

The project addresses the GCOS requirements for the ECV “Greenhouse Gases” (GHGs). Carbon dioxide (CO2) and methane (CH4), which are the two most important anthropogenic GHGs. State-of-the-art retrieval algorithms for remote sensing of these gases will be developed further. Multi-year Carbon Dioxide (CO2) and Methane (CH4) data sets will be generated and validated.

Successful inverse modelling of surface fluxes of methane has been demonstrated using data from the first years of the SCIAMACHY mission. Encouraging initial global distributions of CO2 have been derived from SCIAMACHY nadir spectra but a data quality sufficient for inverse modelling has not yet been reached (errors due to aerosols and residual clouds need to be further reduced). GOSAT has only recently been launched and significant efforts will be needed to achieve the required data quality. Advanced CH4 and CO2 retrieval algorithms will be further developed within this project. This can potentially lead to a GHG ECV product that can be used for deriving sources and sinks of these ‘anthropogenic’ GHGs.

Two existing satellite sensors will be used as the main data sources: SCIAMACHY on ENVISAT and TANSO on GOSAT. Both instruments measure NIR/SWIR spectra of reflected solar radiation and are sensitive to CO2 and CH4 concentration changes close to the Earth’s surface. Consequently they carry information on regional surface fluxes, i.e., on regional surface sources and sinks. The accuracy requirements for such an application are demanding, especially for CO2 but also for CH4.

Given the limited availability and maturity of such observations, the project will focus more on algorithm development and less on "system''. A two-year, round-robin exercise will be conducted for ten different CO2 and CH4 retrieval algorithms, as developed by IUP, SRON, and ULE for SCIAMACHY and GOSAT. GHG data products (columns and profiles) derived from AIRS, IASI, MIPAS and ACE-FTS measurements will also be used in scientific studies to assess the extent to which they can constrain surface fluxes.

The best algorithms will be applied to the most complete satellite observations record available. A fast processing scheme, combining SCIAMACHY and GOSAT measurements, will be used to cover the time period 2002 until present. This can potentially deliver a consistent ten-year record for both species. A more accurate, but highly computationally intensive, 'full physics' processing scheme will also be applied to a single year of data.

The consortium is confident that the GCOS requirements for the planned CH4 data sets can be met, but notes that, with currently available sensors, achieving comparable quality for CO2 must be considered as a major scientific challenge, rather than a firm requirement.

Cooperation

The GHG_cci project team has close co-operation with the NOAA CarbonTracker, NASA-ACOS (OCO2 mission), and JAXA and NIES GOSAT teams.

For validation against ground-based network observations the project team will rely on established and well maintained data series acquired by instruments affiliated with the Carbon Observing Network (TCCON), and with WMO's Global Atmosphere Watch (GAW) and its contributing networks, namely the Network for the Detection of Atmospheric Composition Change (NDACC).

TCCON is a network of ground-based Fourier Transform Spectrometers recording direct solar spectra in the near-infrared spectral region. From these spectra, accurate and precise column-averaged abundance of CO2, CH4, N2O, HF, CO, H2O, and HDO are retrieved. The World Data Centre for Greenhouse Gases of GAW includes the data from 24 sites with CH4 measurements and about 29 sites for CO2. The Network for the Detection of Atmospheric Composition Change includes 21 stations equipped with FTIR spectrometers that are recording solar or lunar absorption spectra in the mid-infrared range on a regular or quasi-continuous basis. Timely access and usage for geophysical validation of all these data will be ensured by a dedicated validation team including IUP, KIT, BIRA/IASB and EMPA.

Project Start

The project start date is scheduled for Sep. 01.

7 SEA_LEVEL_CCI [GCOS O.2]

Project Team

Scientific leadership of the Sea_level_cci project is assured by LEGOS/CNES (A.Cazenave). Project management is provided by CLS (F).

The EO science team includes U. Hamburg (D), IFREMER (F), LEGOS (F), GFZ (D), IsardSat (E), DTU Space (DK), NERSC (N).

The Climate Research Group, lead by U. Hamburg (D) includes NERSC(N), LEGOS (F) and ECMWF. The project team is very well linked to the IPCC process, and includes lead and co-authors of the IPCC WG1 AR4 and AR5. Identified user organizations include National meteorological offices and institutes, CLISAP, CLIVAR, GLOSS, PSMSL.

System engineering work will be performed by Logica (UK) and CLS(F).

Project Scope

The project responds directly to the GCOS requirements for the Sea level ECV (Product O.2 in GCOS-107) through the generation of multi-mission ECV products from the altimeters on Topex/Poseidon and Jason series, as well as ERS1/2, Envisat and Cryosat (i.e1991– present)

The GCOS requirements are considered very ambitious with respect to existing altimeters and the relatively short length of the exiting altimetry-based sea-level time series. The team will therefore critically review the GCOS requirement and assess the scientific limits of ECV data products of the best quality possible with existing data.

The team plan to improve and evaluate more than sixty individual processing algorithms from the complete radar-altimeter data processing chain, in order to optimize control over accuracy and drift of radar altimeter measurements and generate long-term consistent records of global and regional sea-level variations. The planned improvements fall into three main categories:

- Instrumental corrections improvement and errors characterization
- Geophysical corrections improvement and errors characterization
- Impact of ENVISAT at high latitudes and coastal zone

The project builds upon long-term investments and expertise that the participating organizations have made in multi-mission altimetry data processing over the last two decades, and upon advances in ocean data assimilation achieved via GODAE.

The project team will perform independent validation and comprehensive error characterization of the data products. User feedback will be collected via the climate research group to assess the quality and usefulness of the products for climate modelling. A comprehensive suite of state-of-art numerical ocean (UoH, ECMWF) and coupled (NERSC/Bergen Climate Model) models and

variational analysis tools will be utilized for this purpose. In complement, a closure budget study will be performed (LEGOS) based on observation analysis

Cooperation

The project team will coordinate with international research efforts on sea-level observations via the Ocean Surface Topography Science Team. Direct links to numerous international climate research programmes are assured by individual team members active in WCRP programmes, notably CLIVAR and WOAP, as well as the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC). There is well-established cooperation with key US research groups at NASA/JPL, NOAA/NESDIS/STAR, U. Colorado and U. South Florida.

Coordination is assured with the FP7 MyOcean GMES project by individual team members who are also part of that project. The Sea_level_cci project team is also exploring potential for cooperation with other European teams expert in altimetry processing and sea-level.

Project Start

The Sea_level_cci project will be kicked off on 15 July.

8 SST_CCI [GCOS O.3]

Project Team

The scientific leadership for the SST_cci project is assured by Edinbugh University,UK (C. Merchant). Project management is provided by Space ConneXions (UK).

The EO science team includes SST experts from University of Leicester, UK Met Office Hadley Centre, Météo-France, Danish Meteorological Institute, and Norwegian Meteorological Institute.

The Climate Research Group led by the Hadley Centre, provides excellent connections to the international climate research and modelling community.

The systems engineering team, lead by Brockmann Consult, incorporates expertise from national operational centres (Hadley Centre, Meteo-France, DMI, Met.No), and OSI SAF.

Project Scope

Existing satellite SST records do not meet the GCOS requirement for accuracy and stability, combined with temporal and spatial resolution, which asks for:

''A blended SST analyses generated from complementary satellite data sets including infrared and microwave instruments capable of supporting climate accuracy global analyses. The output shall be accurate to 0.25K, have a high spatial resolution (1 km) globally), a stability of better than 0.1K/decade and a 3-hourly observing cycle.''

This project will provide a significant improvement over current state-of-the art by developing algorithms tuned to the requirements of the climate community and a prototype system to generate climate quality SST data products.

The project will develop and improve SST algorithms to exploit the combined ATSR and AVHRR times series, spanning 1991 – present. The key improvements will be (i) new and improved optimal estimation techniques beyond those initiated by the ARC project, (ii) radiance bias correction with reference to ARC SSTs, (iii) better robustness to atmospheric aerosol, and (iv) mitigation of diurnal SST variability by adjustment of SST to a reference depth and time of day.

A multi-sensor approach, incorporating geostationary infrared (IR) sensors and passive microwave sensors, will also be prototyped to provide a long (1991-2011) time series of consistent SST products. This will be applied to produce a merged climate quality SST analysis product, based only on satellite data, which will be independently validated by the climate community.

Problems in high-latitudes, including flagging issues for both passive microwave and IR sensors, and cloud-and-ice discrimination to avoid biased SSTs, will be addressed. All products will be

error-characterized, with uncertainty estimates built up from first principles, which will in turn be validated against uncertainties observed relative to independent reference in situ data.

The following data sets will be exploited:

- (A)ATSR 1991-2010: ~23 TB
- AVHRR GAC 1978-2013: ~17 TB
- SEVIRI 1 year: ~500 GB
- Metop 1 year: ~4 TB
- AMSRE 2002-2010: ~7 GB
- TMI 1997-2010: ~9 GB
- ERA40/ERA-op 1991-2009: ~230 GB
- ECMWF interim when available, expect 4-5 times larger than ERA40/ERA-op.
- Others (reference data etc.): ~1 GB

Cooperation.

The project builds upon extensive existing European infrastructure (e.g. MetOffice Hadley Centre SST analysis systems (OSTIA, HadISST), ESA (A)ATSR, archives, EUMETSAT Ocean and Sea Ice Satellite application Facility (OSI-SAF), EU MyOcean Project). It also builds on the results of previous projects (e.g. ESA Medspiration, EU MERSEA). The UK AATSR Reprocessing for Climate project (ARC), represents the state-of-art benchmark against which improvements will be assessed.

The project team has direct links to the IPCC process, and includes the chair of the GCOS SST and Sea Ice working groups, as well as several coordinators from the Group for High Resolution SST (GHRSST).

The team has links to more than forty national and international research institutes and programmes in twenty countries, that can be engaged as independent users to assess the SST_cci data products.

Project Start

Project kick off is scheduled for 01 August 2010.

9 OCEAN_COLOUR_CCI [GCOS O.4]

Project Team

Scientific leadership of the Ocean_Colour_cci project is assured by Plymouth Marine Laboratory,UK (S. Sathyendranath). Project management is provided by Vega (UK) and System engineering will be performed by Brockmann Consult (D).

The EO Science Team includes international experts in Ocean Colour from PML (UK), GKS (D), Brockmann Consult (D), HYGEOS (F), NERSC (N) and JRC (EC)**.** The team combines expertise in MERIS cal/val, IOP retrieval and data merging,. There are strong links to many previous and current projects including ESA-Glint, -Synergy, -Case2 regional, -water radiance, and the DUE CoastColour project. Expertise on SeaWiFS, MODIS, CZCS is ensured through collaboration with NASA and NOAA. The team includes co-authors of IOCCG reports, and a co-author of the last two IPCC WG1 assessment reports AR3, AR4).

The Climate Research Group combines expertise on ecosystem modelling, development and validation of coupled physical and biological models from PML (UK), GKSS (D), NERSC (N), University of East Anglia, Norwich (UK). They have direct links to cooperating teams in USA and Japan.

Project Scope

The very challenging GCOS requirements of 5% accuracy for the normalised water leaving reflectance at 443 nm, with a 1% per decade stability, 1 km spatial resolution, and daily coverage are currently not met by any single satellite.

This project will contribute to the GCOS Ocean Colour ECV Product O.4 [and Actions O-11, O-12, O-13 in the 2006 CEOS Response to the GCOS IP] by developing consistent, climate-quality Ocean Colour data products for the period 1997-2010, including error characterisation of the complete processing chain, using cross-calibrated MERIS, MODIS, and SeaWiFS data.

The most challenging element is the atmospheric correction: For this the POLYMER algorithm developed by HYGEOS, and the Glint and Atmosphere Correction processor (GAC) developed for MERIS at GKSS, will be tested and compared in a round robin exercise against standard L2 products. Other available algorithms, including those developed by the Ocean Biology Processing Group at NASA, will also be inter-compared.

A variety of data merging algorithms will be tested, including methods developed by JRC for combining multi-year data records from the recent SeaWiFS/MODIS/MERIS archive extending back to 1997 - possibly extended by the use of the proof-of-concept CZCS instrument (1978-1986) , while tracing the associated error propagation.

Validation and user assessment will be conducted independently: This will be based on field-based datasets, inter-comparison between different satellite products, and tests on trends, their errors and limits. Data from in-situ networks will include SeaBASS, NOMAD, MOBY, BOUSSOLE, OC-AERONET, MERMAID, as well as data from nationally- and EU-funded projects. The satellite products will be compared to models (model skill assessment) and used to test the sensitivity of models to observations (data assimilation). A European marine information system and model validation portal currently being developed by PML in EC FP7 NETMAR will be used for this task.

Cooperation

The team, which includes five IOCCG members, has extensive links to international institutions, agencies and modelling groups expert in Ocean Colour and climate research,. Projects of particular importance include: the SAFARI, ChloroGIN projects for GEO, the multi-laterally funded ‘Dynamic Green Ocean Project’’ (DGEOP) and ‘’Marine Ecosystems Model Inter-comparison Project’’ (MAREMIP) and the FP7 “Marine Ecosystem Evolution in a Changing Environment” project (MEECE).

Coordination with the operational ocean-modelling community in GMES is ensured by team members who are also coordinating the FP7 MyOcean Ocean Colour Thematic Assembly Centre (OCTAC) and Arctic Monitoring and Forecasting Center (AMFC).

Project Start

Project kick-off is scheduled for 01 August 2010.

10 GLACIERS_CCI [GCOS T2.1]

Project Team

The Science lead of the Glaciers_cci project is assured by University of Zurich (F.Paul). U.Zurich will also ensure overall project management.

The EO scientific team includes experts form University of Zurich (Switzerland), University of Oslo (Norway), GAMMA (Switzerland), University of Leeds (UK) and ENVEO (Austria). The Engineering Team is from GAMMA and University of Zurich.

The Climate Research Group includes European experts in regional climate modeling with an emphasis on glaciers (ETH Zurich), on numerical modeling of ice sheets, ice caps and glaciers (U.Bristol). These are supported by experts regional in glacier mapping and hydrological modeling in the Himalaya (KfG, ICIMOD) and experts on quality and standards in glacier monitoring. (WGMS, NVE).

The team includes three contributing authors of the IPCC AR4 WG1 report, and two lead authors of IPCC AR5 WGI. It also includes co-authors of the WGMS Fluctuation of Glacier (FOG) reports, GLIM reports, the GCOS ECV itself, and the IGOS Cryosphere Theme Report.

Key users include the World Glacier Monitoring Service (WGMS), the GLIMS inventory hosted by the NSIDC (USA), and the WCRP CliC Programme.

Project Scope

The Glaciers_cci project will contribute to GCOS by helping complete the baseline inventory of glaciers and by regional change assessment. The project focuses on the following three elements of the ECV:

- glacier area in the form of detailed glacier inventory data for the Glacier Data Base
- change assessment for glacier parameters a) length, b) area and c) elevation
- glacier velocity fields (from optical and SAR sensors)

The team will build on the results of previous projects (ice2sea (FP7), GLIMS (NASA) and Globglacier(ESA)). It will focus on data gaps the existing glacier inventory of the following key regions:

- Alaska: missing northern part (Brooks range and Alaska range)
- Canadian Arctic: missing regions on Ellesmere Island
- Svalbard: (with NPI)
- FSU: Caucasus and other regions (with RAS)
- Himalaya: Pamir and Karakorum (with ICIMOD and others)
- New Zealand, South Georgia, Tierra Fuego, Patagonia (with Regional Centres)

The project team will coordinate directly with the regional centres, indicated above, responsible for these regions in the GLIMS inventory.

Regions already covered by GlobGlacier or GLIMS will be supplemented with a further point in time to perform change assessment. The Himalaya region is included but cannot be fully covered by this project alone.

Cooperation

The project team has already established mechanisms for coordinating with NSIDC (GLIMS, USA), the World Glacier Monitoring Service (Switzerland), NVE (Norway), ETH (Switzerland) and KfG (Germany). Individual team members will also ensure direct connection to related projects such as CryoClim, ice2sea, and INTEGRAL. Links will be made to the global research community via GLIMS and CliC.

For calibration and validation purposes the focus is on regions where high quality data are already available (Alps, Norway) supplemented by additional data sets (high resolution satellite data) in other regions given that a good temporal coincidence can be found. A further regional focus will be in regions with long-term mass balance measurements at an additional validation site (elevation change).

As field data for glacier velocity are sparse, validation will generally be performed by using different sensors and techniques for the same region. For in-situ data, the project team will exploit its strong links to WGMS (for glacier length changes, mass balance), to national agencies (e.g. for accurate high resolution DEMs i.e. aerial photography, LIDAR), to glaciological research community including WCRP CliC and GLIMS.

Project Start

The planned project start date is scheduled for September 01.

11 LANDCOVER_CCI [GCOS T.5.1]

Project Team

Scientific leadership for the Landcover_cci team is assured by the Catholic University of Louvain (P. Defourney). UCL also provides project management.

The EO Science team incorporates expertise from previous Global Landcover projects, notably GLC2000 and GlobCover and GlobCorine and TREES via partners UCL(B), Brockmann Consult (D), and JRC (EC). Expertise (Frederich Schiller University of Jena (D)) on the use of SAR for wetlands and urban classes, draws on the EC-funded SIBERIA, SIBERIA-II projects and the ESA BIOMASSAR project. The Validation expert group is reinforced wrt GlobCover by the participation of JRC.

The Climate Research Group, coordinated by Wageningen University (NL), combines expertise on the impact of land cover on climate models (Hadley Centre), hydrological modelling (MPI), and modelling of carbon cycle, water cycle and land-air fluxes (LSCE). This group will provide comprehensive user assessment and feedback on the quality and impact of the products in the context of climate models.

The System Engineering group incorporates expertise from previous projects, with Brockmann associates handling pre-processing sub-systems and UCL the classification sub-systems.

Project Scope

The GCOS requirements for land cover (accuracy and stability: 15% omission/commission for individual classes) cannot be met by the current set of space sensors. The Landcover_cci project team therefore plans many improvements to approach a more consistent description of land cover and its temporal stability.

This project will generate a multi-sensor global land cover ECV dataset, using MERIS FRS, MERIS RR, SPOT-VGT and ASAR instruments. It will produce three combined land cover products for the years 2000, 2005 and 2010. This will contribute significantly to the GCOS Land Cover ECV (responding to the need for Product T.5.1 of GCOS-107, and actions T26, T27 of GCOS-92).

The project builds upon the state-of-art established by GlobCover. Improved algorithms will be developed and validated for: geo-location, spectral and radiometric calibration, atmospheric correction, land-water mask, surface reflectance values over water, cloud and cloud shadow detection, snow identification, projection, compositing, spectral signature use for classification, temporal signature use for classification, improvement of specific class classification by use of SAR, land cover change. This will involve revisiting areas in GlobCover, to improve details on all steps of the proven methodology.

The classification stage will be improved by adding more spectral bands, extending the time window used and incorporating additional observations (MERIS RR and VGT). Three different test methods will be used. The potential for using SAR to improve classification of urban and water classes will be assessed. Some additional elements on calibration of MERIS and geo-location in high latitudes, from the ESA SnowRadiance, GlobSnow and GlobAlbedo projects will be used.

Cooperation

The project team has excellent links to the IPCC process, and includes several lead and co-authors of the IPCC AR4 report, nominees for AR5, and an external reviewer of the Stern report. The team has effective working links with international partners from GOFC-GOLD, CEOS, GTOS, FAO, UNFCC-REDD, as well as NASA. The team is active in GTOS ECV Land Cover Assessment, CEOS Protocol development, and cooperates with the MODIS team. There are strong links to ESA Quality Working Groups and coordination is planned with NASA, JAXA and CNES.

A group of international experts, under the coordination of JRC, has been established for validation purposes and is linked to modelling initiatives (LSCE, MPI-M and MO Hadley Centre). Access to in-situ data for validation will be provided, via JRC to FRA2010 and TREES databases, and to the Geoland2, GlobCover 2005 and 2009 validation datasets.

Coordination with EC-funded and national projects is assured by team members who are also involved in the Geoland-2 and GHG_Europe projects, and the VEGECLIM (B) project.

Project Start

Project KO is scheduled for 01 August 2010

12 FIRE_CCI [GCOS T.9]

Project Team

The scientific leadership of the Fire-cci project is assured by University of Alcalà, Spain (E.Chuvieco). Project management is provided by GAF-AG (Germany).

The EO Science Team includes European experts on burned area detection and has working links to the major international validation networks (GOFC-GOLD Fire and CEOS LPV-Fire). The team includes DLR for data pre-processing, INIA(Spain), School of Agriculture of Technical University of Lisbon (ISA, Portugal) and University of Leicester (UK) for algorithmic development.

The Climate Research Group includes U.Jülich (D), IRD(F), and LSCE (F). Very good links exist to European and international research programmes (Global Carbon Project, and GFEDv3). The group includes three IPCC AR5 WG1 co-authors.

The Systems Engineering Team is lead by GMV (Spain).

Project Scope

The project addresses the GCOS Fire Disturbance ECV (Product T.9). Currently none of the existing burned area products responds effectively to GCOS requirements, in particular with respect to spatial and temporal consistency.

The Fire_cci project aims to improve consistency using better algorithms for both pre-processing and burned area detection while incorporating error characterisation. The project will focus on the key variable: burned area. It will incorporate active fire observations as a supplemental variable to improve detection of BA across varying biomes. Inter-comparisons will be made with existing products in close collaboration with other research teams focusing on US data, with the aim of developing a consistent time series of burned area over the period 1995-2009. This will include comprehensive validation with existing high-resolution data and will expand the validation database for improved geographical and temporal representativity.

Algorithm development and validation will focus on 10 test sites of 500 x 500 km, covering the maximum time range of each sensor ATSR-2 (1995-2008), VEGETATION (1998-2009) and MERIS (2003-2009). These test sites will include at least one example from the major biomes affected by fires: Tropical forest, Tropical savannas, Boreal forest, Temperate-Mediterranean forest, selected by considering historical records of fire occurrence and the suggestions of end-users and the GOFC-GOLD regional networks.

Five annual global coverages will be generated to assess the contributions and consistency of each of the sensors for periods of sensor overlap: 1999-2000 (for inter-comparison of ATSR-2 and

VGT-1), 2002-2003 (for inter-comparison of ATSR-2, AATSR, VGT-1, VGT-2 and MERIS RR) and 2005 (for inter-comparison of MERIS RR, MERIS FRS, VGT-1, VGT-2, and AATSR).

The Climate Research Group will strengthen collaboration between the observational and modeling communities to enable a quantitative assessment of Dynamic Global Vegetation Models (DGVMs) and Earth System Models (ESMs). The IRD team will use the CASA global biochemical model for studying specific regions at different scales (1km, 10km, 50km, 100km) where information on vegetation, fire, soil and climate are well known. LSCE will conduct model-to-observations comparison using ORCHIDEE-SPITFIRE at seasonal and inter-annual timescales and at global, regional and local scales. JUELICH will use the global burned area product to estimate emission fluxes of trace gases and aerosols using the RETRO approach and compare them with other inventories (GFEDv3, MACC). If significant differences occur, a simulation will be performed with the chemistry transport model MOZART.

The partners in the User Assessment will initiate a carbon cycle/vegetation model inter-comparison exercise dedicated to introducing of fire information into the scheme under the umbrella of the Carbon-Land Model inter-comparison Project (C-LAMP) project and the regional North American Carbon Program (NACP) and CARBOEUROPE – synthesis. The will include an assessment of the impact of burned area products on climate prediction. Thus calibrated carbon cycle models will participate to future scenarios for IPCC AR-5.

Cooperation

The project team is well linked to the GOFC-GOLD Fire Implementation Team and to the CEOS Land Product Validation Fire subgroup. Specific agreements have already been reached with regional scientists for validation in Russia, Mexico, Argentina, SE Asia, S Africa, and Australia. Other sources of validation data will also be exploited, in particular the Canadian Large Fire Database, and fire perimeters for European countries since 2000, as produced by JRC. FAO UN-REDD, Conservation International, and JRC Natural Hazards Unit have all expressed interest in the project outputs.

Project Start

The project kick-off is planned for early September.

13 CLIMATE MODELLING USERS GROUP (CMUG)

CMUG comprises four partners, led by the UK Met Office Hadley Centre, together with ECMWF, Max Planck Institute for Meteorology (Hamburg), and MétéoFrance. CMUG fulfils the need to bring a climate modellers perspective to the programme and to enable the satellite data community and the "Climate Modelling Community" to work closely together. Another important task is to provide the role of integration across the 11 diverse ECV projects.

The overall objectives of CMUG are threefold:

(1) Support integration within the CCI programme *by providing ESA and the CCI Projects with (i) requirements and user assessment from the Climate Modelling Community and (ii) feedback from a "climate system" perspective (e.g. examining consistencies across ECVs, synergies / overlap within model production systems).*

(2) Foster the exploitation of Global Satellite Data Products within the Climate Modelling Community *by (i) promoting the use of CCI data sets to climate modellers and (ii) by building partnership and links with existing research organisations, networks and scientific bodies of the Climate Modelling Community.*

(3) Assess quality and impact of individual/combined Global Satellite Data Products in Climate Model and Data Assimilation *by (i) assessing suitability of products for climate applications (e.g. climate modelling, decadal prediction, reanalysis, etc), and by (ii) quantifying their incremental value on model performance in an objective manner.*

CMUG will interact with the ECV projects, via a clearly-defined interface, managed by ESA, and following the schedule and documentation tree applicable to all ECV projects.

CMUG will provide an integrated, working-level gateway from CCI to the international climate modelling community. This will be facilitated by making presentations and organizing side events at major international meetings of this community, as well as by convening focussed workshops. CMUG will set-up a dedicated web-site to provide information on their plans and activities, and to facilitate detailed scientific consultation and feedback from the community at large, throughout the programme.

CMUG was kicked-off in March 2010.

CMUG aims to bridge the gap between climate modellers and EO data providers working within the CCI programme. As a first step, the CMUG team is mapping and documenting the observational needs and modelling capabilities of the climate modelling community. This information will then be provided to individual CCI projects to refine the GCOS requirements and then to define ECV data product specifications tailored to the needs of climate modellers.

To this end, a data requirement form has been produced (available on www.cci-cmug.org) and a survey has been performed within the climate modelling community, through email / phone campaign and promotion at a series of meetings including:

- TOVS (April 2010), USA – presentation by MOHC
- EUGENE (26-27 April, Germany) – presentation by MPI-M
- EGU – dedicated CMUG splinter session (6 May, Vienna)
- IS-ENES 1st General Assembly (27 May, Barcelona) – presentation by MeteoFrance
- EUMETSAT (22-24 June, Germany) – presentation by MOHC
- ESA Living Symposium (28 June - 1 July, Bergen) – presentation by MOHC

The dedicated CMUG splinter session at the "European Geophysical Union"(EGU) event in Vienna had participation of 29 climate modellers. The requirements survey was distributed at the GEWEX cloud assessment meeting in Berlin and an article about CCI & CMUG was publshed in the GEWEX newsletter.

CMUG has contacted the "European Network for Earth System Modelling" (ENES – www.enes.org), which represents the majority of climate modelling centres in Europe taking part in the FP7 project IS-ENES. They have agreed to provide a coordinated reply to the survey questions, with particular focus on data format and meta-data.

CMUG is also establishing links, with the CMIP5 network in charge of managing the climate data and model experiments in support of the IPCC next assessment. Contacts for this have also been made via the "British Atmospheric Data Center" (BADC).

The GMUG survey results and feedback from the different meetings will be synthesised within a first deliverable document. This will be circulated to all CCI project teams as an input to their own domain-specific user requirements analysis, and will also be publicly accessible on-line.