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## **ESA SUPPORT TO GCOS AND OTHER CLIMATE MONITORING ACTIVITIES**

CGMS is informed of the status of the Earthwatch Programme Element, Global Monitoring of Essential Climate Variables (also known as the 'ESA Climate Change Initiative').

# ESA SUPPORT TO GCOS AND OTHER CLIMATE MONITORING ACTIVITIES

## 1. INTRODUCTION

In November 2008 the ESA Ministerial Council adopted a new programme, the “Climate Change Initiative” (CCI) focusing on the delivery of satellite-based ECVs to support climate change modelling and prediction.

The ESA Climate Change Initiative aims to provide consistent long-term global records of the “Essential Climate Variables” that are required by the Global Climate Observing System (GCOS) to support the work of the International Panel on Climate Change and the United Nations Framework Convention on Climate Change, as described above. The programme focuses on those climate variables for which ESA satellite data sets (past thirty years of archives, ERS-1, ERS-2, Envisat, future Earth Explorer and Sentinel missions) will make a major contribution to complement that of international partner space agencies.

The long-term preservation of data from Earth observation missions, operated and acquired by ESA, is of paramount importance for the monitoring of long-term global trends with regard to many environmental parameters. The Climate Change Initiative (CCI) builds on Europe’s substantial expertise in processing, generating, and exploiting global data sets. Its goal is to guarantee the availability of space-based information for the future, in a form readily usable by scientific communities and government bodies.

## 2. THE CCI IMPLEMENTATION

### 2.1. INITIAL IMPLEMENTATION STEPS

The implementation of the CCI has been prepared by ESA on the basis of a wide consultation with international partners and representatives of the climate research and modelling communities. A Climate Science Advisory Board (including representatives of GCOS, WCRP, JCOMM, GTOS, ECMWF and ESAC) was convened on 29 April 2009 at ESRIN and provided an independent and expert scientific advice and a series of recommendations that have helped setting up the programme. The ESA Earth Science Advisory Committee (ESAC) was also consulted prior to, and after, the CCI programme adoption. Wider consultation also took place in 2008-2009 through numerous opportunities, including workshops and meetings involving international partners and user organisations active in the European framework (EC FP7, Eumetsat, EEA, GMES), as well as in the CEOS, GEO, WCRP and GCOS context. This consultation process has led to establishing a number of prioritisation criteria that have been used to define the approach and first steps for the CCI implementation.

### 2.2. SELECTION OF THE TEAMS

A competitive tender for proposals to perform the detailed requirements definition, algorithm development, validation and prototyping for a first set of eleven “Essential Climate Variables” was released by ESA in the last quarter of 2009. The eleven ECVs to be addressed in the first phase of the CCI were:

Atmospheric domain: Ozone, Clouds, Aerosols, Greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>)

Oceanic domain: Sea level, Sea surface temperature, Sea ice, Ocean colour

Terrestrial domain: Land cover, Glaciers and ice caps, Fire disturbance (Burned areas and active fires).

In September 2010, contracts were signed with the following ten groups:

<b>GCOS ECV</b>	<b>CCI Project</b>	<b>Science Leader</b>
A.4	Cloud	Deutscher Wetterdienst ( <i>R. Hollmann</i> )
A.7	Ozone	BIRA-IASB ( <i>M. van Roozendaal</i> )
A.8	Aerosol	DLR / FMI ( <i>T. Holzer-Popp / G. De Leeuw</i> )
A.9	GHG	U. Bremen IUP ( <i>M. Buchwitz</i> )
O.2	Sea Level	LEGOS-CNES ( <i>A. Cazenave</i> )
O.3	SST	U. Edinburgh ( <i>C. Merchant</i> )
O.4	Ocean Colour	Plymouth Marine Laboratory ( <i>S. Sathyendranath</i> )
T.2.1	Glaciers	U. Zurich ( <i>F. Paul</i> )
T.5.1	Land cover	Université Catholique de Louvain ( <i>P. Defourny</i> )
T.9	Fire	U. Alcalá ( <i>E. Chuvieco</i> )

### 2.3. PROJECT TEAM ORGANIZATION AND WORK PLAN

Each project team typically includes experts from ten or more research organizations. Each team has a sub-group with specialist scientific expertise in Earth observation, a sub-group specialised in climate research and modelling, and a sub-group of system engineering experts. Each team also 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 three years of the projects: requirements analysis and product specification; algorithm development, inter-comparison and selection; system Prototyping and ECV production; final product validation and user assessment; system specifications; and, project management.

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

The First CCI Team Collocation meeting took place in Frascati, Italy, in October 2010.

### 2.4. DELIVERABLES

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.

It is worthwhile to note that the CCI project deliverables (data, quality, calibration/validation, documentation, review, open access) have been specified in accordance with the "Guideline for the Generation of Satellite-based Datasets and Products meeting GCOS Requirements".

### 2.5. COMPLEMENTARY PROJECTS

Invitations to Tender for three new ECV projects, being conducted as part of the ESA Strategic Initiative (STRIN), were issued during the recent period, i.e:

Sea ice

Ice sheets

Soil moisture

These new ECV projects will significantly enhance ESA member states contribution to GCOS, and strengthen ESA's coordinated international action through CEOS WG-Climate.

The projects will address the same cardinal objectives and follow the same work structure as the nine active CCI ECV projects. ESA aims to complete the tender evaluation within the third quarter of 2011, so that the three additional project teams can join the Second CCI Collocation meeting in October. Although they will start one year later, they will benefit significantly from the results already generated by the CCI teams.

### **3. CURRENT STATUS**

#### **3.1. OVERALL PROGRESS**

CCI programme activities have continued progressing well and on schedule during this reporting period. Scientific interactions with CMUG and different CCI project teams continue to develop fruitfully. International coordination is progressing constructively, both within Europe, and internationally via the recently established CEOS WG-Climate.

All CCI teams have now established robust and detailed user requirements, starting from the overall GCOS requirement for their specific ECV. This has been achieved by a variety of means such as literature reviews, user surveys and scientific workshops. Based on the significant international effort dedicated to this via CCI, all project teams and members of the ESA Executive have been able to contribute substantially to the on-going review of the GCOS satellite supplement. This feedback to GCOS constitutes a first deliverable output of the CCI programme.

Most teams have also completed the first version of the Product Specifications. The User Requirements Documents and the Product Specifications Documents have been circulated to relevant international scientific bodies for independent review and comment, and the feedback has been incorporated in updated versions.

#### **3.2. ROUND ROBIN**

The teams have started intensive "Round Robin" algorithm inter-comparisons and improvements to determine which algorithms, or combinations of algorithms, will best respond to the demanding climate quality requirements. Significant effort is being deployed to define rigorous evaluation procedures, to gather adequately representative satellite test data sets, to access high-quality independent external validation data from in-situ, airborne and other sources, along with relevant climate re-analysis data sets. The initial results are already yielding valuable new insights into algorithm performances and confirm the need for the exercise. Some teams have already identified the need to prolong the round-robin phase in order to fully address the emerging scientific issues. This is being done without major slippage on other tasks.

The "Round Robin" results will be used to generate the most complete and consistent ECV data products possible in the present first three-year phase of the CCI programme.

#### **3.3. INTERNATIONAL COOPERATION**

All teams have been cooperating actively with international partners both inside and outside of Europe. This includes national research projects in ESA Member States, EC FP7 research projects as well as relevant ESA exploitation projects – in particular the ESA EO Quality Working Groups.

The CCI teams are ensuring openness and transparency, specifically requested by GCOS and WCRP, by placing all deliverable documents on their project web-sites, soliciting and responding to external independent scientific review comments.

The CCI data standards working group, with participation from all CCI teams, has continued working actively to agree common data standards applicable for all CCI ECV data products. A CCI

systems engineering working group, with membership from each team, is in parallel looking at common system issues across all CCI projects.

### **3.4. USER ASSESSMENT**

It is important to note that, although the overall user assessment of the programme results is by definition foreseen at the end of the programme, user assessment is a continuous activity which is performed *throughout the programme*: both at project-level by the climate research users within each team, and at programme level via the Climate Modelling Users Group (CMUG).

## **4. REFERENCES**

Further information about the ESA CCI can be found on the following WWW address which offers the possibility to download many supporting relevant documents:

<http://www.esa-cci.org/>