

CCI+ Overview

Pascal Lecomte, CCI Collocation Oxford, 20 March 2018

CCI 8th Collocation Meeting – 20-22 March 2018
St Hughes College - Oxford



The real and official name of the programme is:

**Global Monitoring of Essential Climate Variables
GMECV**

The programme is widely known as

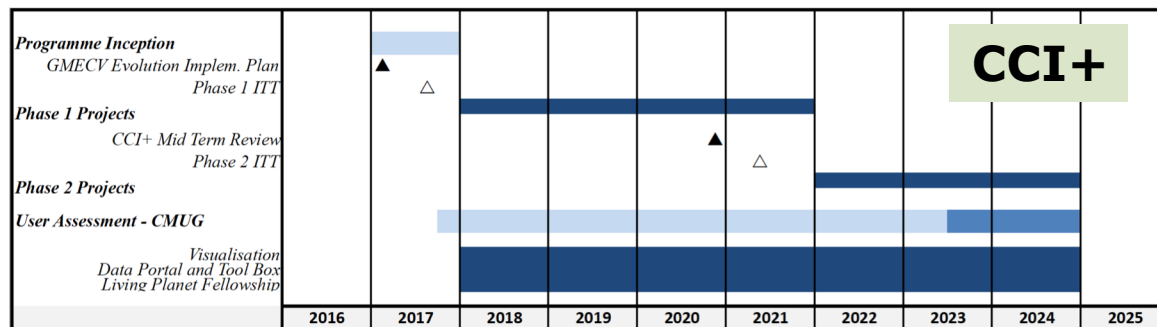
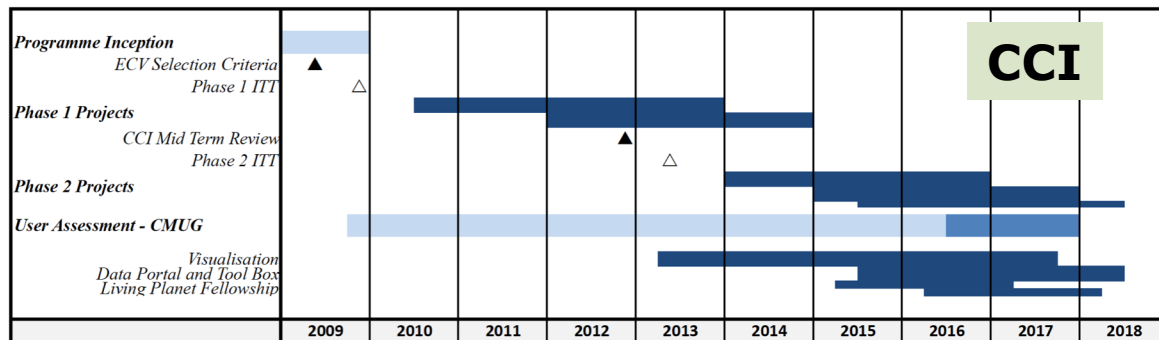
**Climate Change Initiative
CCI**

But this is exactly the same programme

To distinguish the period 2019-2017 from the period 2018-2024 we call the first one CCI and the second one CCI extension or CCI+

For practical reasons we have since the beginning implemented the programme via 3 to 4 years contracts called phases
We therefore have had **CCI Phase 1** and **CCI Phase 2** and we are initiating **CCI+ Phase 1** and we will have later **CCI+ Phase 2**

CCI schedule



The ESA Team



Pascal Lecomte	Programme Management;
Simon Pinnock	CMUG, Water Vapour, Cloud, Aerosol, CSWG;
Stephen Plummer	Fire, Lakes, LST, CCI Fellowship;
Anna Maria Trofaier	Snow, Soil Moisture, Sea Ice, Glaciers;
Christian Retscher	Ozone, Greenhouse Gases;
Olivier Arino	MR Land Cover, HR Land Cover;
Jérôme Benveniste	Sea Level, Sea Level Budget Closure;
Marcus Engdahl	Ice Sheets (Greenland and Antarctica);
C. Donlon, P. Cipollini	SST, Ocean Colour, Sea State, Salinity;
Frank Martin Seifert	Permafrost, Biomass;
Ed Pechorro	Open Data Portal, Tool Box, DEWG;
C. Downy, P. Fisher	Visualisation, Education;



Introduction



Realize the full potential of the long-term global EO archives that ESA, together with its Member states, has established over the last thirty years.....

..... as a significant and timely contribution to the ECV databases required by the United Nations Framework Convention on Climate Change

7 Years / 93 Meuro

7 Years / 85 Meuro



WORLD METEOROLOGICAL
ORGANIZATION

INTERGOVERNMENTAL
OCEANOGRAPHIC COMMISSION

**THE SECOND REPORT ON THE ADEQUACY
OF THE GLOBAL OBSERVING SYSTEMS FOR
CLIMATE IN SUPPORT OF THE UNFCCC**

EXECUTIVE SUMMARY

April 2003

GCOS - 82 (ES)

(WMO/TD No. 1143)

UNITED NATIONS
ENVIRONMENT PROGRAMME

INTERNATIONAL COUNCIL FOR
SCIENCE



INTERGOVERNMENTAL
OCEANOGRAPHIC COMMISSION

**IMPLEMENTATION PLAN FOR THE
GLOBAL OBSERVING SYSTEM FOR CLIMATE
IN SUPPORT OF THE UNFCCC**

October 2004

GCOS - 92

(WMO/TD No. 1219)

INTERNATIONAL COUNCIL FOR
SCIENCE

-- September 2006

Climate System

(CEOS) Response to the
Implementation Plan (IP)

Science and Technical Advice (SBSTA)
USA (USA) delegation

sa
2006
012

Measurement domain	Essential Climate Variables
Atmospheric	<p>Surface: air temperature, wind speed and direction, water vapour, pressure, precipitation, surface radiation budget</p> <p>Upper-air: temperature, wind speed and direction, water vapour, cloud properties, Earth radiation budget, lightning</p> <p>Composition: carbon dioxide (CO₂), methane (CH₄), other long-lived greenhouse gases, ozone, aerosol, precursors for aerosol and ozone</p>
Oceanic	<p>Physics: temperature: sea surface and subsurface; salinity: sea surface and subsurface; currents, surface currents, sea level, sea state, sea ice, ocean surface stress, ocean surface heat flux</p> <p>Biogeochemistry: inorganic carbon, oxygen, nutrients, transient tracers, nitrous oxide (N₂O), ocean colour</p> <p>Biology/ecosystems: plankton, marine habitat properties</p>
Terrestrial	<p>Hydrology: river discharge, groundwater, lakes, soil moisture</p> <p>Cryosphere: snow, glaciers, ice sheets and ice shelves, permafrost</p> <p>Biosphere: albedo, land cover, fraction of absorbed photosynthetically active radiation, leaf area index, above-ground biomass, soil carbon, fire, land surface temperature</p> <p>Human use of natural resources: water use, greenhouse gas fluxes</p>



Proposal for a CCI Extension – CCI +

CCI+ Objectives & Scope



CCI+ Objectives:

- **research, development, qualification** and **delivery to users** of pre-operational ECV products
- **definition, sizing** and **demonstration** of ECV processing systems
- **transfer** of ECV production to operational entities outside ESA

Driven by **climate user requirements** defined by GCOS, under authoritative advice from CSAB, and strong coordination with the international Space Agencies response to GCOS via the Joint CEOS/CGMS Working Group on Climate (WGClimate).

CCI+ Scope:

1. Development of new ECVs (i.e. ECVs that were not started in CCI so far)
2. New R&D on ECVs that were started in CCI
3. Cross-ECV scientific exploitation
4. Outreach and Communication

NB: CCI+ will not build operational processing systems

CCI+ Implementation and Procurement Plans



Selection will be based on criteria already defined by Member States

(ref. ESA/PB-EO(2009)32, rev. 1):

- Response to GCOS requirements (to be revised in 2016)
- Availability, quality, uniqueness and importance of the satellite data
- Maturity of retrieval algorithms
- Ability to capitalise on European scientific expertise
- Prospects for transition to an external operational context

Taking into account:

- Overall level of Member States contributions
- Need for complementarity with other ECV activities in Europe (C3S, CDOP-3, H2020, etc.)

List of new ECVs selected with the Climate Science Advisory Body early 2017, after CMIN-16.

- CSAB meeting on January 17th, 2017 to support Executive in formulating the Implementation Plan
- GMECV Evolution Implementation Plan presented to PB-EO in February-2017
- CCI+ Phase 1 Procurement Plan endorsed in May 2017

CSAB Recommendations



Of 11 new ECV activities (10 plus Permafrost) proposed for CCI+, the Board recommends four - Water Vapour, Sea Surface Salinity, Snow Cover and Permafrost - as highest priority.

The Board recommends five others - Land Surface Temperature, Above Ground Biomass, Lakes, Sea State, and High Resolution Land Cover - as worthy candidates for CCI+ funding.

With respect to High Resolution Land Cover, the Board recognised the likely stronger interest in local to regional (rather than global) versions of these products, suggesting the need for some partnerships to establish the design and application of data and services based on such very high resolution products.



Schedule for the implementation

1. New ECVs

- Negotiations being finalised
- Kick off in April or early May

2. New R&D on existing ECVs

- Statement of work being finalised
- ITT to be launched in April for proposals to be received before the Summer break

3. X-ECV

- CMUG Proposal is being evaluated
- Pending successful negotiations kick off April or early May

4. Knowledge Exchange

- SoW for Open Data Portal, Tool Box and Knowledge Exchange being prepared
- ITT to be launched in September for proposals to be received before the Winter break

(i) New ECVs – CSAB Recommendations



- New ECVs

1. Water Vapour
2. Salinity
3. Sea State
4. HR Land Cover
5. Snow
6. Lakes
7. Above Ground Biomass
8. Permafrost
9. Land Surface Temperature



(i) New ECVs – Preliminary Results of the ITT



- New ECVs

1.	Water Vapour	Univ. Reading	UK	M. Hegglin / M. Schröder
2.	Salinity	Argans	UK	J. Boutin / N. Reul
3.	Sea State	CNRS	FR	Fabrice Ardhuin
4.	HR Land Cover	Univ. Trento	IT	Lorenzo Bruzzone
5.	Snow	ENVEO	AT	Thomas Nagler
6.	Lakes	CLS	FR	J.-F. Crétaux / S. Simis
7.	Above Ground Biomass	Univ. Aberystwyth	UK	Richard Lucas
8.	Permafrost	GAMMA RS	CH	Annett Bartsch
9.	Land Surface Temperature	Univ. Leicester	UK	Darren Ghent



(ii) New R&D on ECVs already started in CCI

Atmosphere	Ocean	Terrestrial
Composition	Surface	
Aerosols Properties	Sea Surface Temperature	Land Cover
Carbon Dioxide & Methane	Sea Level	Fire Disturbance
Ozone	Sea Ice	Soil Moisture
Long-Lived Greenhouse Gases	Ocean Colour	Glacier and Ice Caps
Precursors (for Aerosols and Ozone)	Sea State	Ice Sheets
Upper Air	Current	Snow Cover
Cloud Properties	Sea Surface Salinity	Albedo
Temperature	Carbon Dioxide Partial Pressure	Leaf Area Index (LAI)
Water Vapour	Phytoplankton	FAPAR
Wind Speed and Direction	Ocean Acidity	Lakes
Earth Radiation Budget	Sub Surface	Above Ground Biomass
Surface	Carbon	Permafrost
Surface Air Pressure	Current	Ground Water
Surface Air Temperature	Nutrients	River Discharge
Surface Precipitation	Ocean Acidity	Soil Carbon
Surface Radiation Budget	Oxygen	
Water Vapour (Surface humidity)	Salinity	
Near-Surface Wind Speed, Dir	Temperature	
	Tracers	
	Global Ocean Heat Content	
Within CCI Scope	Started in CCI	

(ii) New R&D on ECVs already started in CCI



Further R&D on ECVs is needed in CCI+ to:

- Improve **quality** of ECV products closer to meeting GCOS goals (e.g. accuracy, spatial resolution, long term stability), and improve cross-ECV **consistency**.
- Develop algorithms for "difficult" **ECV variables** required by GCOS, e.g. regional sea-level, coastal ocean colour, aerosol absorption, sea-ice drift, ...
- Extend ECV **length** by developing methods to bring older less well-calibrated satellite instruments into the time series (e.g. ATSR-1, AVHRR), and develop **corrections** for future instrument degradation.
- Fully exploit the **new capabilities** of Sentinel and Earth Explorer instruments, e.g. new types of measurement, new spectral bands, wider swaths, higher resolution.
- Develop climate-quality methods to join-up **multi-mission time series**, especially where there are **gaps**, e.g. Envisat to Sentinel-1 & -3.
- Increase maturity of ECV product **uncertainty estimates**.
- Develop better **merged** ECV products (e.g. polar + geostationary)
- Perform **algorithm round-robins** to objectively assess promising new ECV retrieval techniques.

(iii) Cross-ECV Activities



Cross-ECV activities are a key strength of CCI and CCI+

CCI has succeeded to build an active multi-disciplinary community fostering dialogue and cooperation between the EO and climate science – as recommended by both CSAB and ESAC.

1. CCI+ CMUG-type activity providing UK Met. Office UK To be defined

- an integrated climate user perspective across all ECVs
- demonstration exploitation of the CCI+ ECV products
- feedback to the CCI+ teams on ECV quality and consistency
- outreach to the wider climate modelling community

2. CCI+ Cross-ECV targeted scientific studies

- Sea Level Budget Closure TU Dresden DE Martin Horwath
- Demonstrate the value of the CCI and CCI+ ECVs and to strengthen uptake by the wider climate community.
- E.g. Analysis of multiple ECVs for IMBIE, sea-level budget closure, carbon-cycle research, *etc.*

3. CCI+ Young Scientist Research Fellowship Scheme

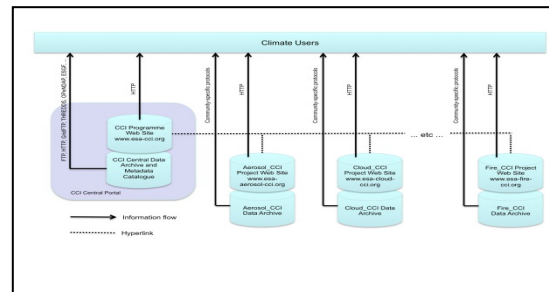
- To stimulate exploitation by the next generation of climate scientists.



(iv) Knowledge Exchange

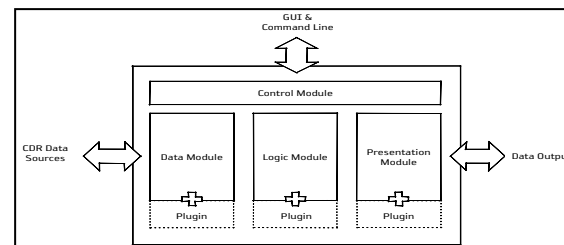
Open Data Portal

... to provide open, free, and easy access to the CCI+ ECVs via multiple standard climate community interfaces.



Software Toolbox

... to equip users at all levels with the tools they require to visualise, analyse and manipulate the ECV data.



Visualisation Tool

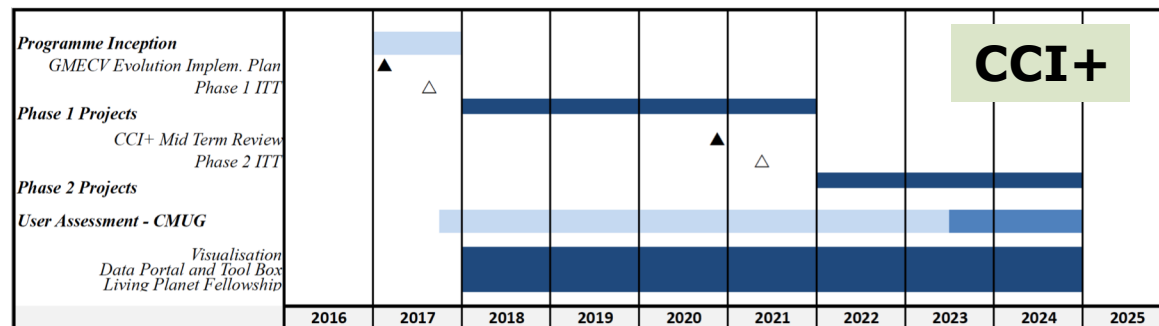
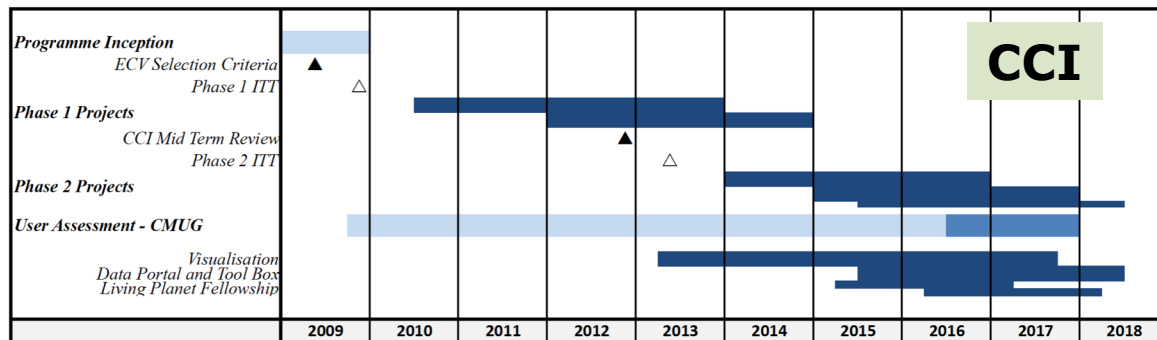
... to provide interactive visualisations of the ECVs to help communicate the types of climate information satellites can provide.



Education

Leverage the new availability of CCI's consistent multi-ECV database to build the user community among young scientists in the making.

CCI schedule



- Procurement of the three other activity lines
 - New R&D in existing ECVs Open Tender
 - Cross-ECV activities Open Tender
 - including CCI Research Fellowship (calls in 2019, 2021 and 2023)
 - Knowledge Exchange Activities Open tender
 - Open Data Portal
 - CCI Tool Box
 - Visualisation
 - Other Knowledge Exchange activities

- The procurement process and exact content still to be defined:

Realize the full potential of the long-term global EO archives that ESA, together with its Member states, has established over the last thirty years.....

- ECV Products accessible in an operational environment (e.g. C3S but not only)

..... as a significant and timely contribution to the ECV databases required by the United Nations Framework Convention on Climate Change

- Scientific Publications in peer reviewed journals with citations in IPCC reports.

CCI+ Summary



- CCI+ is a proposal for the evolution of CCI over the period 2017-2024 to develop new ECV data products required by **climate science** and **climate services**.
- As for CCI, the objective is to **transfer the R&D results into an operational context** outside ESA once the ECV algorithms and pre-operational processing systems are sufficiently mature.
- CCI+ will enhance the contribution of European EO science to future **UNFCCC IPCC assessments**, as part of the international coordinated action on climate observations through CEOS and GCOS.
- Both **new ECVs** as well as **new R&D on ECVs already started in CCI** are included, complemented by supporting activities providing an integrated climate user perspective, on cross-ECV exploitation, Knowledge Exchange.
- The proposed CCI+ activities are **complementary** to other activities on ECVs in Europe (e.g. C3S, H2020, EUMETSAT SAFs) , and will be closely linked with international climate science programmes.

