CCI+ Overview

Pascal Lecomte, CCI Collocation Oxford, 20 March 2018
CCI 8th Collocation Meeting – 20-22 March 2018
St Hughes College - Oxford
GMECV versus CCI

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

CCI

CCI+

Programme Inception
ECV Selection Criteria
Phase 1 ITT

Phase 1 Projects
CCI Mid Term Review
Phase 2 ITT

Phase 2 Projects

User Assessment - CMUG
Visualisation
Data Portal and Tool Box
Living Planet Fellowship


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GMES/C Evolution Implement. Plan
Phase 1 ITT

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CCI+ Mid Term Review
Phase 2 ITT

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European Space Agency
The ESA Team

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Programme Management;

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CMUG, Water Vapour, Cloud, Aerosol, CSWG;

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Fire, Lakes, LST, CCI Fellowship;

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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
Climate Change Initiative - Objectives

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
## GCOS 200

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

- 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**

<table>
<thead>
<tr>
<th></th>
<th>ECV</th>
<th>Institution</th>
<th>Country</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Vapour</td>
<td>Univ. Reading</td>
<td>UK</td>
<td>M. Hegglin / M. Schröder</td>
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<tr>
<td>2</td>
<td>Salinity</td>
<td>Argans</td>
<td>UK</td>
<td>J. Boutin / N. Reul</td>
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<tr>
<td>3</td>
<td>Sea State</td>
<td>CNRS</td>
<td>FR</td>
<td>Fabrice Ardhuin</td>
</tr>
<tr>
<td>4</td>
<td>HR Land Cover</td>
<td>Univ. Trento</td>
<td>IT</td>
<td>Lorenzo Bruzzone</td>
</tr>
<tr>
<td>5</td>
<td>Snow</td>
<td>ENVEO</td>
<td>AT</td>
<td>Thomas Nagler</td>
</tr>
<tr>
<td>6</td>
<td>Lakes</td>
<td>CLS</td>
<td>FR</td>
<td>J.-F. Crétaux / S. Simis</td>
</tr>
<tr>
<td>7</td>
<td>Above Ground Biomass</td>
<td>Univ. Alberystwyth</td>
<td>UK</td>
<td>Richard Lucas</td>
</tr>
<tr>
<td>8</td>
<td>Permafrost</td>
<td>GAMMA RS</td>
<td>CH</td>
<td>Annett Bartsch</td>
</tr>
<tr>
<td>9</td>
<td>Land Surface Temperature</td>
<td>Univ. Leicester</td>
<td>UK</td>
<td>Darren Ghent</td>
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</table>
(ii) New R&D on ECVs already started in CCI

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

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.
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Procurement Concept - 2018

• 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:
Measure for Success

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.