Towards a Copernicus Climate Change service

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with contribution from D. Sciocco

Copernicus units

LPS Edinburgh 10/10/2013
Copernicus Climate Change service

The challenge

The graph shows the temperature trends over the years from 1900 to 2000. The black line represents observations. The blue shaded area represents models using only natural forces, while the pink shaded area represents models using both natural and human forces. The observed data is compared with models to understand the impact of human activities on climate change.
Copernicus Climate Change service

Climate Change fingerprints

Surface Air Temperature

Atmospheric CO2

Global Sea Level

Global Ocean Heat Content

Snow cover

Glacier Volume

Arctic sea ice extent
EU Regulation (911/2010) specifies that “access to information for climate change monitoring in support of mitigation and adaptation policies” shall be included in the GMES service component.

A Climate Change service must be consistent with GFCS and GCOS initiatives:

- Monitor the climate system
- Detect and attribute climate change
- Provide information to assess impacts of, and support adaptation to, climate variability & change
consultation process involving climate experts, relevant DGs and major European (climate-involved) institutions, the ‘Helsinki GMES climate’ conference (Jul 2011) and the GMES user forum (Nov 2011).

The 6th FP7 space call for 2013 has prioritized developments relevant for a Climate Change service

EC funding: 26 M€
<table>
<thead>
<tr>
<th>Atmosphere</th>
<th>Ocean</th>
<th>Terrestrial</th>
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<tbody>
<tr>
<td><strong>Composition</strong></td>
<td><strong>Surface</strong></td>
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<tr>
<td>Aerosols Properties</td>
<td>Sea Surface Temperature</td>
<td>Land Cover</td>
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<tr>
<td>Methane &amp; Long-Lived GHGs</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>Carbon Dioxide</td>
<td>Ocean Color</td>
<td>Glacier and Ice Caps</td>
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<tr>
<td>Precursors (for Aerosols &amp; O3)</td>
<td>Sea State</td>
<td>Ice Sheets</td>
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<tr>
<td><strong>Upper Air</strong></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 Vapor</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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<tr>
<td>Earth Radiation Budget</td>
<td></td>
<td>Above Ground Biomass</td>
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<table>
<thead>
<tr>
<th>Surface</th>
<th>Sub Surface</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Surface Air Pressure</td>
<td>Carbon</td>
<td>Permafrost</td>
</tr>
<tr>
<td>Surface Air Temperature</td>
<td>Current</td>
<td>Ground Water</td>
</tr>
<tr>
<td>Surface Precipitation</td>
<td>Nutrients</td>
<td>River Discharge</td>
</tr>
<tr>
<td>Surface Radiation Budget</td>
<td>Ocean Acidity</td>
<td>Soil Carbon</td>
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<tr>
<td>Water Vapour (Surface humidity)</td>
<td>Oxygen</td>
<td></td>
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<tr>
<td>Near-Surface Wind Speed, Dir</td>
<td>Salinity</td>
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<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>
Architecture of the Copernicus Climate Change service from research to operations

- from European commission e.g., FP7 Space call
- from other bodies e.g., MS, ESA, Eumetsat, EEA, WMO...

Selected set of information for customer DGs

MS and other users & customers
Architecture of the Copernicus Climate Change service

from European commission e.g., FP7 Space call

from other bodies e.g., MS, ESA, Eumetsat, EEA, WMO..

Harmonization/Coordination & QA platform

Climate Data Store

Observed, analysed and simulated Essential Climate Variables plus derived set of indicators relevant to consistently monitor and simulate Earth Climate responses to forcings
Architecture of the Copernicus Climate Change service

- from European commission e.g., FP7 Space call
- from other bodies e.g., MS, ESA, Eumetsat, EEA, WMO...

Harmonization/Coordination & QA platform

Climate Data Store (CDS)

- Harmonization/Coordination & QA platform
- Sectorial Information System
- Customization platform
- Climate Data Store
- Harmonization/Coordination & QA platform

Sea-level rise

- Globally gridded products at medium resolution
- Gridded products over Europe at resolution as high as possible
- Source: Legos/CNES/CLS
- Source: CLS
- Source: ice2sea

Globally averaged products
Architecture of the Copernicus Climate Change service

Forestry

Source: JRC

Coastal zones

Source: ice2sea

Sectoral Information System

Climate indicators & indices relevant to the various EU sectoral policies
from European commission e.g., FP7 Space call

from other bodies e.g., MS, ESA, Eumetsat, EEA, WMO..

Harmonization/Coordination & QA platform

Consistent Climate Data Store

Customization platform

Sectoral Information System

Selected set of information for customer DGs

MS and other users & customers
Architecture of the Copernicus Climate Change service

A logical view

- Harmonization/Coordination & QA platform
  - Consistent Climate Data Store
  - Customization platform
  - Sectoral Information System
  - Evaluation platform

- Selected set of information for customer DGs
- MS and other users & customers

- Monitoring, quality assessment of the service and feedbacks to production

- from European commission e.g., FP7 Space call
- from other bodies e.g., MS, ESA, Eumetsat, EEA, WMO..
Architecture of the Copernicus Climate Change service

A logical view

- **Harmonization/Coordination & QA platform**
- **Consistent Climate Data Store**
- **Customization platform**
- **Sectoral Information System**

Selected set of information for customer DGs

MS and other users & customers

Monitoring, quality assessment of the service and feedbacks to production

Education, general public and authorities, reports, media, bulletin

from European commission e.g., FP7 Space call
from other bodies e.g., MS, ESA, Eumetsat, EEA, WMO..
Copernicus Climate Change service

from European commission e.g., FP7 Space call
from other bodies e.g., MS, ESA, Eumetsat, EEA, WMO..

Harmonization/Coordination & QA platform

Consistent Climate Data Store

Customization platform

Sectorial Information System

Climate-ADAPT platform

Selected information for customer DGs

MS & other customers

Evaluation platform

Outreach platform
Copernicus Climate Change service

Road map Phase I

Climate Data Store - 20 ECVs & 7 indicators - Observed, re-analyzed and model projected products

ATMOSPHERE
Surface Air Temperature
Surface Precipitation
Water Vapor
Surface Radiation Budget
Earth Radiation Budget
Carbon Dioxide & Methane
Ozone & Aerosols
Cloud properties

OCEAN
Ocean Color
Sea Ice
Sea Level
Sea Surface Temperature
Global Ocean Heat Content

LAND
Snow Cover
Glaciers & Ice Caps
Albedo
FAPAR
Fire Disturbances
Ice Sheets

Sectoral Information System – 8 sectors & 18 indices
Agriculture and forestry
Health
Energy
Infrastructure
Coastal areas
Water management
Tourism
Insurance

ATMOSPHERE
OCEAN
LAND
## Copernicus Climate Change service

**Road map**
- Phase I
- Phase II

### Climate Data Store - 33 ECVs & 7+ indicators -
Observed, re-analyzed and model projected products

<table>
<thead>
<tr>
<th>ATOMOSPHERE</th>
<th>OCEAN</th>
<th>LAND</th>
</tr>
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<tbody>
<tr>
<td>Surface Air Temperature</td>
<td>Ocean Color</td>
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<tr>
<td>Ozone &amp; Aerosols</td>
<td>CO₂ partial pressure</td>
<td>Lakes</td>
</tr>
<tr>
<td>Cloud properties</td>
<td>Ocean Activity</td>
<td>Permafrost</td>
</tr>
<tr>
<td>Upper Air Temperature</td>
<td>Sea Surface Salinity</td>
<td>Land Cover</td>
</tr>
<tr>
<td>Other Long-Lived GHGs</td>
<td>Current Salinity</td>
<td>Leaf Area Index</td>
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### Sectoral Information System – 12 sectors & 18+ indices

- Agriculture and forestry
- Health
- Energy
- Infrastructure
- Coastal areas
- Water management
- Tourism
- Insurance
- Disaster risk reduction
- Marine and fisheries
- Transportation
- Biodiversity
• Global means, trends and anomalies
• EU means, trends and anomalies
• Global and EU anomaly ranking
• EU Records
• Climate Extreme Index
• Drought Palmer Index
• Common Sense Climate Index
• ...

Climate Data Store - 20 ECVs & 7 indicators - Observed, re-analyzed and model projected products
### Sectoral Information System – 8 sectors & 18 indices

<table>
<thead>
<tr>
<th>Index</th>
<th>Sector</th>
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<tr>
<td>Vegetation health</td>
<td>Agriculture &amp; Forestry</td>
</tr>
<tr>
<td>Crop moisture stress</td>
<td>Agriculture &amp; Forestry</td>
</tr>
<tr>
<td>European Drought</td>
<td>Agriculture &amp; Forestry</td>
</tr>
<tr>
<td>Ocean colour/currents/level</td>
<td>Coastal areas</td>
</tr>
<tr>
<td>Heat Stress</td>
<td>Health</td>
</tr>
<tr>
<td>Climate extremes</td>
<td>Health</td>
</tr>
<tr>
<td>Air freeze</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Residential Energy Demand Temperature</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Climate means and trends</td>
<td>Tourism</td>
</tr>
<tr>
<td>Extreme events</td>
<td>Tourism</td>
</tr>
<tr>
<td>Regional snowfall</td>
<td>Tourism</td>
</tr>
<tr>
<td>Snow</td>
<td>Water management</td>
</tr>
<tr>
<td>EU drought</td>
<td>Water management</td>
</tr>
<tr>
<td>Lake level</td>
<td>Water management</td>
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<td>SST means &amp; trends</td>
<td>Marine &amp; fisheries</td>
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<td>Climate Means &amp; trends</td>
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**Copernicus Climate Change service**

**Provisional timing**

### Proof of concept

- **Phase I**
  - **Y0**
  - 2014/15

### Pre-operational Phase I

- **Y1**

### Operational Phase

- **Y2**
- **2014/15**
- **20 ECVs, 7 indicators and 18 indices**

- **Y3**
- **Y4**
- **2020/21**
- **Phase I + II**
  - **33 ECVs, 7+ indicators and 18+ indices**

### Phase III ??

- **Y5**
- **Y6**
- **50 ECVs**
Thank you
Operating the Copernicus Climate Change service

Logical information flow

Advisory Groups

- Science (SAG)
- Application (AAG)

EC CC service

DELEGATED BODY

Climate Data Store

Sectorial Info System

Evaluation & QC

Outreach Platform

CC-PORTAL Climate-ADAPT

Customer DGs, Member States and other users

WP (n+1) + AAR (n)

if OK

if not OK

suggestions & recommendations
Gouvernance of the Copernicus CC service

EC CC service

Advisory groups

Climate Data Store
Evaluation & QC
Sectorial Info System
Outreach

suggestions & recommendations

Customer DGs, Member States and other users

High level interactions

USER FORUM
INTERNATIONAL ADVISORY BOARD

Evaluation & QC
Governance of the Copernicus Climate Change service

- Advise the service on the plans and annual Work Programs proposed by the delegated body for populating the Climate Data Store (CDS)

- Provide an assessment of the CDS Annual Activity Reports and propose adequate solutions to improve, if and when appropriate, the quality of the products available in the CDS

- Respond efficiently to requests related to the CDS from the Evaluation and Outreach platforms as appropriate
➢ **Advise** on the overall orientations and actions of the Climate Change service

➢ **Ensure** that the global dimension of the Climate Change issues is addressed as appropriate

➢ **Promote and facilitate** interactions with other international bodies dealing with Climate Change issues
Governance of the Copernicus Climate Change service

Climate Change
Science Advisory Group*

Chair: TBD
Sec: TBD

Members: EU Climate Centers
Members: EUMETSAT-SAF leader
Members: ESA-CCI leaders
Members: FP7 projects leaders
Members: TBD on ad hoc basis

• SAG meeting in BXL twice a year prior to the full operational phase
• Interactions favored via teleconferences and emails

* SAG limited to 12/14 members

Tasks

• Advise the service on the plans and annual Work Programs proposed by the delegated body for populating the Climate Data Store (CDS)

• Provide an assessment of the CDS Annual Activity Reports

• Propose adequate solutions to improve, if and when appropriate, the quality of the products available in the CDS

• Respond efficiently to requests related to the CDS from the Evaluation and Outreach platforms as appropriate
Climate Change Application Advisory Group*

Chair: TBD  
Sec: TBD  
Members: SBA experts  
Members: DGs  
Members: GEO representative  
Members: FP7 projects leaders  
Members: TBD

• AAG meeting in BXL twice a year prior to the full operational phase

• Interactions favored via teleconferences and emails

* AAG limited to 12/14 members

Tasks

Advise the service on the plans and annual Work Programs proposed by the delegated body for populating the Sectorial Information System (SIS)

• Provide an assessment of the SIS Annual Activity Reports

• Propose adequate solutions to improve, if and when appropriate, the quality of the products available in the SIS

• Respond efficiently to requests related to the SIS from the Evaluation and Outreach platforms as appropriate
Climate Change Advisory Board

Chair: MEP
Sec: TBD

Member: EC Science advisor
Member: WCRP
Member: GCOS
Member: WMO/GFCS
Member: UNFCC/UNEP/IPCC
Member: NOAA/NCDC
Member: EGU

• meeting in BXL once a year

Tasks

• Advise on the overall orientations and actions of the Climate Change service

• Ensure that the global dimension of the Climate Change issues are addressed as appropriate

• Promote and facilitate interactions with other international bodies dealing with Climate Change issues
Atmospheric CO$_2$ at Mauna Loa Observatory

Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
’…Mitigation will reduce the amount of future climate change and the risk of impacts that are potentially large and dangerous.’

’…Climate change is inevitable and policy responses should include adaptation to climate change.’

Extracted from an information statement of the American Meteorological Society August 2012
Architecture of the Copernicus Climate Change service

from European commission e.g., FP7 Space call

from other bodies e.g., ESA, Eumetsat, EEA, WMO..

Harmonization/Coordination & QA platform

Consistent Climate Data Store

Customization platform

Sectorial Information System

Evaluation platform

Selected set of information for customer DGs

MS and other users & customers
Architecture of the Copernicus Climate Change service

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- Selected set of information for customer DGs
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