



Climate Change

# Climate Change Service

Status Update: 08-02-2017

Dick Dee





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# C3S in a nutshell

## Climate Data Store

- ECVs past, present and future
- Observed, reanalysed and simulated
- Derived climate indicators
- Tools to support adaptation and mitigation at global and European level
- Open and free access

## Sectoral Information System



## Evaluation and Quality Control

- Monitors quality of C3S products and services
- Ensures C3S delivers state-of-the-art climate information to users
- Identifies gaps in service provision
- Bridges Copernicus with the research agenda in Europe (e.g. H2020, national research projects)

## Outreach and Dissemination

- Web content
- Public outreach
- Coordination with national outreach
- Liaison with public authorities
- Conferences, seminars
- Training and education



# Building Upon National and European Investments

National investments: Modeling capabilities, in-situ observations, seasonal forecasts, ...



ERA5, ERA6  
Data rescue  
Satellite data reprocessing



Access to *in situ* climate observations  
European and Arctic regional reanalyses



EQC on gridded observations  
ECV datasets production



Best practices  
Vocabularies, provenance, metadata  
User engagement



Workshop on Attribution in October 2017 to decide what next



Significant uptake on ECV datasets production





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## C3S - Development timeline

Stage 0/I - Proof of Concept/Pre-Operational
Stage II - Operational ~20 ECVs, ~5-6 Sectors
Stage III - Operational ~30 ECVs, ~10 Sectors

2014

2015

2016

2017

2018

2019

2020

2021

Stage 0/I

Stage II

Stage III



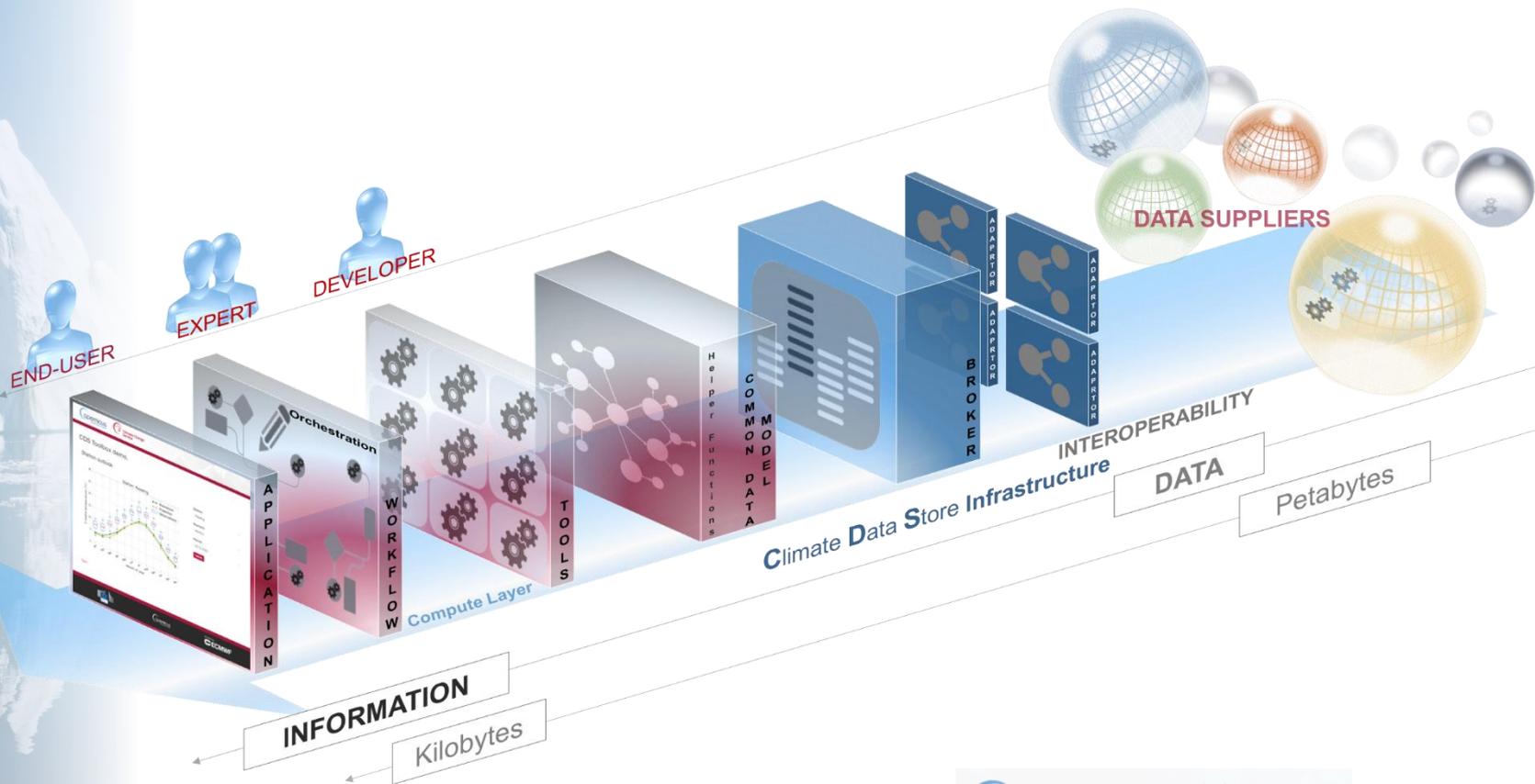
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# Climate Data Store



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# Building the CDS infrastructure





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# Developing CDS content



## Scientific basis:

- Essential Climate Variables as defined by GCOS
- GCOS Status Report and Implementation Plan
- IPCC, CMIP



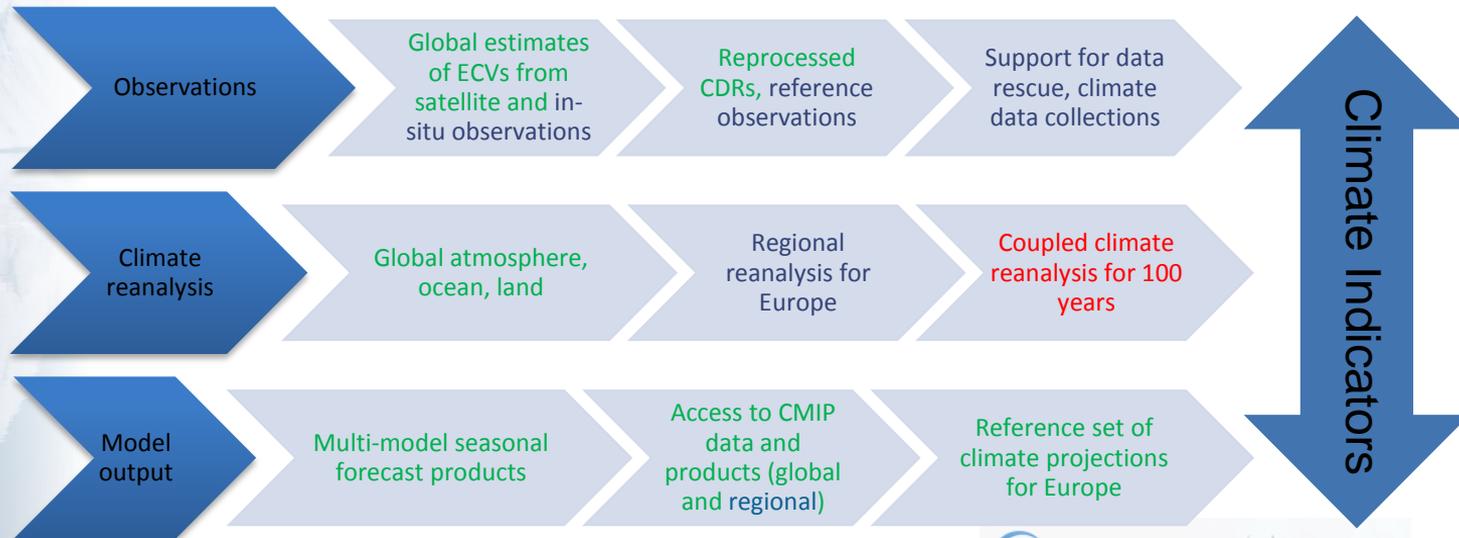
Action engaged



In preparation  
(PIN or ITT out)



Not started





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## ECV products for CDS

- Initial set of ~ 30 ECVs planned for stages II and III
- Products will become available via the CDS during 2017/2018
- Additional/alternative ECV products to follow (e.g. NOAA CDRs, GPCP, ...)



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C3S_312a	ECV products from observations	9 contracts, 12 ECVs	Started 2016Q4
C3S_311a	In situ observations (Lot 4)	High-resolution ECV products for Europe	Likely start 2017Q1
C3S_312b	ECV products from observations	Additional 8-10 ECVs	ITT in preparation
ERA5	Global atmospheric reanalysis	Atmosphere, land, sea state	Started 2016Q1
ORA5	Global ocean reanalysis	Ocean, sea ice	Complete



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# Status for Atmospheric ECVs

	GCOS Status Report	C3S Technical Annex	CDS	Reanalysis	Observations
<b>Atmosphere (surface)</b>					
Air temperature	4.3.1	Stage III	2017	ERA5	C3S_311a
Wind speed and direction	4.3.2	Stage III	2017	ERA5	C3S_311a
Water vapour	4.3.3	Stage III	2017	ERA5	C3S_311a
Pressure	4.3.4		2017	ERA5	C3S_311a
Precipitation	4.3.5	Stage III	2017	ERA5	C3S_311a
Surface radiation budget	4.3.6	Stage III	2017	ERA5	
<b>Atmosphere (upper air)</b>					
Temperature	4.5.1		2017	ERA5	
Wind speed and direction	4.5.2	Stage III	2017	ERA5	
Water vapour	4.5.3		2017	ERA5	
Cloud properties	4.5.4	Stage III	2017	ERA5	
Earth radiation budget	4.5.5	Stage III	2017	ERA5	
<b>Atmosphere (composition)</b>					
Carbon dioxide	4.7.1	Stage III	2017		C3S_312a
Methane	4.7.2	Stage III	2017		C3S_312a
Other long-lived greenhouse gases	4.7.3	Stage III	2018		C3S_312b
Ozone	4.7.4	Stage III	2017	ERA5	C3S_312a
Aerosol	4.7.5	Stage III	2017		C3S_312a



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## Not yet included:

- Existing ECV products (e.g. NOAA CDRs, CM-SAF products, GPCP, ...)
- Regional reanalysis products



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# Status for Oceanic ECVs

	GCOS Status Report	C3S Technical Annex	CDS	Reanalysis	Observations
<b>Ocean (physics)</b>					
Sea Surface Temperature	5.3.1	Stage III	2017	ORA5	C3S_312a
Subsurface Temperature	5.4.1	Stage III	2017	ORA5	
Sea Surface Salinity	5.3.2		2018	ORA5	
Subsurface Salinity	5.4.2	Stage III	2018	ORA5	
Sea Surface Currents	5.3.6		2018	ORA5	
Subsurface Currents	5.4.3	Stage III	2018	ORA5	
Sea Level	5.3.3	Stage III	2017	ORA5	C3S_312a
Sea State	5.3.4		2018	ERA5	
Sea Ice	5.3.5	Stage III	2017	ORA5	C3S_312a
Ocean Surface Stress	NEW		2018	ORA5	
Ocean Surface Heat Flux	NEW		2018	ORA5	
<b>Ocean (biochemistry)</b>					
Inorganic Carbon	NEW		2018		C3S_312b
Ocean Colour	5.3.7	Stage III	2018		C3S_312b



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# Status for terrestrial ECVs

	GCOS Status Report	C3S <sup>2</sup> Technical Annex	CDS	Reanalysis	Observations
<b>Land (hydrology)</b>					
Lakes	6.3.4	Stage III	2018		C3S_312b
Soil moisture	6.3.16	Stage III	2017	ERA5	C3S_312a
<b>Land (cryosphere)</b>					
Snow	6.3.5	Stage III	2017	ERA5	
Glaciers	6.3.6	Stage III	2017		C3S_312a
Ice sheets and ice shelves	6.3.7	Stage III	2018		C3S_312b
Permafrost	6.3.8	Stage III	2018		C3S_312b
<b>Land (biosphere)</b>					
Albedo	6.3.9	Stage III	2017		C3S_312a
Land cover (including vegetation type)	6.3.10	Stage III	2018		C3S_312b
Fraction of absorbed photosynthetically	6.3.11	Stage III	2017		C3S_312a
Leaf area index	6.3.12	Stage III	2017		C3S_312a
Fire	6.3.15	Stage III	2018		C3S_312b



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# Atmospheric reanalysis

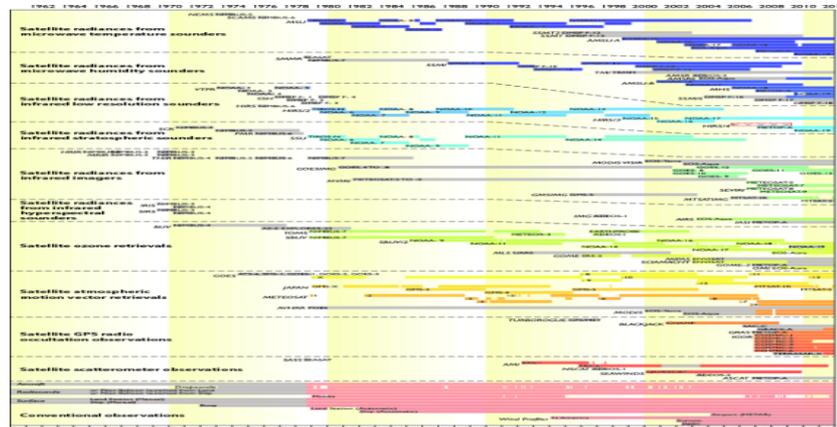
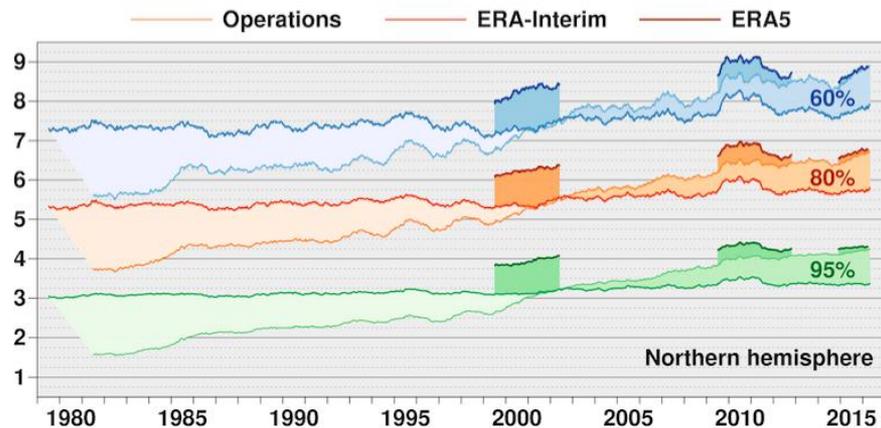
## ERA5 global reanalysis:

- Atmosphere/land/wave parameters
- 31 km global resolution, 137 levels
- Hourly output from 1979 onward
- Based on IFS Cy41r2 (March 2016)
- Using improved input observations
- Ensemble data assimilation
- Providing uncertainty estimates

## Regional reanalysis:

- European + Arctic domains
- Higher spatial resolution
- ITT C3S\_322 issued 2016 Q4
- Bids under evaluation

Range (days) when 365-day mean 500hPa height AC (%) falls below threshold





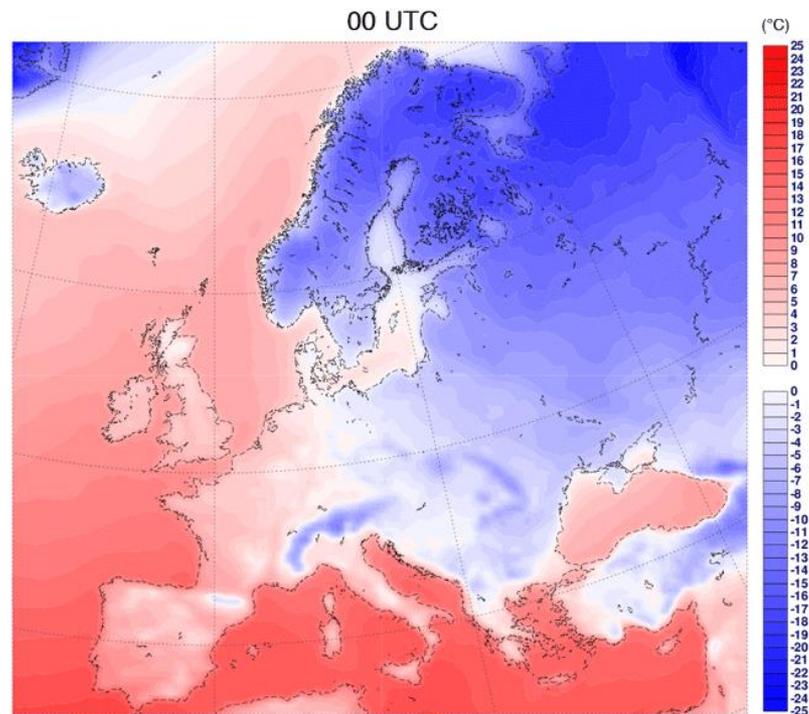
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## ERA5: Data release schedule

### ERA5 release plan:

- Nov 2016 **Test data (Jan-Feb 2016)**
- Apr 2017 **Hourly data from 2010 - 2016**
- May 2017 **Daily updates at short delay**
- Apr 2018 **Complete from 1979 onward**

Reanalysis is now an operational  
service provided by ECMWF



ERA5 hourly temperatures for January 2016



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## Input for reanalysis and assessment

### ***C3S\_311b: Reprocessing of Satellite Data Records***

*Directly negotiated contract with EUMETSAT – started 2016Q3*

WP Number	WP Title	Start	End
WP1	Atmospheric Sounding FCDRs	Q1/2017	Q3/2019
WP2	Radio Occultation FCDRs	Q2/2017	Q2/2021
WP3	Scatterometer FCDR	Q1/2020	Q1/2021
WP4	Meteosat Radiance FCDR	Q4/2016	Q1/2021
WP5	Atmospheric Motion Vectors TCDRs	Q2/2017	Q4/2020
WP6	Polar Multi-Sensor Aerosol Product	Q3/2019	Q2/2021
WP7	Operational Preparation Activities	Q1/2018	Q2/2021
WP8	International Coordination	Q1/2020	Q2/2021
WP9	Activity Coordination and Management	Q4/2016	Q2/2021



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## In situ observations

### ***C3S\_311a: Collection and Processing of In Situ Observations***

Lot 1: Coordination of data rescue activities

Lot 2: Access to observations from global climate data archives

Lot 3: Access to observations from baseline and reference networks

Lot 4: Climate monitoring products for Europe based on *in situ* observations

*Contracts likely to start 2017Q1*



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# CDS Evaluation & Quality Control

## C3S\_51 Lot 2: ECV products derived from observations

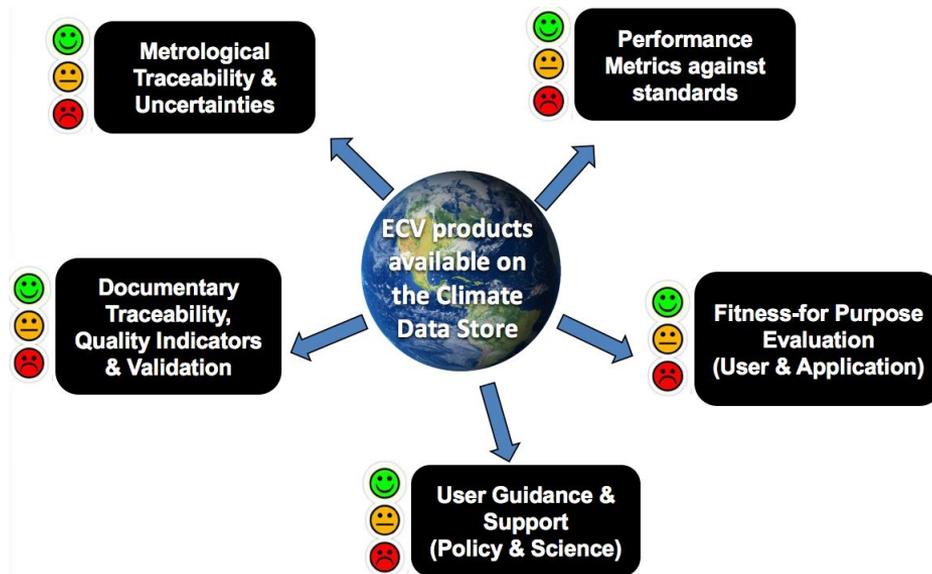
Contract started 2016Q4

### C3S\_511: Quality assessments of ECV products

- Single-product assessments
- Multi-products assessments
- Thematic product assessments

ITT has been published

**Deadline for proposals: 14 March 2017**

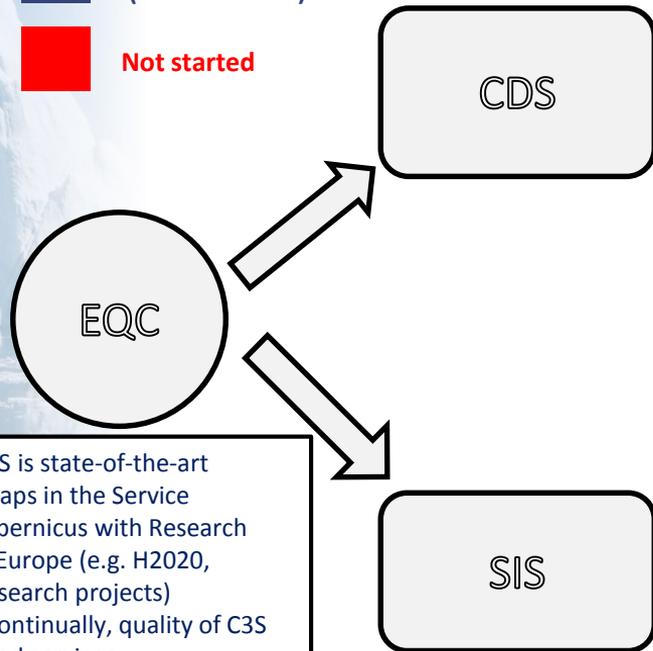




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# EQC: Engaged and future activities

- Action engaged
- In preparation (PIN or ITT out)
- Not started



Ensures C3S is state-of-the-art  
 Identifies gaps in the Service  
 Bridges Copernicus with Research  
 Agenda in Europe (e.g. H2020,  
 national research projects)  
 Monitors continually, quality of C3S  
 products and services  
 "Quality Assurance" body  
 Contributes and develops  
 URDB/SES/etc documents



Quality assurance for seasonal forecasts



Quality assurance framework for earth observations



Quality assurance for climate projections



Quality assessment of ECV products and reanalyses



Sectoral gap analysis and user requirements



**EQC of operational SIS**





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# Additional information at [climate.copernicus.eu](http://climate.copernicus.eu)

The screenshot shows the homepage of the Copernicus Climate Change Service. At the top, there is a navigation bar with the Copernicus logo, the text 'Climate Change Service', a search bar, and a 'Contact us' button. Below this is a secondary navigation menu with links for 'ABOUT C3S', 'NEWS & MEDIA', 'EVENTS', 'TENDERS', 'PRODUCTS', 'SERVICES', and 'USER SUPPORT'. The main banner features a collage of images: a cracked, dry landscape, a busy port with shipping containers, and a coastal town. A central text box reads 'CLIMATE INFORMATION FOR YOUR PLANNING'. Below the banner are three columns of featured content:

- IN FOCUS:** A thumbnail for the '4th International Conference on Energy & Meteorology (ICEM)' with the subtitle 'Challenges in Addressing Climate and Water Services for Energy'. The text below reads: 'Copernicus at the 4th International Conference on Energy & Meteorology (ICEM)' and '26 Jan 2017'. A 'READ MORE' button is at the bottom.
- MONTHLY MAPS:** A thumbnail showing a world map and a regional map of Europe with a temperature scale from -14 to 14 °C. The text below reads: 'Average surface air temperatures for January 2017' and 'January 2017'. An 'ARCHIVE' button is at the bottom.
- NEWS:** A list of three news items:
  - 26 Jan 2017: 'Copernicus at the 4th International Conference on Energy & Meteorology (ICEM)'
  - 12 Jan 2017: 'Principal Climate Scientist - an exciting new job opportunity at C3S'
  - 13 Dec 2016: '#OpenDataHack @ECMWF - explore creative uses of open data'An 'ARCHIVE' button is at the bottom.