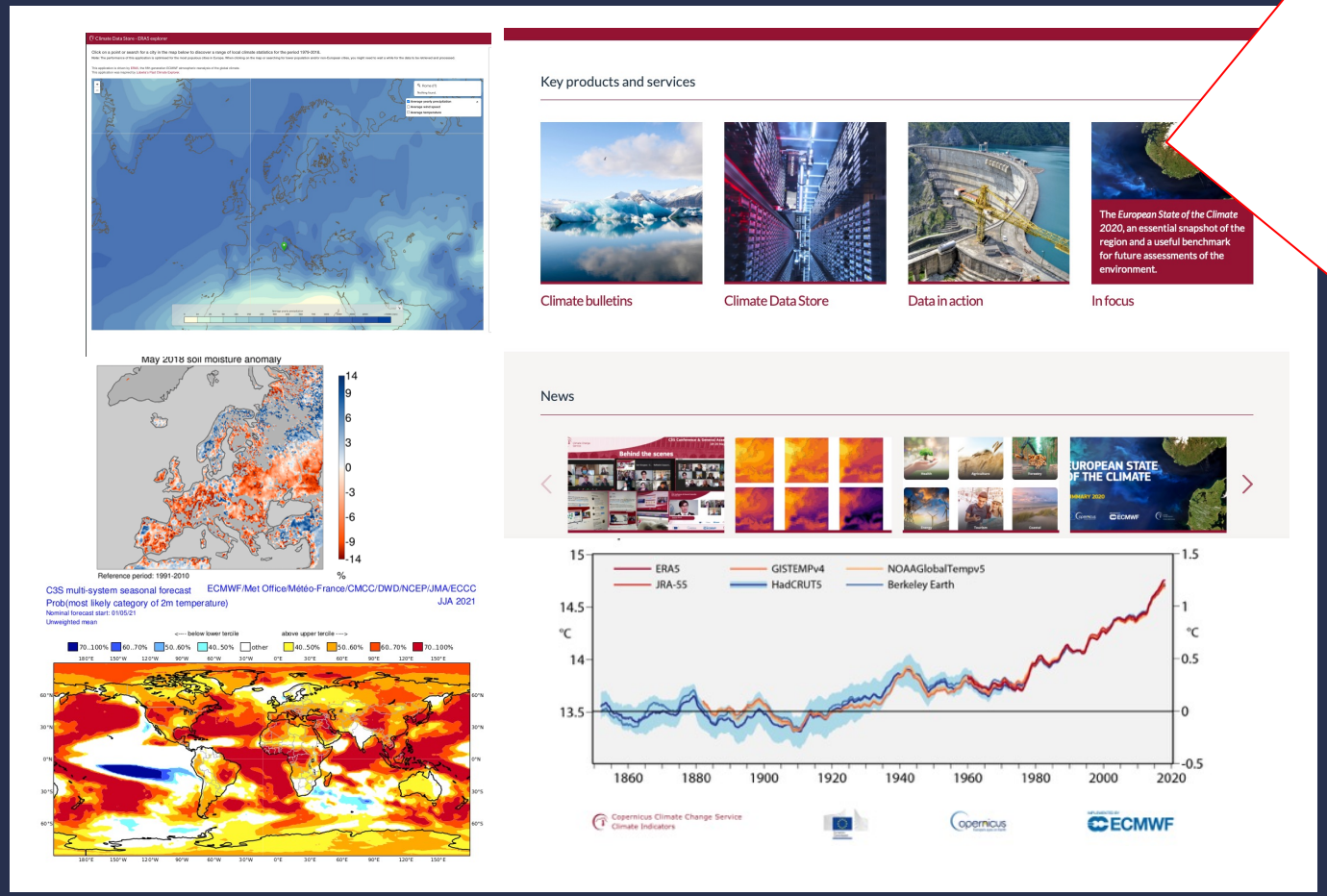
C3S plans for Copernicus 2.0: **an update.**

Carlo Buontempo & the C3S team

C3S, Copernicus Department , ECMWF

Climate Change

http://climate.copernicus.eu



Fully funded until 2027

...es:

- ...lity-controlled ... based on ...t the ... cli...
- tools to ... mitigation a... strategies by p... ...ers and businesses;
- examples of best practice in the use of climate information.

ECMWF
EUROPEAN CENTRE FOR MEDIUM RANGE WEATHER FORECASTS

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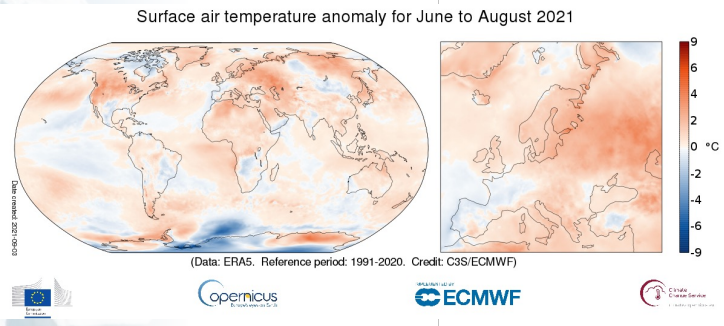
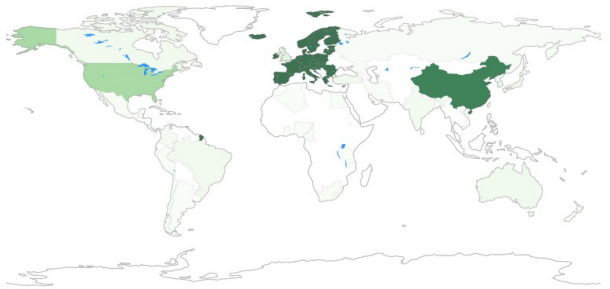
C3S highlights

C3S is explicitly highlighted as an exemplar climate service in IPCC AR6: chapter 12 (WGI, August 2021) and **ERA5** appears over 100 times throughout the report.



The average June-August temperature for Europe was 0.96°C above the 1991-2020 average for the season which marks the warmest boreal summer in this data record (albeit only by a very small margin).

With nearly 100.000+ users on the CDS, 33 applications, and the **72PB** of data delivered since day1, C3S user bases continues to grow.



European Climate Data Explorer

A new interface to EEA Climate Adapt allows a broader set of users to benefit from C3S data and develop climate adaptation strategies.

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C D S / C 3 S S t a t i s t i c s

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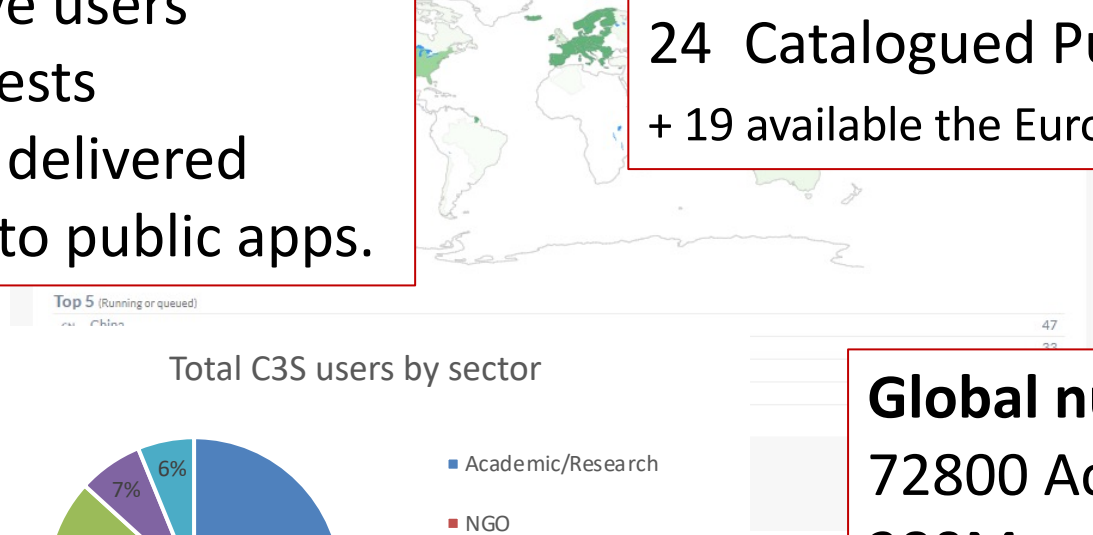
100.000+ registered users

109 Catalogued Datasets

Daily average:
1100 Active users
600k requests
75Tb data delivered
275 Visits to public apps.

24 Catalogued Public applications
+ 19 available the European Climate Data Explore (EEA)



Global numbers:
72800 Active users
280M requests
72PB data delivered

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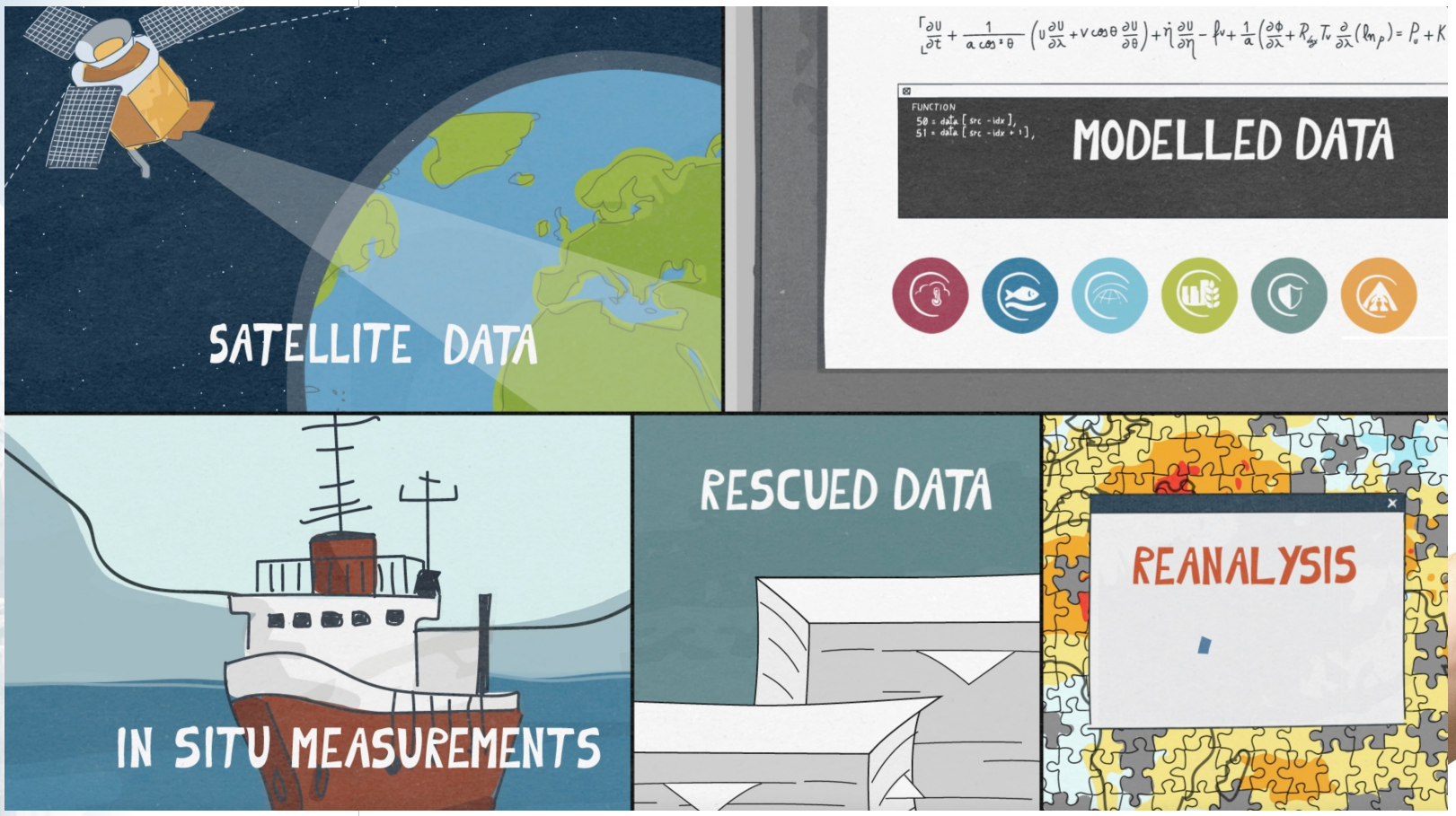
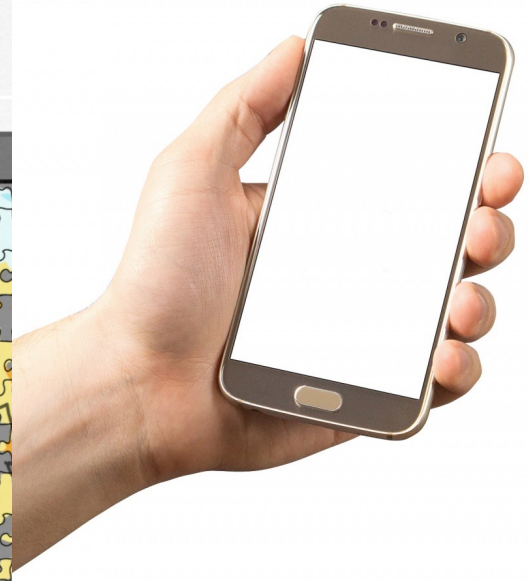
The building blocks





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C3S2 & JOINT SERVICES procurement

Climate Change

2021	
Planned Procurements	27 ITTs 4 Direct Negotiations
Planned Contracts	23 to kick-off in 2021

Until the agreement on UK participation in Copernicus is finalised, the UK will not be able to participate in the parts of the Copernicus programme that are open only to EU member states.
[…]
UK organisations could previously bid for Copernicus contracts tendered through ECMWF and Mercator Ocean. Until the Copernicus agreement is implemented, UK organisations cannot bid for Copernicus Services contracts except in exceptional circumstances that need to be justified to the European Commission.

Source:
https://www.gov.uk/guidance/uk-involvement-in-the-eu-space-programme

Observations		Status Aug-21
C3S2_312a_Lot1,2,3,4,5	Essential Climate Variable products derived from observations	Negotiation
C3S2_311_Lot1,2,3	Collection and Processing of In Situ Observations	Negotiation
C3S2_310 (DN)	Provision of reprocessed satellite data records	Negotiation
C3S2_120a	Technical contract management support contract C3S2_312	Evaluation
Reanalysis, predictions and projections		
C3S2_314	Support for climate reanalysis including satellite data rescue	Negotiation
C3S2_360	Regional Climate Reanalysis Timely Updates	Negotiation
C3S2_361a	Arctic regional reanalyses - 2nd Generation	Preparation
C3S2_361b	European Regional reanalysis support activity	Preparation
C3S2_370	Operational Seasonal Predictions	In signature
C3S2_375	Decadal prediction service	Preparation
C3S2_380	Operational access to global and regional climate projections and predictions from ESGF	Negotiation
C3S2_381 (DN)	Copernicus Interactive Climate Atlas	Negotiation
C3S2_382	Provision of global and regional projections New content (data) and functionality (WPS) for climate projections in the CDS	Preparation
Applications		
C3S2_43a	Maintenance and Development to Support the C3S – EEA Interface: European Climate Data Explorer	Preparation
C3S2_410	C3S Multi-model Operational Hydrological Seasonal Prediction Service, Global and for Europe	Preparation
C3S2_411	Operational Water SIS	Preparation
C3S2_412	Operational Energy SIS	Preparation
C3S2_413	Operational Insurance SIS	Preparation
C3S2_414	Operational Agriculture SIS	Preparation
Evaluation and Quality Control		
C3S2_510	CDS Evaluation and Quality Control Function - URDB, monitoring	Preparation
C3S2_520	Quality Assurance for Datasets in the Climate Data Store	Publication
Tier 1 and 2 R&D support		
C3S2_601	Advancing ocean data assimilation methodology for climate applications	Evaluation
Communication Services (joint services)		
CJS2_030_Lot1,2,3,4	Corporate communication, content production and design services Public and media relations services Events and experiential marketing services Media buying, media partnership and campaign services	Negotiation
User engagement activities and training (joint services)		
CJS2_152c	Enhance user intelligence: policies and markets evolution	Preparation
CJS2_154a,b	User specific promotion and marketing: Value proposition material - User Segments marketing strategy	Preparation
CJS2_156a	Training and knowledge transfer - User Learning Services	Preparation
CJS2_157a	CRM tool - Customer Relationship Management tool	Preparation
Data stores (joint services)		
CJS2_210 (DN)	Cloud computer and Storage for CDS Bologna	Preparation
CJS2_211	Copernicus Data Stores Modernisation	Evaluation
CJS2_212 (DN)	CDS 1.0 maintenance	Preparation

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Essential Climate Variables in C3S

C3S supports 22 ECV services grouped in 5 thematic areas:

Atmospheric physics	
	Precipitation
	Surface Radiation Budget
	Water Vapour
	Cloud Properties
	Earth Radiation Budget
Atmospheric composition	
	Carbon Dioxide
	Methane
	Ozone
	Aerosol
Ocean	
	Sea Surface Temperature
	Sea Level
	Sea ice
	Ocean Colour
Land hydrology & cryosphere	
	Lakes
	Glaciers
	Ice sheets and ice shelves
	Soil moisture
Land biosphere	
	Albedo
	Land Cover
	Fraction of Absorbed Photosyntheti
	Leaf Area Index
	Fire

Continuous work in the CDS:

- Update of existing ECV products
  - ICDRs, new versions, updated documentation
- Addition of new ECV products
  - Cloud Properties
  - Total Column Water Vapour
  - Fire Radiative Power
- Publication of toolbox applications per ECV product

Quality Assurance tab implemented for 23 ECV products (more to come)

- Transparency / traceability, maturity, fitness for purpose

Procurement strategy for COP2

- Based on **continuity** of existing services but… increasing efficiency and synergy with external services:
  - Federated Activity with EUMETSAT's SAFs
  - Procurement of ocean ECVs jointly with MOI
  - Reducing running costs of current ECV services
  - Continuing collaboration with ESA-CCI
- **Review** of current ECVs landscape towards end 2023

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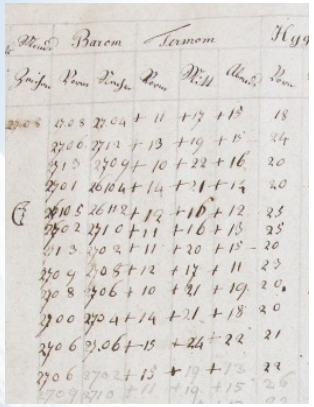
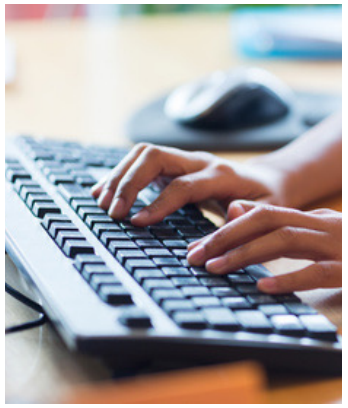
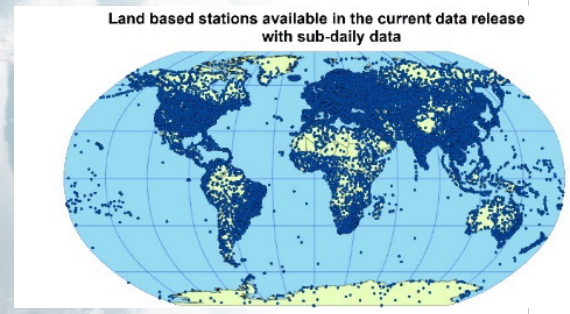
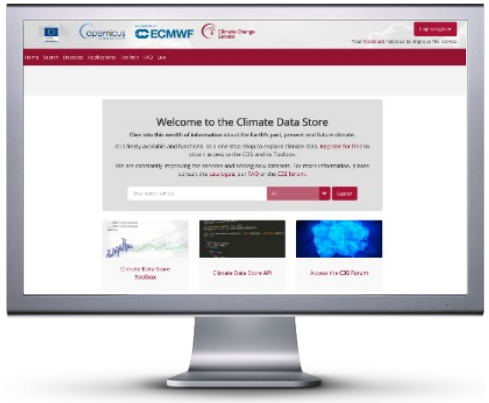
Collection and processing of in situ observations









Historical in situ observations play an important role in C3S, e.g.:

- for accurate climate monitoring
- as input to global/regional reanalyses and other gridded products
- as 'ground truth' for verification of ECV products

C3S focuses on:

- the facilitation of data rescue activities
- the improvement of historical records
- collection into well-maintained archives

What C3S offers:

- Data rescue service (linked with KNMI/WMO I-DARE)
  - overview of data rescue activities
- In-situ data deposit service
  - allows uploads of additional collections
  - e.g., Chilean data from EC cooperation agreement
- Access of in-situ archives via the C3S Climate Data Store

Recent developments:

- Historical land data set (going back to 1755) was released in the CDS on 18 August 2021

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Satellite data reprocessing and data rescue

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Satellite data reprocessing (EUMETSAT: C3S_311b and C3S2_310)

- **COP1** focus was post-1979 operational data of high value, esp. for reanalysis
- Covers: radiances, GNSS-RO, AMVs, Scat and aerosol data
- Pre-ERA6 evaluation underway at ECMWF for radiances and RO data
- Biases in data generally improved & impacts on ERA6 reanalysis expected

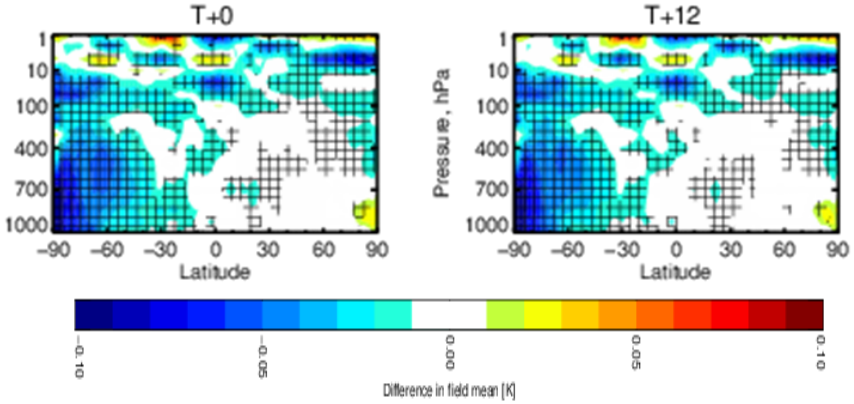
- **COP2** - expected start Q1 2022, covers:
  - Key long-term operational missions (HIRS, SSM/T, Japanese Geo)
  - High value data for European regional reanalysis (high res. Meteosat radiances)
  - High value early data (SSH, SI-1, SMMR)
  - Full uncertainty characterisation for high impact data (MSU, AMSU, ATMS)

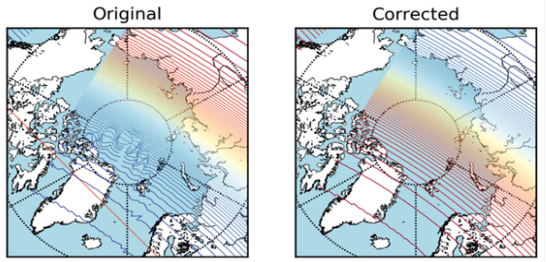
Early Satellite Data Rescue (Spascia, C3S_311c lot 1 and C3S2_314)

- **COP1** focus was recovery, assessment and improvement of pre-1979 data
- Covered 8 early IR sounding and imaging missions
- Improvements included:
  - Recovery, reformatting (NetCDF) and detailed QC of all data
  - Improved geolocation & radiative transfer (RTTOV) modelling
  - Instrument bias characterisation, rel. to ERA5, and root-cause analyses

- **COP2** - expected start Q4 2021, covers:
  - Improved *assimilation readiness* for COP1 sensors & support for ERA6; and
  - Recovery and assessment of several pre-1979 sensors (including MW)

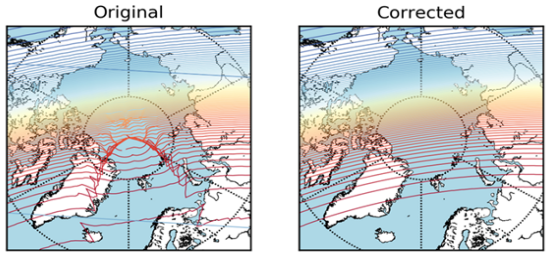
TIROS-N and NOAA-6 HIRS data
Impact on mean field (temperature)
relative to baseline HIRS data
July – December 1979





16/05/1966

Improved geolocation Medium Resolution Infrared Radiometer (MRIR)
Nimbus 2



16/04/1969

Nimbus 3

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Status C3S Reanalysis: global (ERA5, ERA5-Land) and regional (Europe, Arctic)

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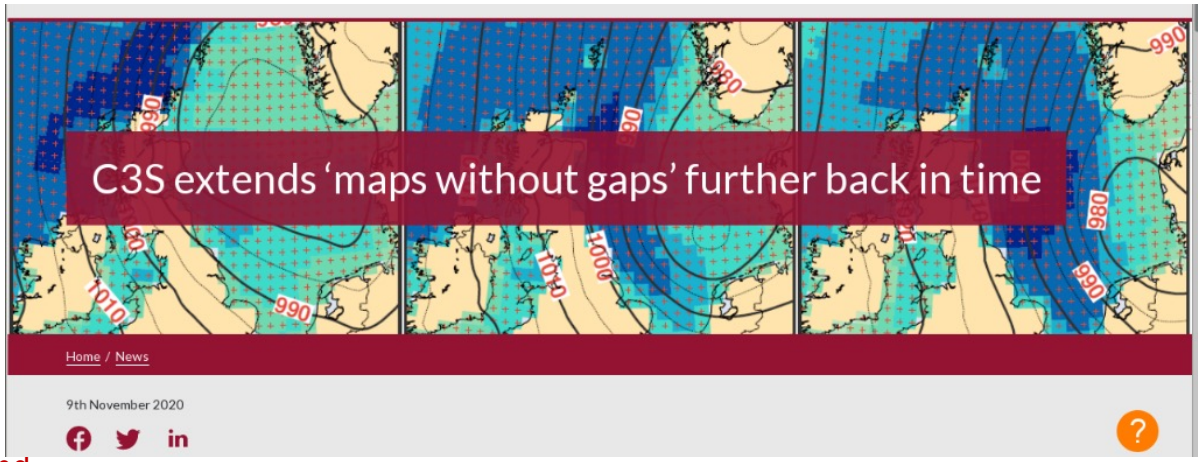
ERA5 (global, 31km)

Daily updates 5 days behind real time from 1979 onwards

Preliminary back extension (1950-1978) is available in the CDS

Final back extension is currently in production:

1) 1959-1978: four parallel streams of 5 year each; 53% complete
2) 1950-1958, potentially 1940-1958: after completion of 1)



ERA5-Land (global, dynamical downscaling to 9km)

Available from 1981, updates 2-3 months latency

Back extension from 1950 has completed and is currently being consolidated and will be made publicly available soon.

Timely updates are delayed until move to the new HPC has completed (2022).

European reanalysis (CERRA, 5.5km)

Production has nearly completed

A dedicated land component is to complete before the end of 2021

Predecessor (UERRA) is available in the CDS

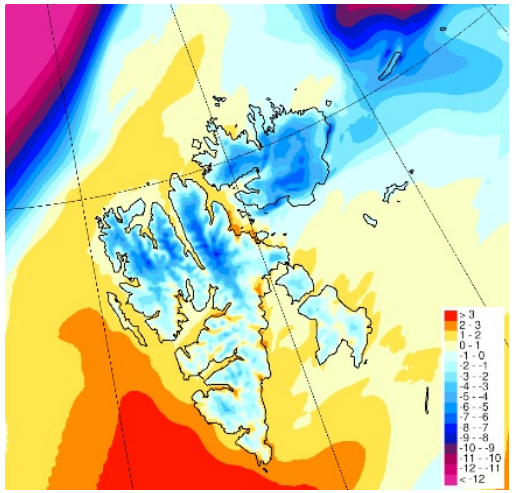
Arctic reanalysis (CARRA, 2 sub-areas, 2.5km)

Period of 1998-2019 (22 years) was published in the CDS in March 2021

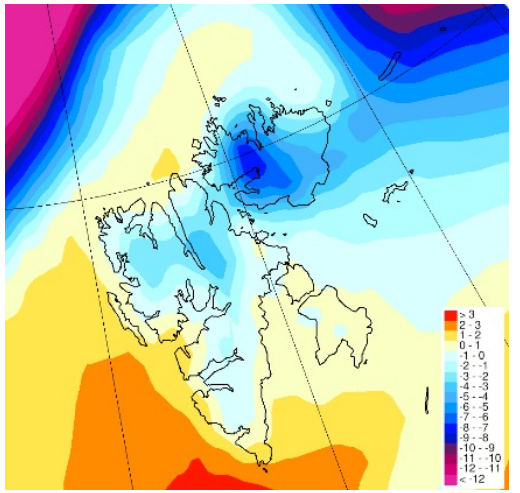
A back extension from 1991 will be completed by the end 2021

A pan-Arctic one-year test period is in production (80% completed); a full pan-Arctic is to be produced in COP2.

Near-surface temperature



CARRA



ERA5

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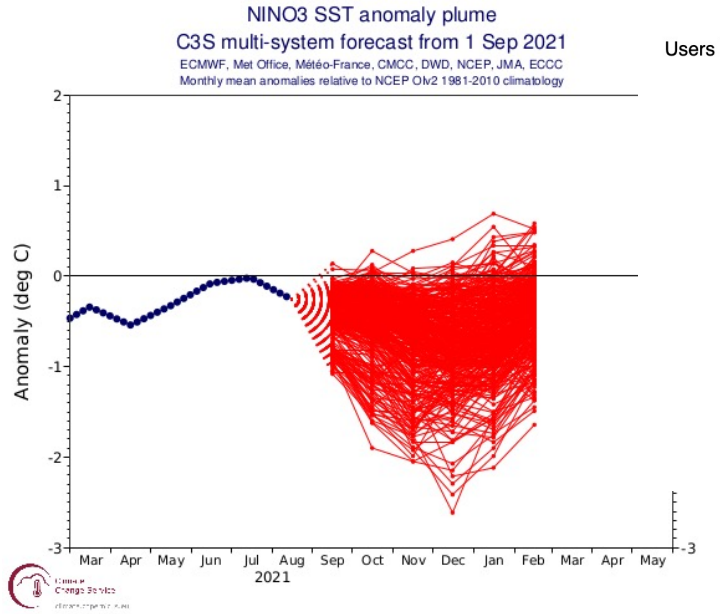
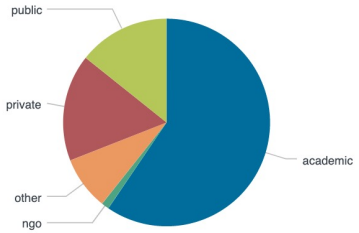
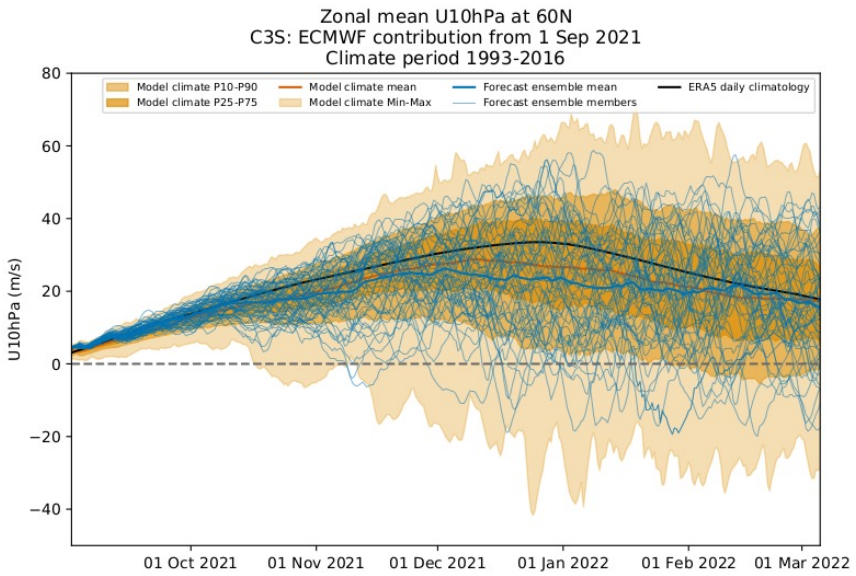
Seasonal predictions

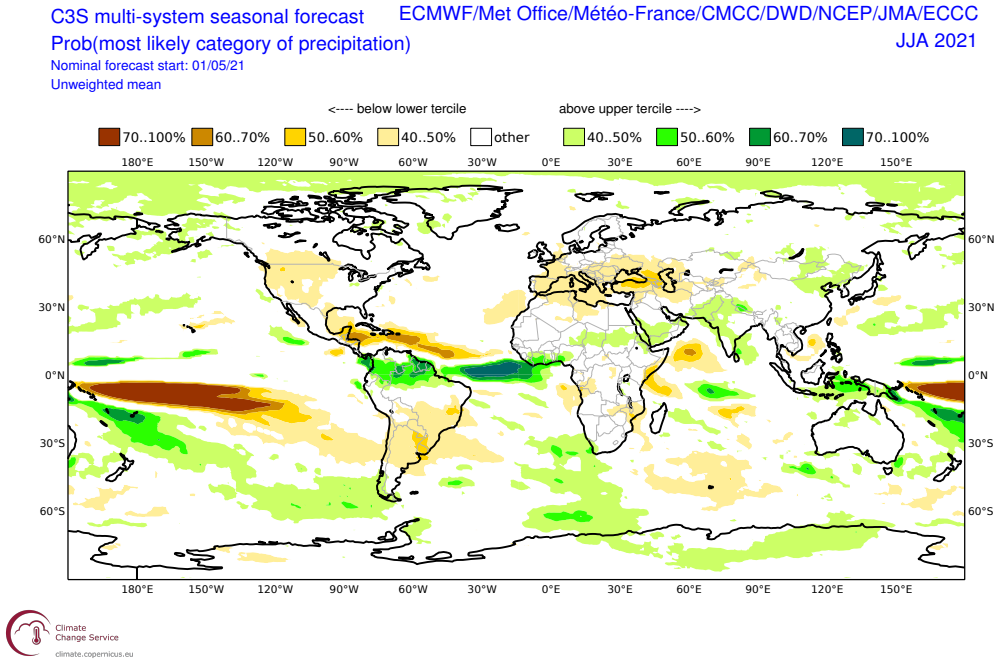


Users by sector



Forecast and hindcast data is openly available here: →





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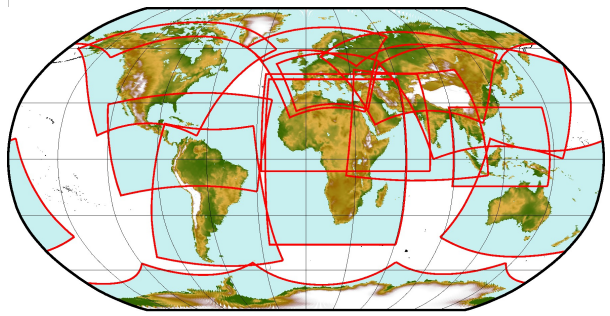
New climate projection data and operating capability in the CDS

- **CMIP6 simulations:** historical simulations and scenario runs;
  - new functionality (e.g. WPS for sub-setting on download)
  - Pre-calculated ETCCDI nearly ready to be published

- **World-wide CORDEX simulations for the CDS**
  - **including non-European regions (EURO-CORDEX, Med-CORDEX, Arctic, Africa, North America, South America are already available, others will come soon)**
  - Give access to data already available at ESGF (and align it to C3S requirements)
  - Give access to data not yet available at ESGF
  - Make available data from multi-region experiments (e.g. CORDEX-CORE)
  - Establish operational connection with the IPCC Climate Atlas



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Evaluation and Quality Control (EQC)

Status

- EQC tabs in the CDS now available for most catalogue entries (covering all dataset categories)
- Quality Assurance Reports regularly published also for tools and applications

New ITTs

- ITT “Quality Assurance for Datasets in the Climate Data Store” published in August
- ITT on User Requirements Database and Service Monitoring in development (to be published in Q4/2021)
- ITT on Quality Assurance for Tools and Applications in development (to be published in 2022)

Outreach

- EQC workshop held in June (organised by BSC) to inform future evolution of EQC function
- Publications with C3S involvement underway on the EQC framework for datasets and the scientific assessment framework (to be published in BAMS)

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C3S – EEA INFORMATION FOR ADAPTION

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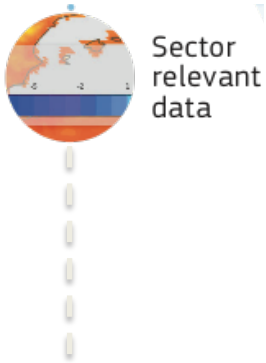
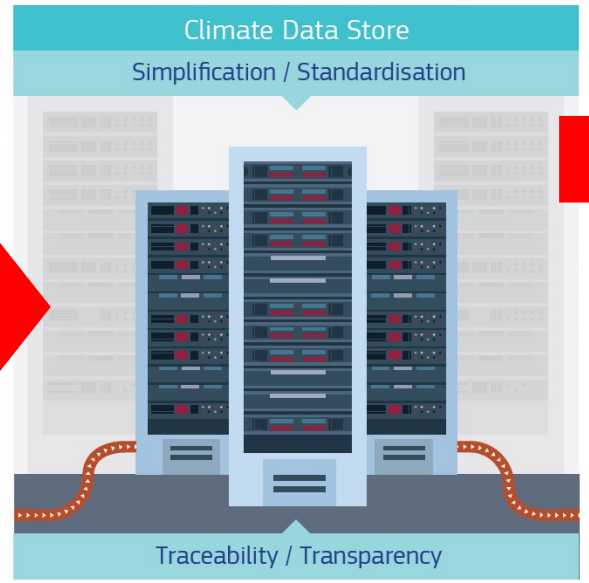
Sectoral Information System Activities

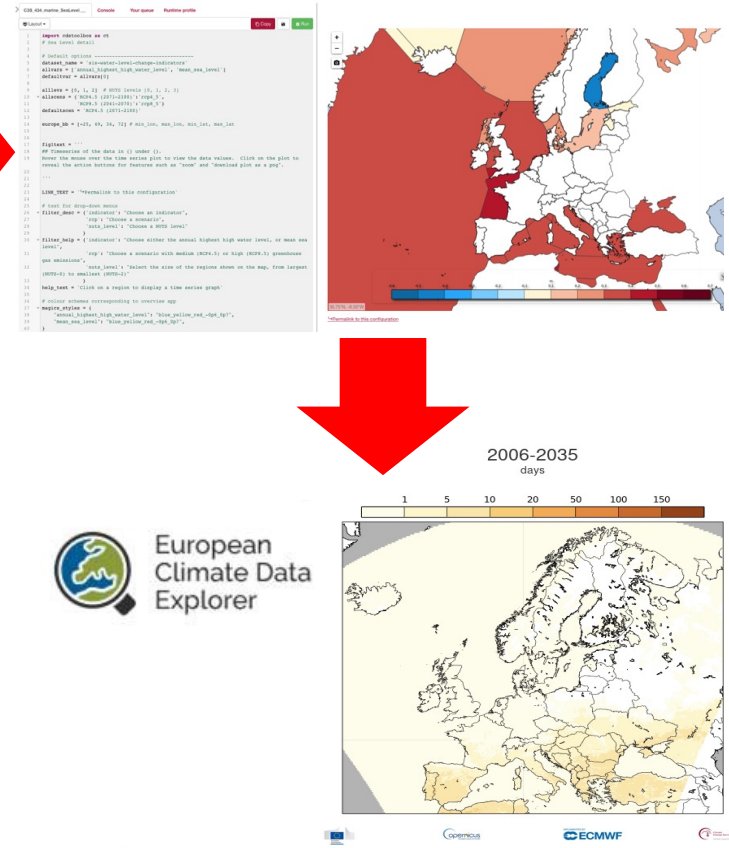


32 ‘High Priority’ Indicators

European Environment Agency



Toolbox workflows



European Climate Data Explorer

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