Climate Change

Climate Change Service

In Situ Data and the Copernicus Climate Change Service

Jean-Noël Thépaut

Copernicus Europe's eyes on Earth

European Commission | ECMWF

Climate Change

The C3S mission

To support European adaptation and mitigation policies by:

- Providing consistent and authoritative information about climate
- Building on existing capabilities and infrastructures (nationally, in Europe and worldwide)
- Stimulating the market for climate services in Europe

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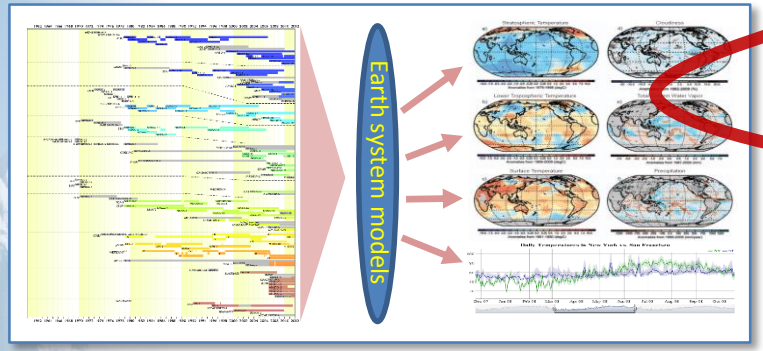
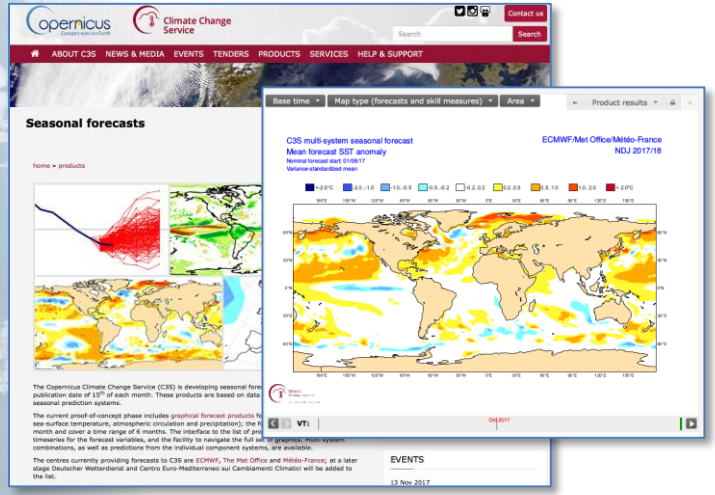
Access to past, present and future climate information

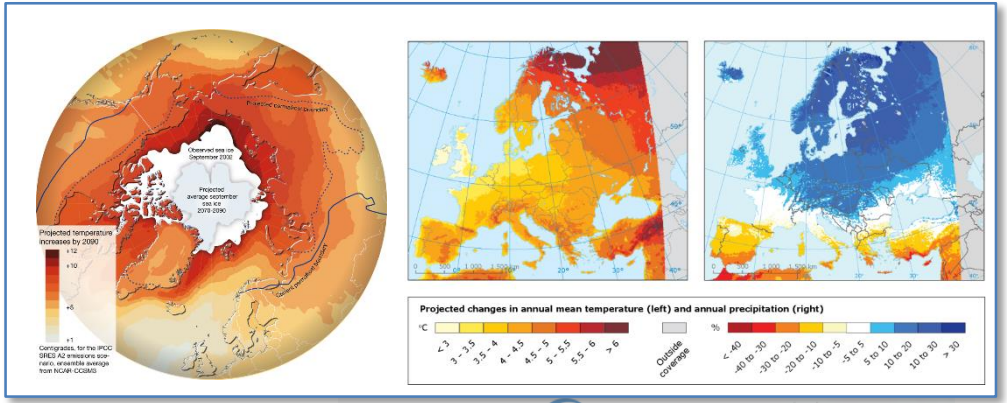


Observations and climate reanalyses

Seasonal forecast data and products

Climate model simulations





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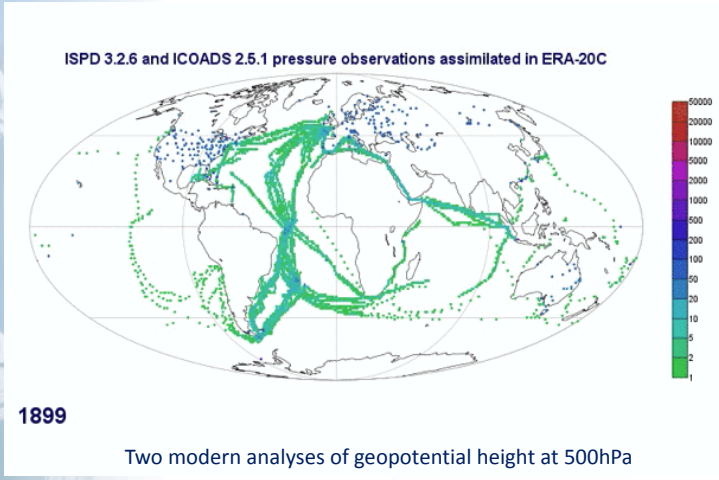
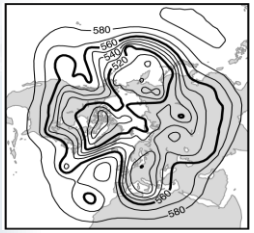
In Situ observations to recover the past climate

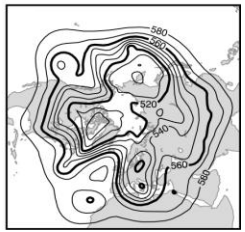
Reaching further back in time: Key challenges



Two modern analyses of geopotential height at 500hPa

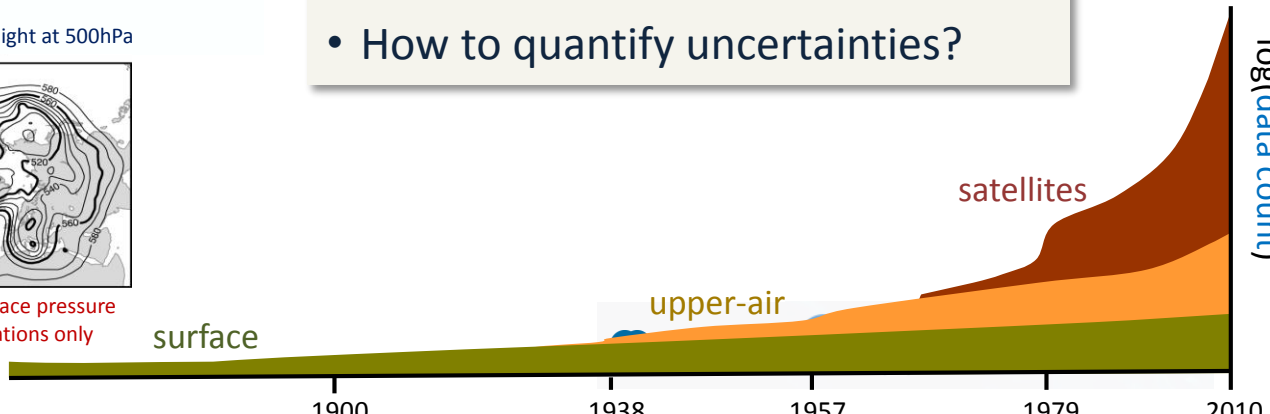


Using all available observations



Using surface pressure observations only

- Which observations are available?
- How best to make use of them?
- What is the role of models?
- How to deal with shifts and biases?
- Can we achieve “climate quality”?
- How to quantify uncertainties?



Whitaker, Compo, and Thépaut 2009

Observations used in Climate Re-analysis – C3S

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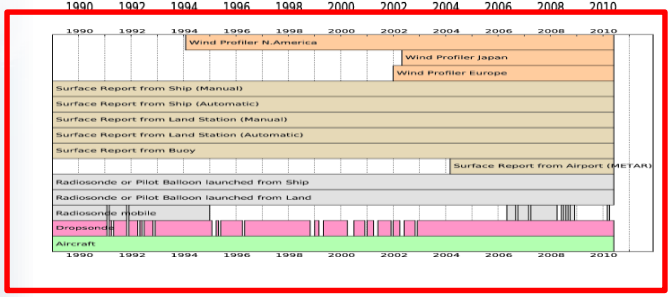
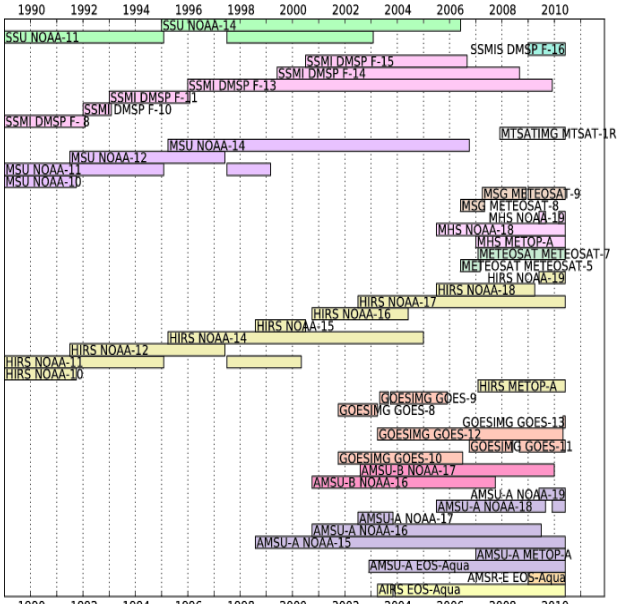
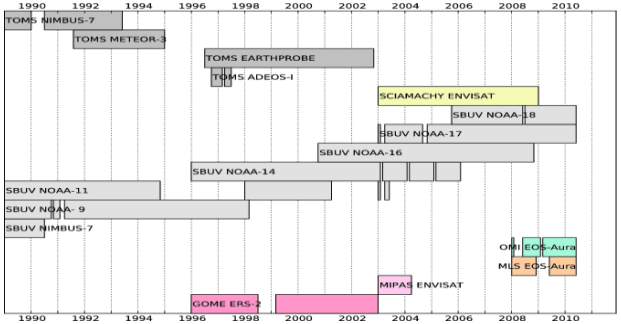
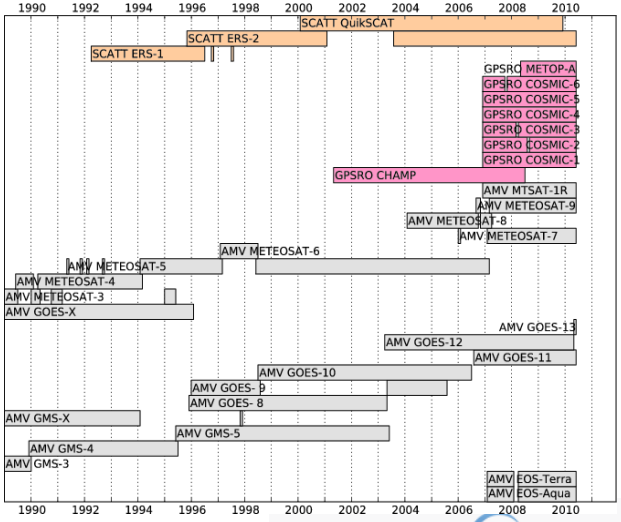
In-situ









Credit: P. Breger

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C3S: EO based Essential Climate Variables

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- Need of in-situ observations also for:
  - Calibration
  - Validation
  - ECVs not measurable from space
  - ..

			C3S_312a				
				C3S_312b			
		GCOS	2017	2018	2019	2020	2021
Atmospheric physics							
	Precipitation	4.3.5		Lot 1			
	Surface Radiation Budget	4.3.6					
	Water Vapour	4.5.3					
	Cloud Properties	4.5.4					
	Earth Radiation Budget	4.5.5					
Atmospheric composition							
	Carbon Dioxide	4.7.1	Lot 6		Lot 2		
	Methane	4.7.2	Lot 6				
	Ozone	4.7.4	Lot 4				
	Aerosol	4.7.5	Lot 5				
Ocean							
	Sea Surface Temperature	5.3.1	Lot 3		Lot 3		
	Sea Level	5.3.3	Lot 2				
	Sea ice	5.3.5	Lot 1				
	Ocean Colour	5.3.7		Lot 4			
Land hydrology & cryosphere							
	Lakes	6.3.4					
	Glaciers	6.3.6	Lot 8				
	Ice sheets and ice shelves	6.3.7					
	Soil moisture	6.3.16	Lot 7				
Land biosphere							
	Albedo	6.3.9	Lot 9		Lot 5		
	Land Cover	6.3.10		Lot 5			
	Fraction of Absorbed Photosynthetic	6.3.11	Lot 9				
	Leaf Area Index	6.3.12	Lot 9				
	Fire	6.3.15					
			2017	2018	2019	2020	2021

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C3S In situ observations activities

Providing users with full access to the *in situ* instrumental data record, in usable form for climate (re-)analysis and assessment

- Support services for data rescue (C3S_311a Lot 1)
- Harmonised access to climate data archives (C3S_311a Lot 2)
- Harmonised access to data from reference networks (C3S_311a Lot 3)
- Gridded ECV products for the European domain (C3S_311a Lot 4)

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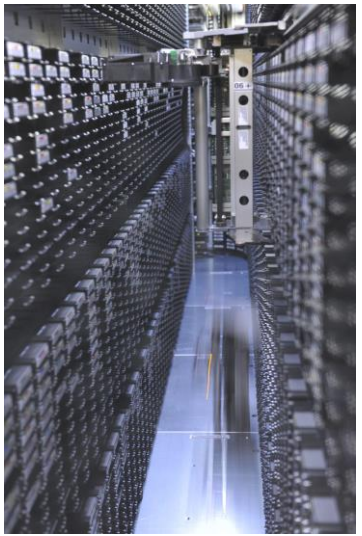
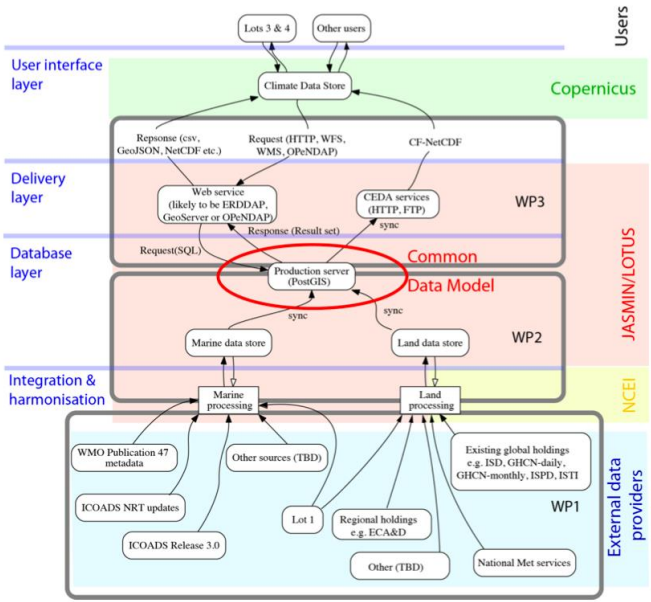
C3S_311a Lot 1: C3S data rescue

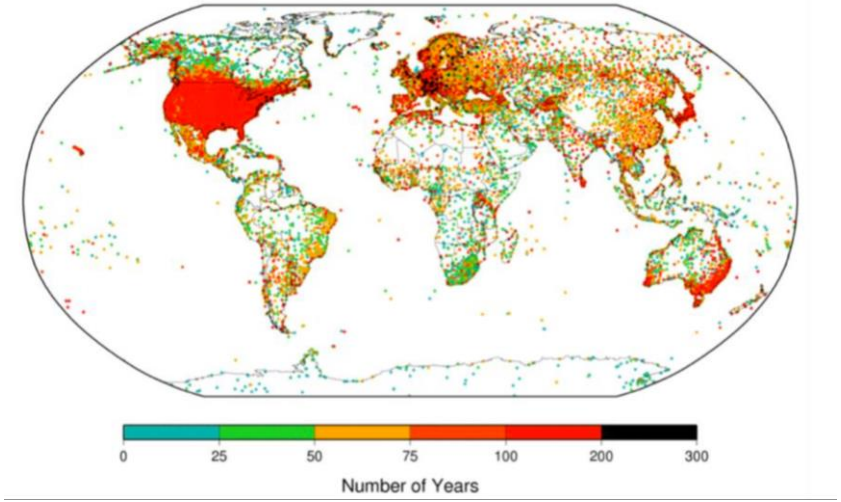
- Registry services for data rescue projects
- Improved access to detailed metadata for active projects
- Tools and best practices, capacity building
- Support for selected high-priority data rescue activities



C3S_311a Lot 2: Observations from global data archives

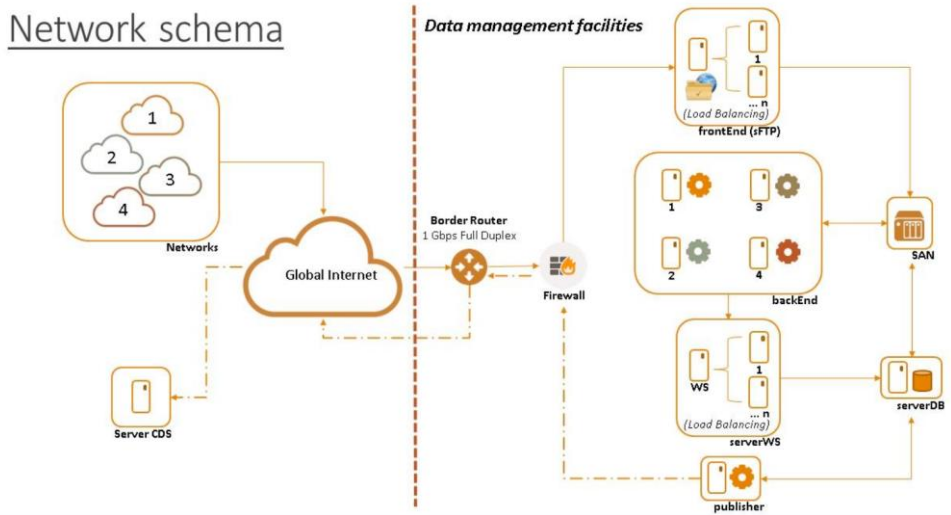
- Merge of major land and marine surface data collections
- Data quality control and homogenization
- Harmonization of data and metadata under a Common Data Model
- Unified data access via the Climate Data Store





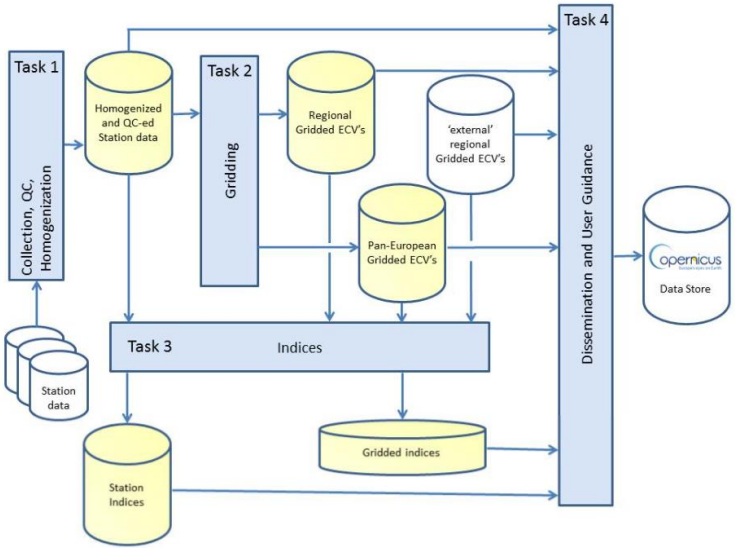
C3S_311a Lot 3: Data from baseline and reference networks

- Focus on atmospheric data: Temperature, humidity, ozone, wind, CO, CO2, C
- Data quality control and homogenization
- Harmonization of data and metadata under a Common Data Model
- Unified data access via the Climate Data Store



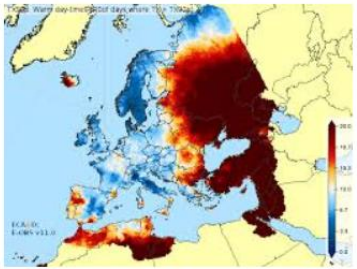
C3S_311a Lot 4: High-resolution ECV products for Europe

- Building on ECA&D and E-OBS: Temperature, precipitation, humidity, wind
- Data collection, quality control and homogenization
- Gridded ECV datasets and climate indices



Precipitation	0.1˚x0.1˚	daily	1951-now	ensemble
Mean/Max/Min T	0.1˚x0.1˚	daily	"	ensemble
Pressure	0.1˚x0.1˚	daily	"	ensemble
Radiation	0.1˚x0.1˚	daily	"	ensemble
Humidity	0.1˚x0.1˚	daily	"	ensemble
Wind speed (10m)	0.1˚x0.1˚	daily	"	ensemble
Wind direction	0.1˚x0.1˚	daily	"	ensemble

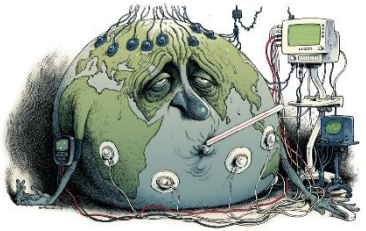
E-OBS



Update: 1- and 6-months

C3S: Operational production of climate indicators

Surface temperature	↑
Greenhouse gases	↑
Rain	–
Sea Ice	↓
Glaciers	↓
Sea Level	↑
Soil Moisture	↓



Credit: Victor & Kennel, Nature Climate Change, 2014.

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