



Climate Change

Copernicus Climate Change Service (C3S): Resources

Joaquín Muñoz-Sabater

ECMWF, C3S

Burjassot Climathón, 26-27 October 2018, Valencia





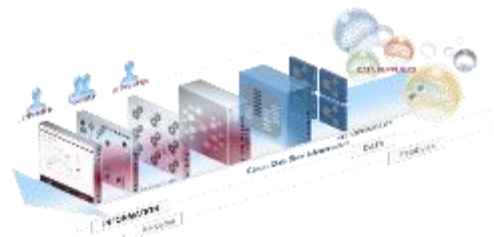
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Hoy ...

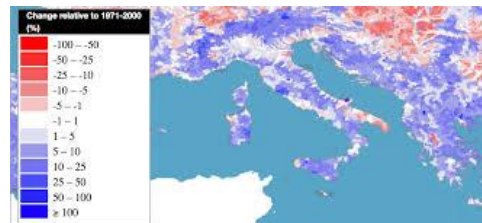
El programa Europeo Copernicus & El servicio de cambio climático (C3S)



El “Climate Data Store”



Ejemplos en el sector del agua





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Un poco de historia

1998: “Manifiesto Baveno” compromiso a largo plazo para el desarrollo de servicios espaciales de vigilancia medioambiental. (GMES)

2001: Cumbre de Gotemburgo. Establecer, para 2008, una capacidad europea de supervisión mundial del medio ambiente y la seguridad

2008-2010: Servicios pre-operacionales

2012: Cambio de nombre. Copernicus

2014: Empieza la fase operativa.
Marco financiero multianual 2014-2020. 4300 M€





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Copernicus: Observaciones de la Tierra y servicios de información



→ Programa de observación de la Tierra de la Unión Europea;

- Gestionado y coordinado por la Comisión Europea
- Implementado en colaboración con los Estados Miembro de la UE, la Agencia Espacial Europea (ESA), EUMETSAT, Mercator Océan, ECMWF y agencias de la UE como la EEA.
- ~4300 M€ en el actual marco multianual de financiación (2014-2020)

→ Sistema basado en datos de satélites de observación de la Tierra y observaciones “in-situ” (no espaciales)

→ **Acceso completo, abierto y gratuito** a los datos y servicios para cualquier ciudadano u organización:

- Mejorar la vida de los ciudadanos
- Ofrecer (administraciones e industria) herramientas para la toma de decisiones



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Componentes de Copernicus

Sentinels



Sentinel-1 (A 2014 / B 2016) – Imágenes SAR
Día y noche, radar, interferómetro



Sentinel-2 (A 2015 / B 2017) – Imágenes Multi-espectrales
Aplicaciones terrestres: agricultura, bosques, ciudades...



Sentinel-3 (A 2016/B 2018) – SAR, radiómetro, espectrómetro
Vegetación, temperaturas superficie tierra y océano, color de océanos, altimetría



Sentinel-4 (A/B) 2023 – MTG. Atmósfera, geoestacionario
Composición de la atmósfera, polución



Sentinel-5P 2017 / Sentinel-5 2021(A/B) – Atmósfera, órbita baja
Composición de la atmósfera, aerosoles, especies



Sentinel 6 (A Jason-CS 2020/B) – Altimetría, órbita baja inclinada
Nivel del mar, altura olas, velocidad viento marino



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Componentes de Copernicus

Sentinels



In Situ

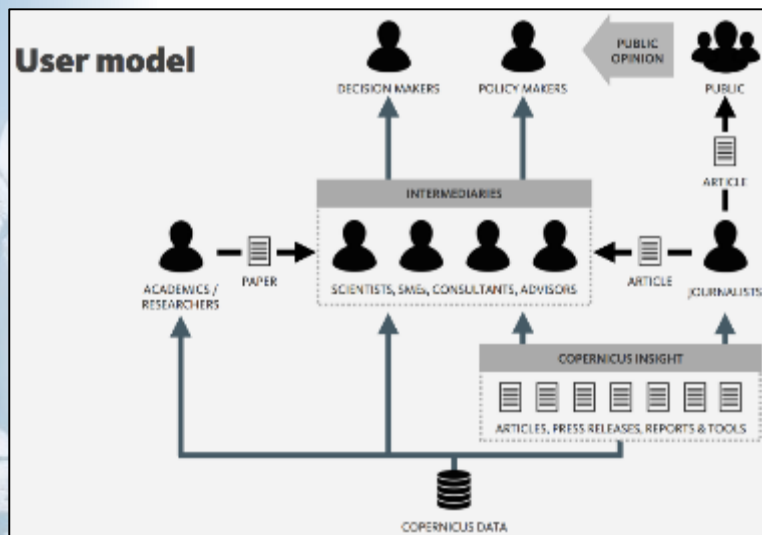
Servicios





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Usuarios: quienes son y qué quieren?



User needs

- Find relevant data
- Content is reliable and trustworthy
- Download data in appropriate form
- Download data they can use/need
- Know they can use data legally
- Keep up to date about tenders
- Get help with data
- Know about the programme (Inc. longevity)
- See Case studies of previous uses
- See high level overviews of information
- Keep up to date with relevant content
- Find content appropriate to area of work
- Have a well structured explicit press area
- Easy to access contact details
- High quality assets

	Scientists, academics, and researchers	SMEs and consultants	Policy advisors and influencers	Journalists
Find relevant data	X	X	X	
Content is reliable and trustworthy	X	X	X	X
Download data in appropriate form	X			
Download data they can use/need	X	X		
Know they can use data legally	X	X		
Keep up to date about tenders	X	X		
Get help with data	X	X		
Know about the programme (Inc. longevity)		X		X
See Case studies of previous uses		X	X	
See high level overviews of information			X	
Keep up to date with relevant content			X	X
Find content appropriate to area of work			X	
Have a well structured explicit press area				X
Easy to access contact details				X
High quality assets				X



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Usuarios: quienes son y qué quieren?

C2	C3	C4	C5	CP1
User Requirement (UR) description	UR class	Raw requirement	User sector	ECV
Free text. Be specific and quantify statements where possible.	Choose from: - Product (complete CP) - Variable (complete CP) - General (complete CG)	Original text. Extract from project source material.	Choose one or more sector from C3S Sectors: - Agriculture and forestry - Coastal - Disaster risk reduction - Energy - Health - Infrastructure - Insurance - Tourism - Transport - Water management	Use terms fi
Seasonal forecasts of precipitation for the insurance sector should be available before the underwriting/renewal season	Variable	seasonal rainfall forecast: Seasonal forecast be made available prior to renewal timeline (Jan 1st - April 1st): Seasonal forecasts do not align with insurance timeline. To be truly useful, a seasonal forecast would need to be made prior to the underwriting/renewal season.	Insurance	Precipitator
Seasonal forecasts of sea surface temperature for the insurance sector should be available before the underwriting/renewal season	Variable	seasonal forecast of ocean surface temperature: Seasonal forecast be made available prior to renewal timeline (Jan 1st - April 1st): Seasonal forecasts do not align with insurance timeline. To be truly useful, a seasonal forecast would need to be made prior to the underwriting/renewal season.	Insurance	Sea surface
Seasonal forecasts of surface temperature for the insurance sector should be available before the underwriting/renewal season	Variable	seasonal forecast of surface temperature: Seasonal forecast be made available prior to renewal timeline (Jan 1st - April 1st): Seasonal forecasts do not align with insurance timeline. To be truly useful, a seasonal forecast would need to be made prior to the underwriting/renewal season.	Insurance	Surface air t
Seasonal forecasts of tropical cyclone activity, specifically the number of storms, for the insurance sector should be available before the underwriting/renewal season	Variable	seasonal forecast of tropical cyclone activity: Seasonal forecast be made available prior to renewal timeline (Jan 1st - April 1st): Seasonal forecasts do not align with insurance timeline. To be truly useful, a seasonal forecast would need to be made prior to the underwriting/renewal season.	Insurance	
Seasonal forecasts of tropical cyclone activity, specifically the Accumulated Cyclone Energy, for the insurance sector should be available before the underwriting/renewal season	Variable	seasonal forecast of tropical cyclone activity: Seasonal forecast be made available prior to renewal timeline (Jan 1st - April 1st): Seasonal forecasts do not align with insurance timeline. To be truly useful, a seasonal forecast would need to be made prior to the underwriting/renewal season.	Insurance	
Seasonal forecasts of precipitation for the insurance sector should cover the full upcoming year	Variable	seasonal rainfall forecast: Seasonal forecast be made available prior to renewal timeline (Jan 1st - April 1st): Seasonal forecasts do not align with insurance timeline. To be truly useful, a seasonal forecast would need to cover the full upcoming year.	Insurance	Precipitator
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Seasonal forecasts of precipitation should have more ensemble members to capture full level of uncertainty	Variable	seasonal rainfall forecast: More ensemble to represent uncertainty: There is an insufficient number of ensemble members in seasonal forecasts. Current ensembles do not capture the full level of uncertainty.	Insurance	Precipitator
Seasonal forecasts of sea surface temperature should have more ensemble members to capture full level of uncertainty	Variable	seasonal forecast of ocean surface temperature: More ensemble to represent uncertainty: There is an insufficient number of ensemble members in seasonal forecasts. Current ensembles do not capture the full level of uncertainty.	Insurance	Sea surface
Seasonal forecasts of surface temperature should have more ensemble members to capture full level of uncertainty	Variable	seasonal forecast of surface temperature: More ensemble to represent uncertainty: There is an insufficient number of ensemble members in seasonal forecasts. Current ensembles do not capture the full level of uncertainty.	Insurance	Surface air t
Seasonal forecasts of precipitation should be available at a higher spatial resolution	Variable	seasonal rainfall forecast: Increasing spatial resolution	Insurance	Precipitator
Seasonal forecasts of surface temperature should be available at a higher spatial resolution	Variable	seasonal forecast of surface temperature: Increasing spatial resolution	Insurance	Surface air t
Seasonal forecasts of precipitation should include forecasts of extremes	Variable	seasonal rainfall forecast: make forecast of extremes	Insurance	Precipitator

Ya, más de 2000 registros!



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C3S

Copernicus Climate Change Service



European
Commission





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Misión del C3S

“The service will help to meet the needs and requirements for a wide variety of C3S services, ranging from the monitoring of climate change impact on different sectors of society to long-term planning and policy development.”

Apoyar las políticas Europeas de adaptación y mitigación:

- Siendo una fuente de información climática consistente y fidedigna
- Construyendo el servicio en torno a capacidades e infraestructuras existentes
- Estimulando el mercado de los servicios climáticos en Europa



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 ECMWF

 Copernicus



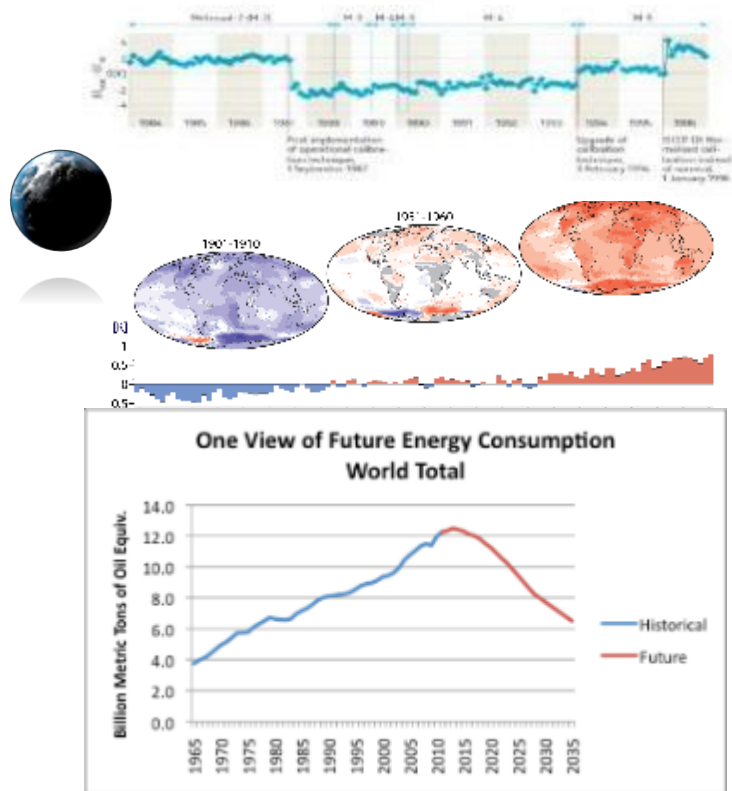


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El Servicio de Cambio Climático (C3S)

Temas tratados en el servicio:

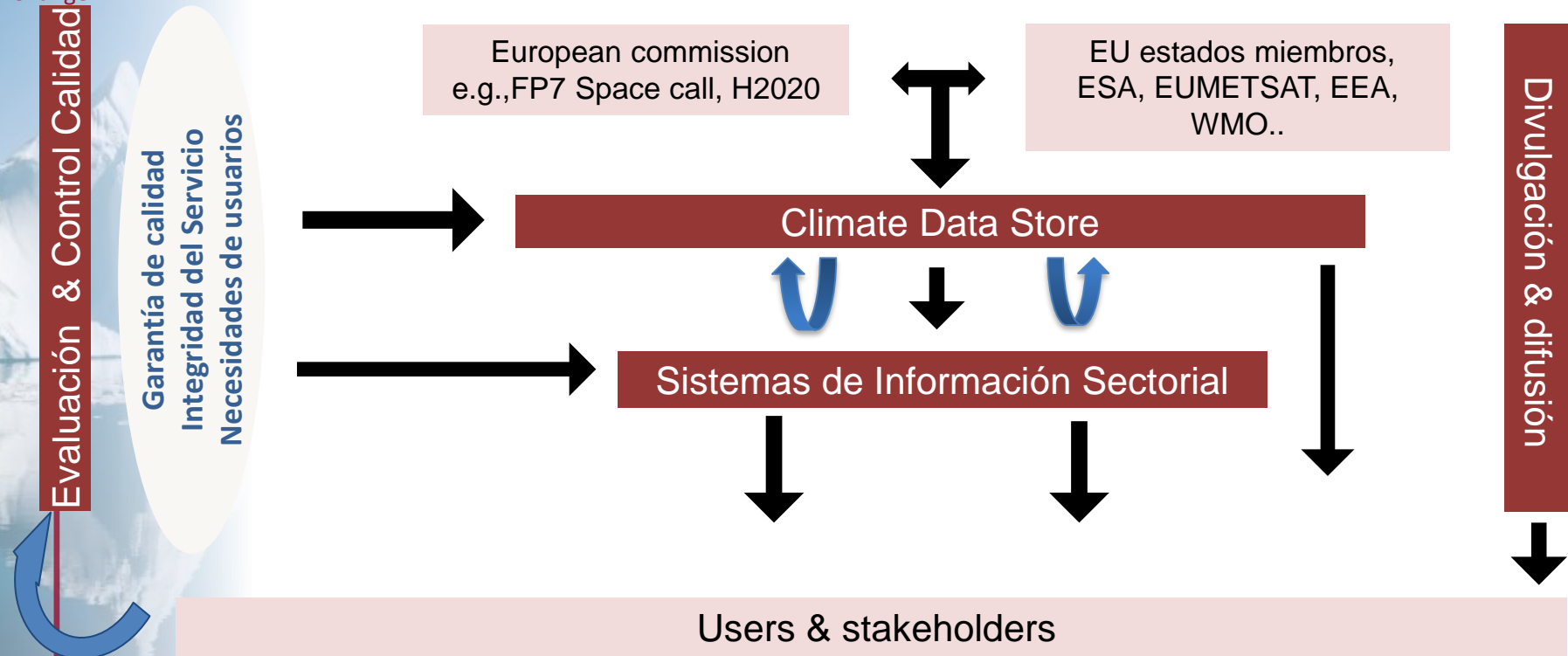
- **Cómo está cambiando el clima?**
 - Observaciones de la Tierra
 - Reanálisis
- **Continuará/se acelerará el cambio climático?**
 - Predicciones
 - Proyecciones
- **Cuáles son los impactos en la sociedad?**
 - Indicadores del clima
 - Información sectorial





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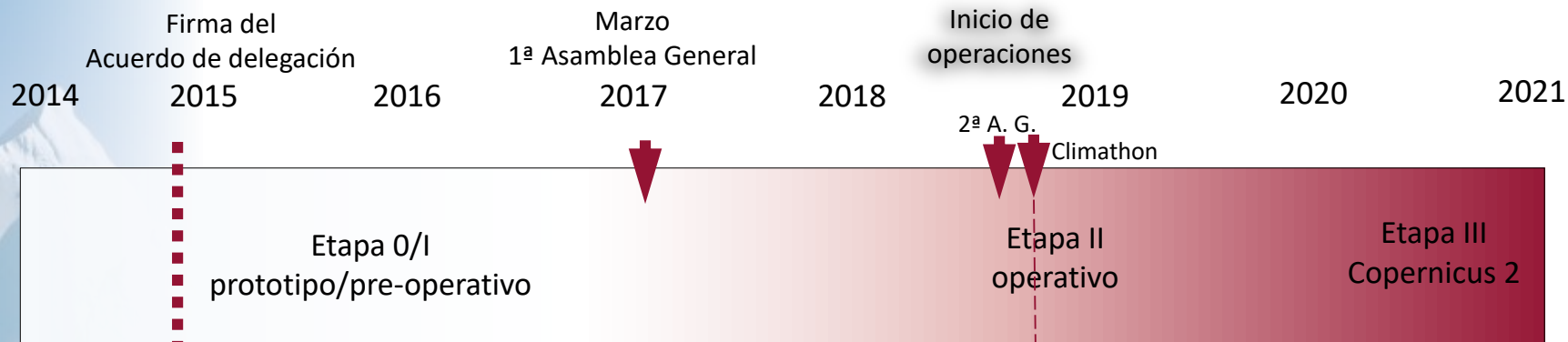
Estructura de C3S





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C3S – ¿Dónde estamos?



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C3S resources

Climate Data Store





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Climate Data Store: ventanilla única climática

“Store” ... grandes almacenes

Estamos rellenoando las estanterías

Ya disponible para los clientes



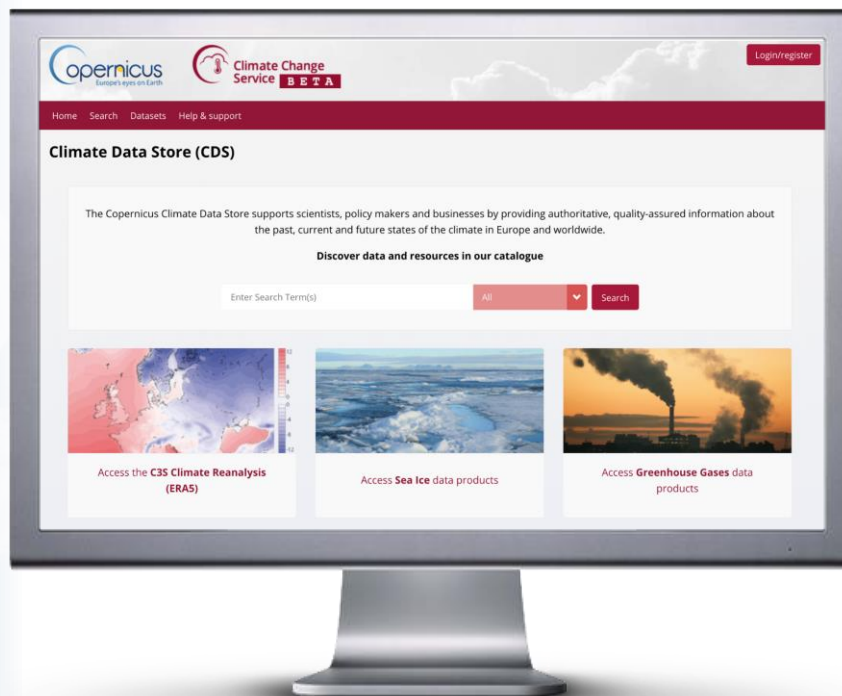
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Climate Data Store: ventanilla única climática



El CDS contiene **observaciones**, global and regional **reanálisis climáticos** globales y regionales, **proyecciones climáticas** y **predicciones estacionales**. También contiene **indicadores climáticos genéricos y sectoriales**.

El CDS está diseñado como un **sistema distribuido**, proporcionando el acceso a **datasets existentes** a través de un **interfaz web unificado**.

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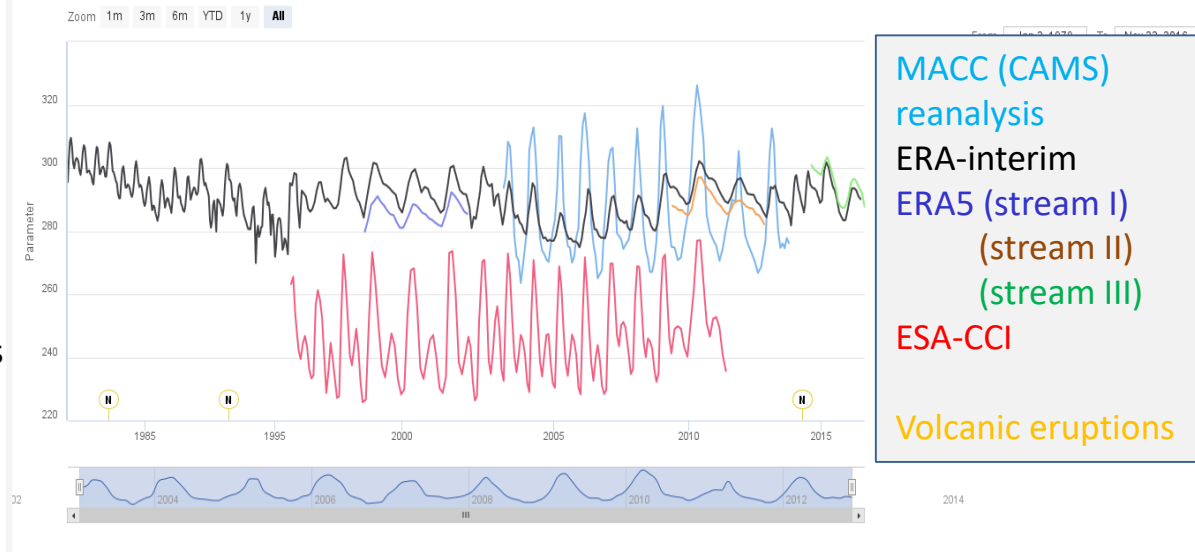
Climate Data Store: "Toolbox"

Desafíos técnicos:

- Diversidad de usuarios
- Diversidad de conjunto de datos
- Gran volumen de datos
- Datos que residen en diferentes lugares
- Interoperabilidad, eficiencia
- Flujos de trabajo definidos por los usuarios
- Variedad de métodos de presentación
- Necesidad de experiencia interactiva
- Acceso via API
- Monitoreo del rendimiento

Global Total Column Ozone

Climate time series chart

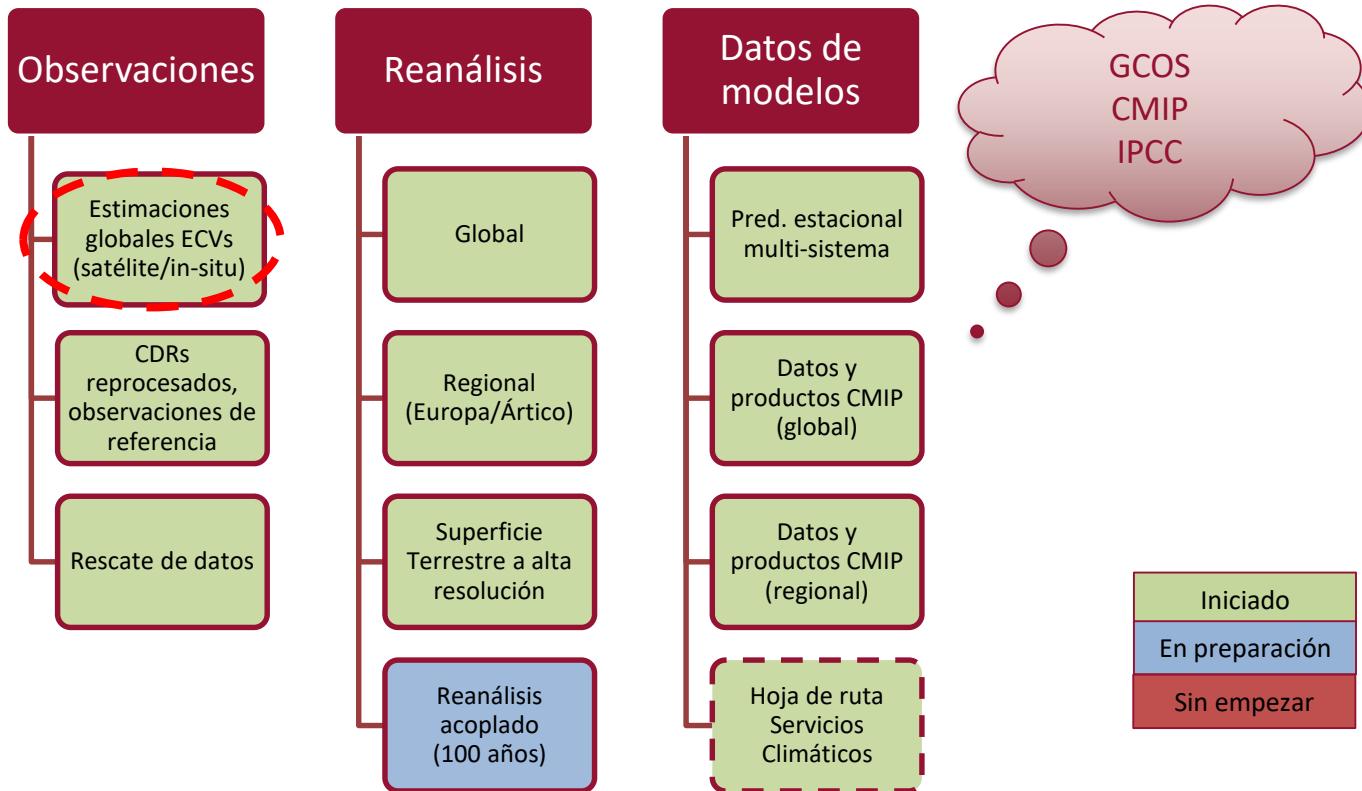


CDS toolbox (abrió en Junio); incremental hasta el 2019



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¿Qué datos ofrece C3S?



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Variables Esenciales del Clima

		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					
Land hydrology & cryosphere							
	Lakes	6.3.4		Lot 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					
	Fraction of Absorbed Photosyntheti	6.3.11	Lot 9				
	Leaf Area Index	6.3.12	Lot 9				
	Fire	6.3.15					
			2017	2018	2019	2020	2021

Generación de registros de datos climáticos de variables esenciales del clima

Fase I: C3S_312a:

- 12 ECVs en 9 Lots

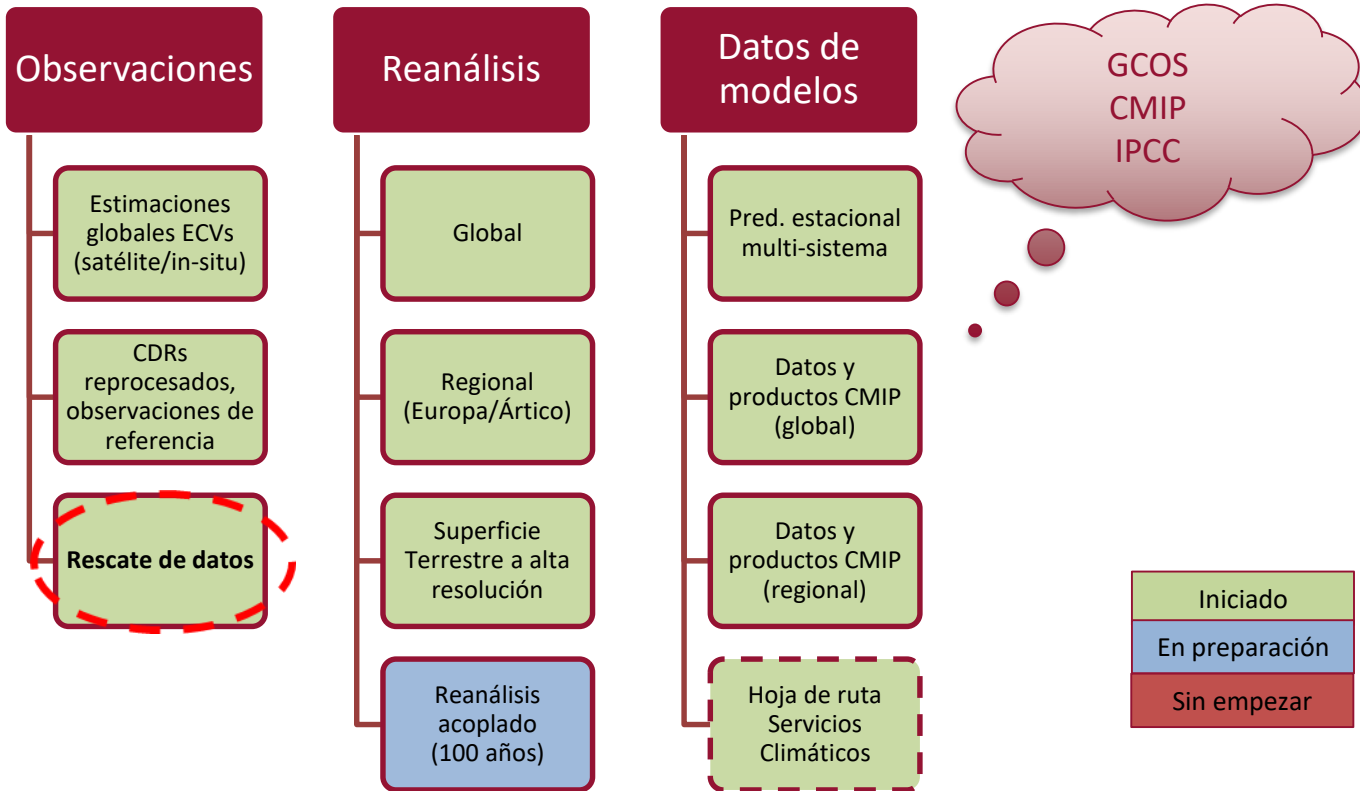
Fase II: C3S_312b:

- 22 ECVs en 5 Lots
- Continuidad del servicio



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¿Qué datos ofrece C3S?



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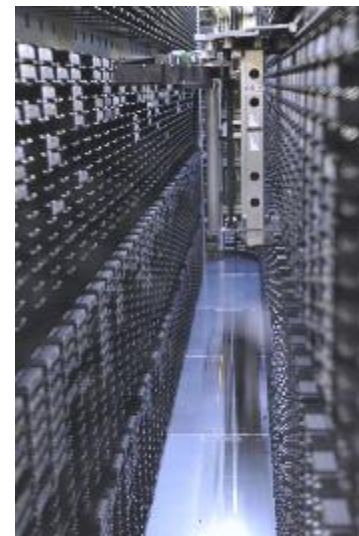
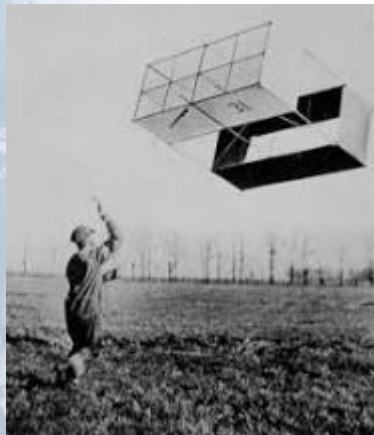




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C3S_311a Lot 1: C3S Recuperación de datos

- Registro de servicios y proyectos de recuperación de datos
- Mejora acceso metadatos en proyectos activos
- Herramientas y buenas prácticas, creación de capacidad
- Apoyo para actividades seleccionadas como alta prioridad





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¿Qué datos ofrece C3S?

Observaciones

Estimaciones globales ECVs (satélite/in-situ)

CDRs reprocesados, observaciones de referencia

Rescate de datos

Reanálisis

Global

Regional (Europa/Ártico)

Superficie Terrestre a alta resolución

Reanálisis acoplado (100 años)

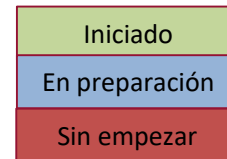
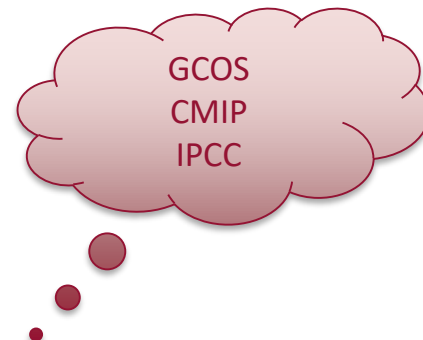
Datos de modelos

Pred. estacional multi-sistema

Datos y productos CMIP (global)

Datos y productos CMIP (regional)

Hoja de ruta Servicios Climáticos



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Climate Data Store: Reanalyses

ERA5 reanálisis a escala global:

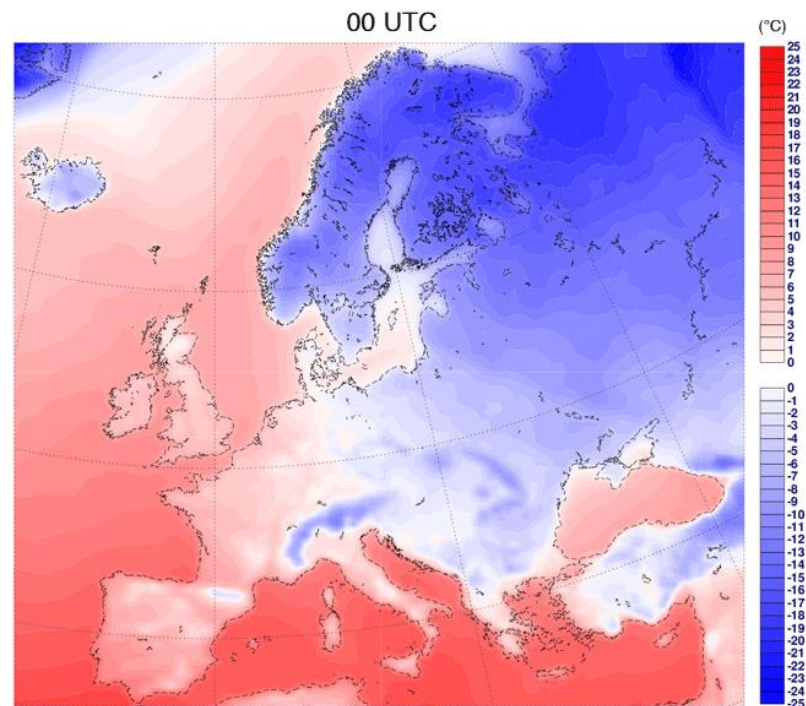
- Variables Atmósfera/Tierra/Olas
- Resolución global 31 km, 137 niveles
- Salida horaria desde 1979 en adelante

- Uso mejorado de las observaciones de entrada
- Estimaciones de incertidumbre
- 2000-NRT disponible

Los reanálisis son ahora un servicio operacional proporcionado por ECMWF

Y... reanálisis de:

- Zonas de Europa + Ártico
- ERA5-Land



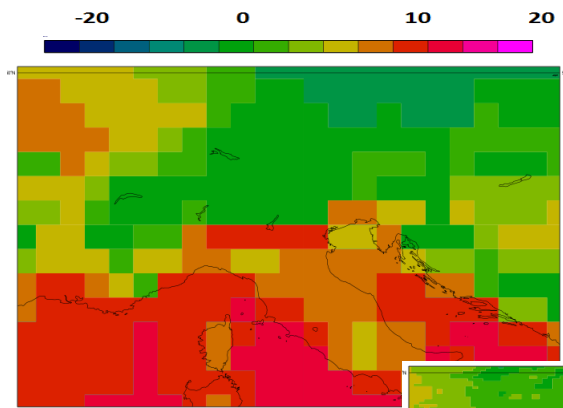
Temperaturas horarias de ERA5 para Enero 2018



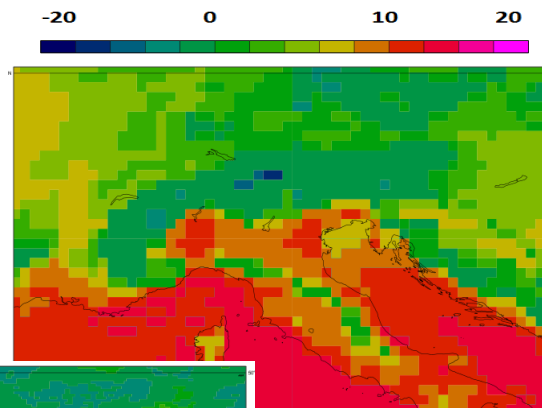
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ERA5-Land ; Mejora de land a alta resolución

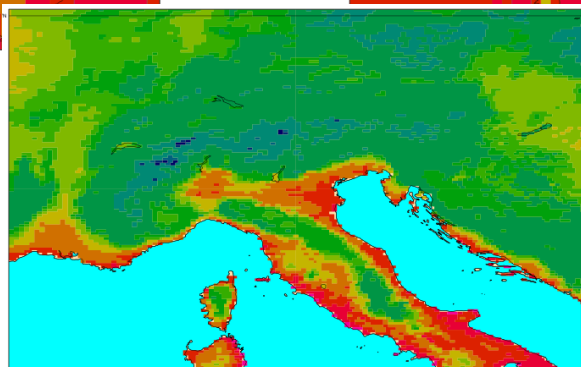
Soil Temperature – 15 March 2010



ERA-Interim (79 km)



ERA5 (31 km)



ERA5-Land (9 km)



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¿Qué datos ofrece C3S?

Observaciones

Estimaciones globales ECVs (satélite/in-situ)

CDRs reprocesados, observaciones de referencia

Rescate de datos

Reanálisis

Global

Regional (Europa/Ártico)

Superficie Terrestre a alta resolución

Reanálisis acoplado (100 años)

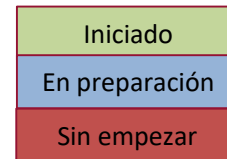
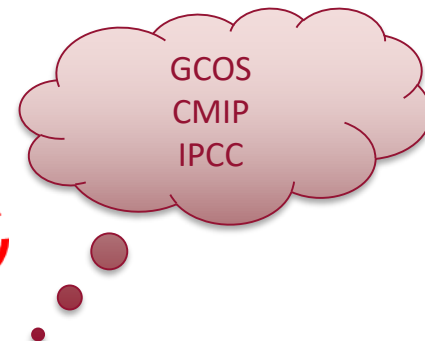
Datos de modelos

Pred. estacional multi-sistema

Datos y productos CMIP (global)

Datos y productos CMIP (regional)

Hoja de ruta Servicios Climáticos



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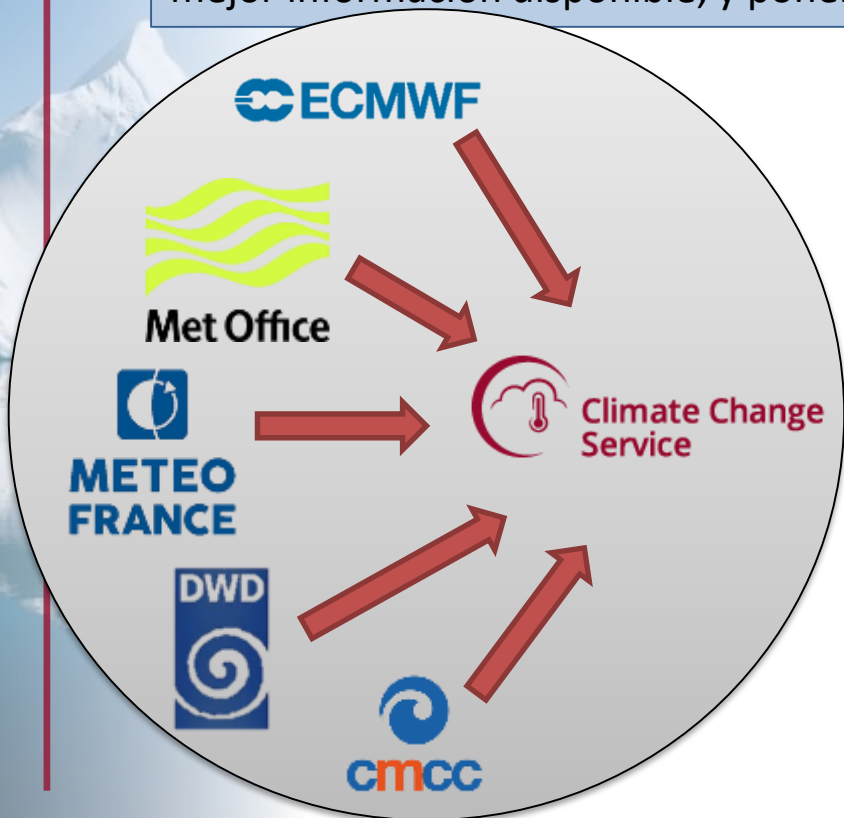




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Predicción estacional en C3S

Objetivo: generar operativamente productos de predicción estacional basados en la mejor información disponible, y ponerlos a disposición del público



Resolución horizontal: global $1^\circ \times 1^\circ$

Tamaño de los conjuntos:

- Predicciones: ~50 miembros
- “Hindcasts”: ~25 miembros x 24 años (1993-2016)

Variables

- Superficie
 - 7 vars cada 6h
 - +30 vars cada 24h
- Vertical (11 niveles, de 925 hPa a 10 hPa)
 - 8 vars cada 12 h

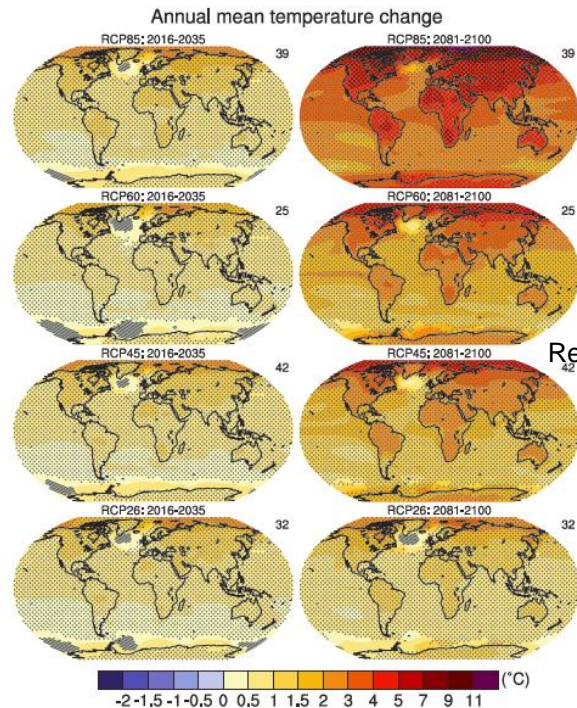
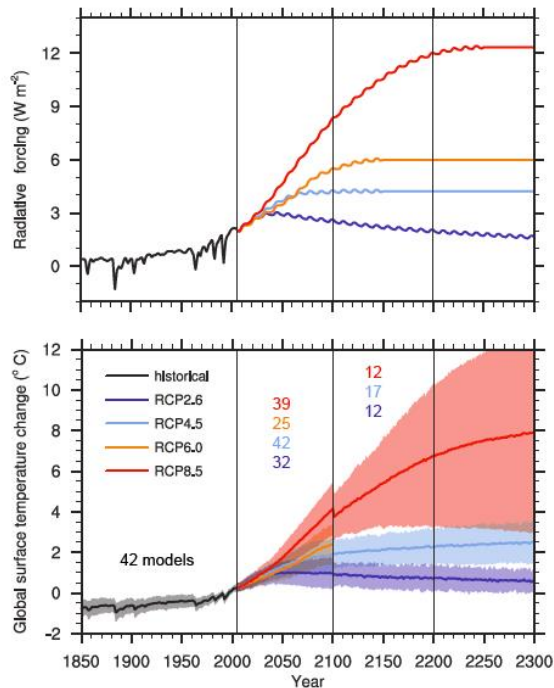
Especificación NetCDF acordada C3S-0.1 (basada en CF)



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Climate projections: concentration scenarios

Projected surface temperature change (from IPCC AR5)

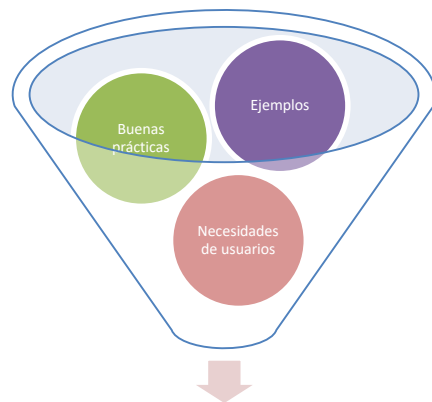


Ref: 1986-2005



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Sistema de información sectorial (SIS)



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Ejemplo SIS: predicción estacional de caudales

PROOF OF CONCEPT

opernicus Europe's eyes on Earth

Climate Change Service

C3S SWICCA CLIMATE IMPACTS SEASONAL FORECASTS SHOWCASES USER GUIDANCE ABOUT

SEASONAL FORECASTS

MAPS GRAPHS AND DOWNLOAD

Select coordinate

Click in map to select coordinate or fill in coordinate below

Selected coordinate: 45.04, 11.38
Catchment subid: 9780069

Lat: Lon:

Subid:

River flow (monthly mean)

— Current monthly mean
 - - - Forecast mean
 - - - Climatological high (66th) percentile
 - - - Climatological median
 - - - Climatological low (33rd) percentile
 ■ Extreme high (90th percentile)
 ■ Extreme low (10th percentile)
 ■ Ensemble range (min—max)
 ■ Ensemble range (5—95 percentiles)
 ■ Ensemble range (25—75 percentiles)

Variable: River flow (monthly mean)

Model: HYPE

<http://swicca.climate.copernicus.eu/>

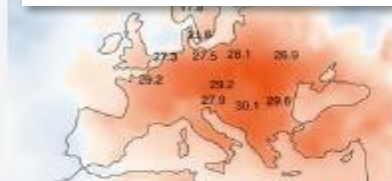
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climate.copernicus.eu

joaquin.munoz@ecmwf.int



Europe's warmest April since 1979

21 May 2018

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Monthly maps and charts of essential climate variables

ARCHIVE



21 May 2018
Copernicus contributes to healthier city living through VITO mapping project



15 May 2018
Copernicus to launch operational service for energy sector

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