ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

Sistema Nazionale per la Protezione dell'Ambiente

SUMMER SCHOOL WORKSHOP

ACTION 2020-2-21:
COPERNICUS
FOR CULTURAL HERITAGE

Cyprus University of Technology

DLR

C3S in support of national hydro-meteorological and climate services and products

Dr. Stefano Mariani

ISPRA – Italian Institute for Environmental Protection and Research

13-16.06.2023

PARCO REGIONALE DELL'APPIA ANTICA
Ex Cartiera Latina - Via Appia Antica, 42

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Copernicus
Europe's eyes on Earth

C3S: Copernicus Climate Change Service

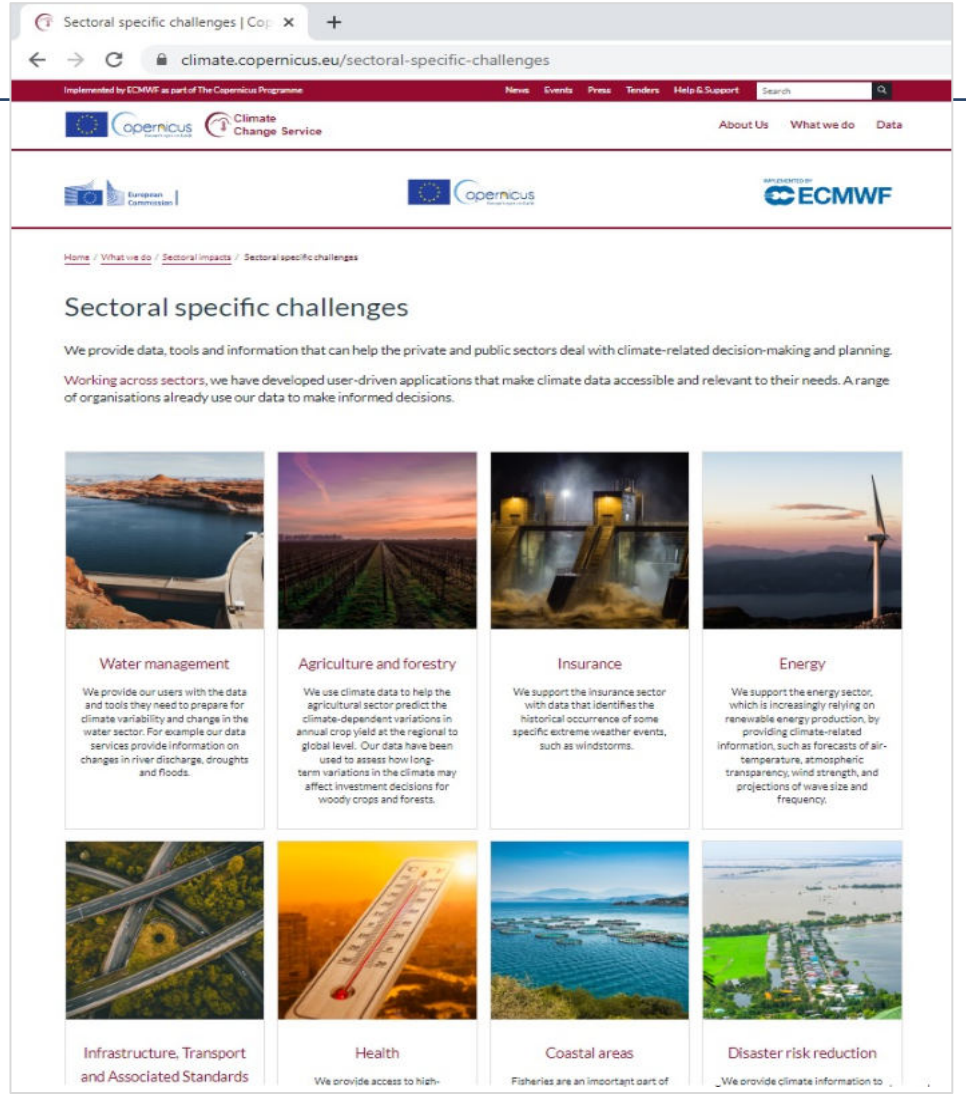
C3S

C3S is managed by the [European Centre for Medium-Range Weather Forecasts (ECMWF)] on behalf of the EC. ECMWF is an independent intergovernmental organization serving its 23 MS and 12 Co-operating States and the broader community.

- C3S is one of six thematic information services provided by the EU Copernicus EO Programme.
- It provides information on past, present and future climate in Europe and beyond.
- The mission is to **support EU climate change adaptation and mitigation policies**, through the supply, in open access mode, of data, information and **user-oriented** products useful to support MS in the process of adapting to current and future effects of climate change and in policies to reduce greenhouse gas emissions.
- C3S work **complements** the range of meteorological and environmental services that each European country already has in place.
- National climate service providers and relevant academic communities are also involved in the implementation of C3S products.
- C3S service elements are implemented by about 260 companies and organizations.

What can C3S provide to users?

- C3S provides climate data and information on impacts on a range of topics and sectoral areas through our Climate Data Store (CDS). The CDS is designed to enable users to tailor services to more specific public or commercial needs.
- Its aim is to provide products – developed in collaboration with national climate service providers and academic communities – that can complement what is already present at national level in terms of meteorological, climate and environmental services.
- C3S shares updates on developments to our service at many meetings and workshops, including our annual General Assemblies. These meetings also allow members of the climate change community to join networking and brainstorming sessions to contribute to future developments of C3S.
- C3S also offers technical support as well as training to users of the CDS, combining online learning with face-to-face events in most countries across Europe.



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C3S portfolio

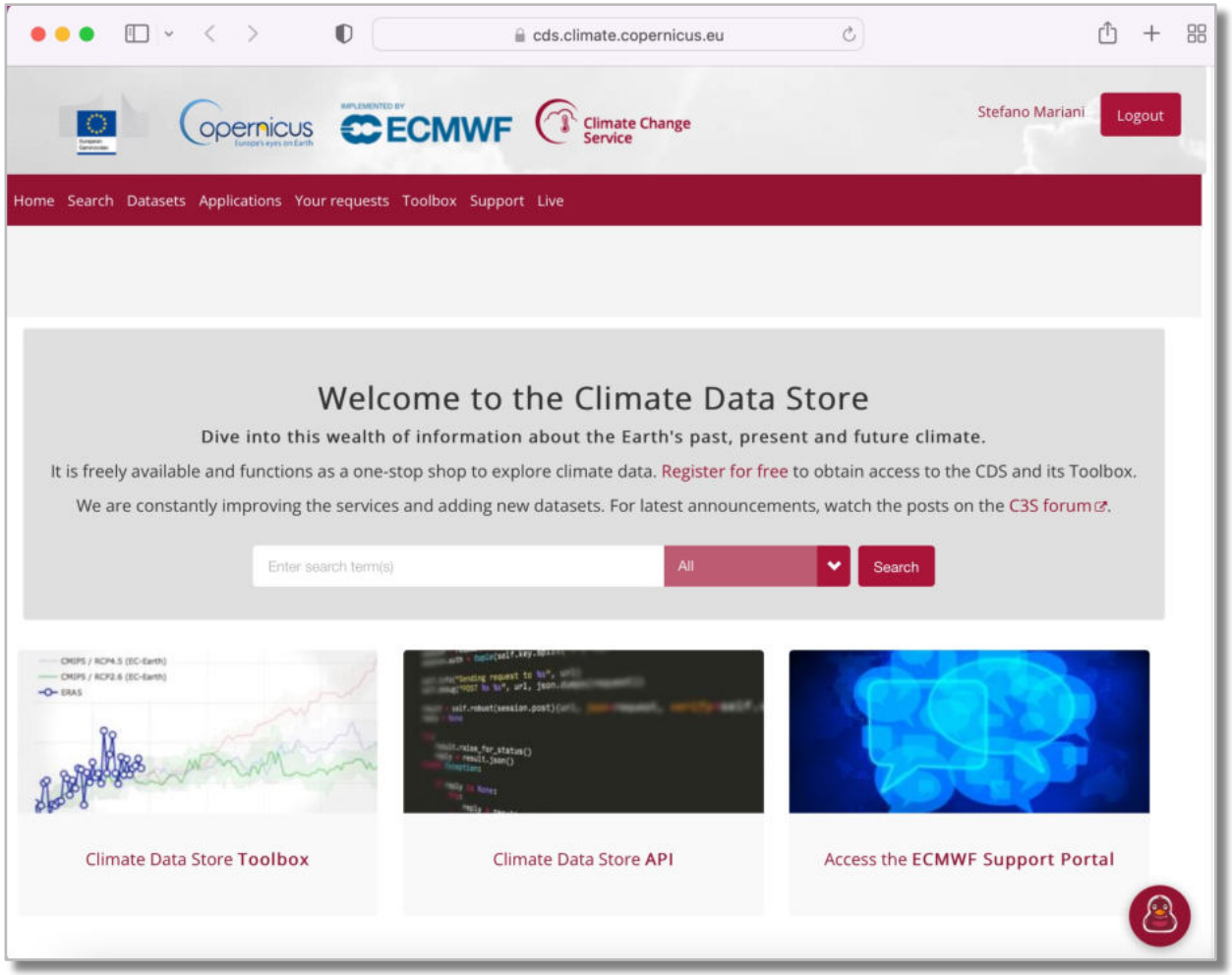
CDS – Climate Data Store

Modalità di accesso al CDS

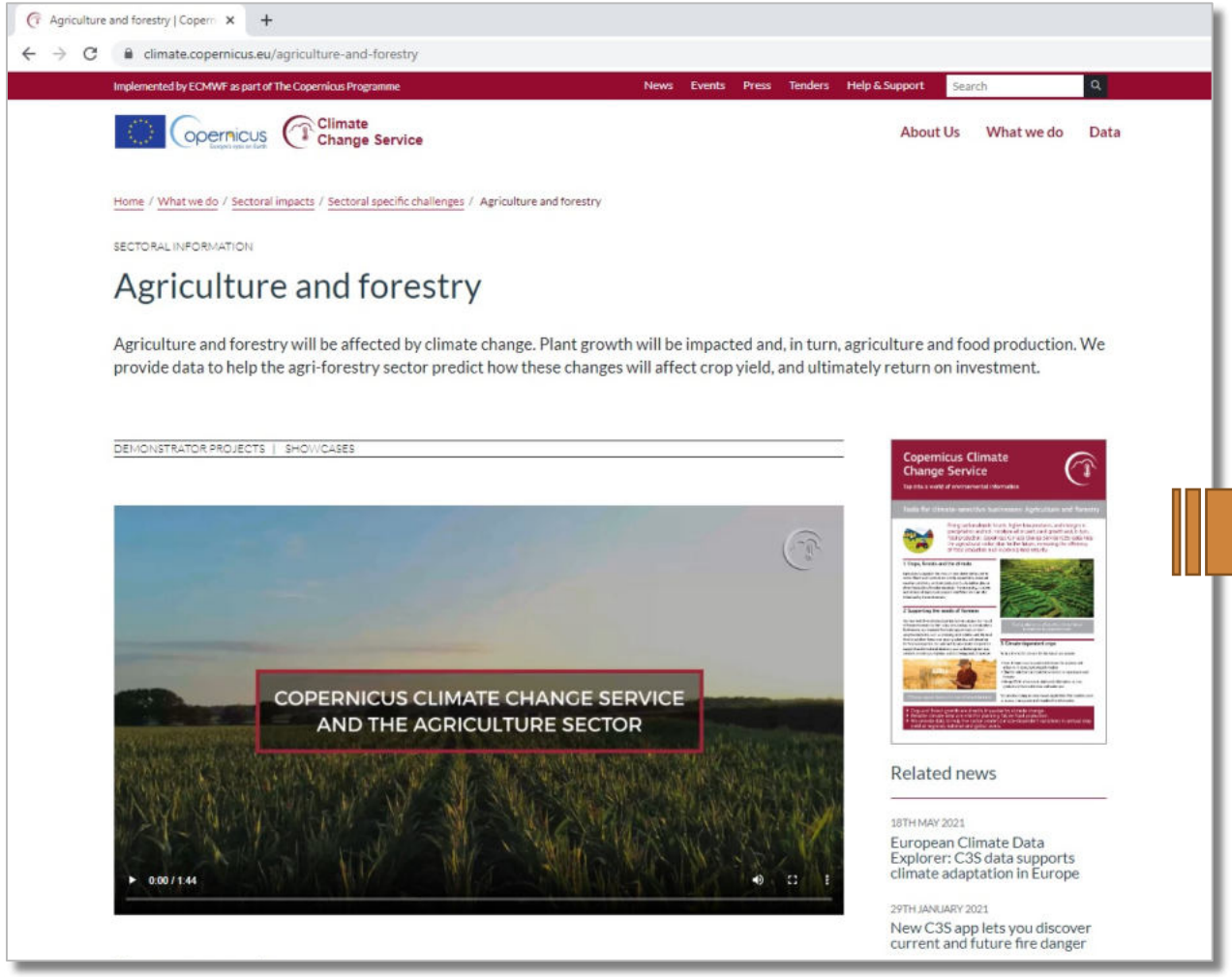
1. Ricerca per parola chiave nelle categorie:
   - Dataset
   - Application
   - Provider
   - ALL
2. CDS Toolbox
3. CDS API (servizio ad hoc di interfaccia di programmazione)

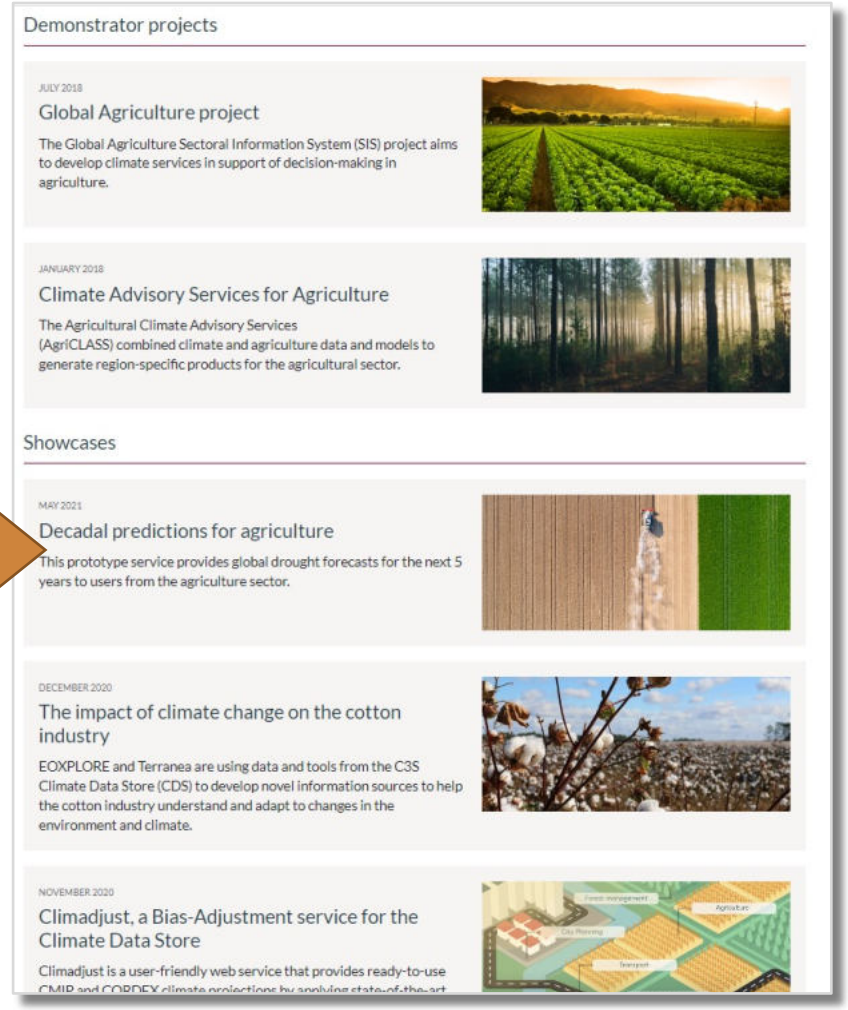
Accesso al portale di supporto gestito dall'ECMWF

Virtual Assistant: Knowledge Duck

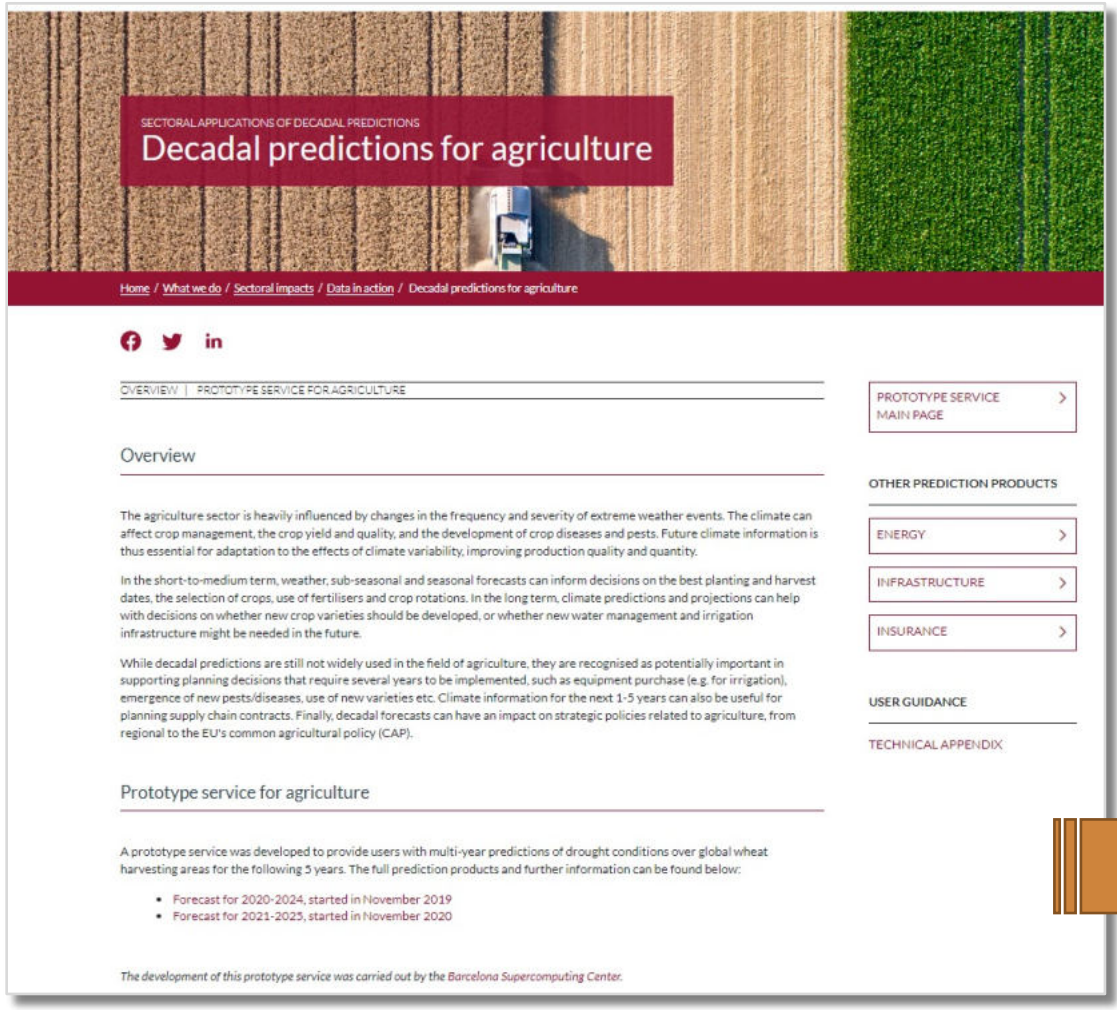


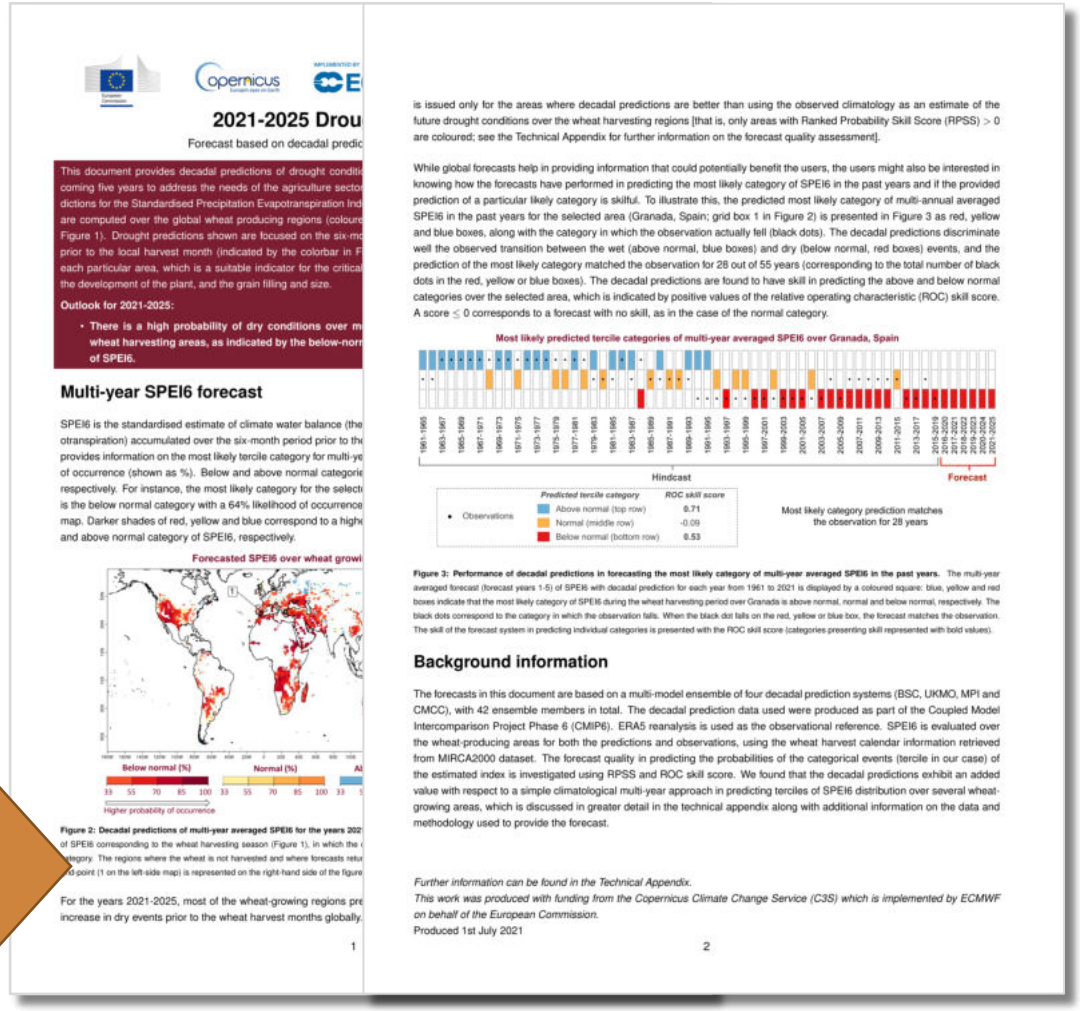
Sectoral Information



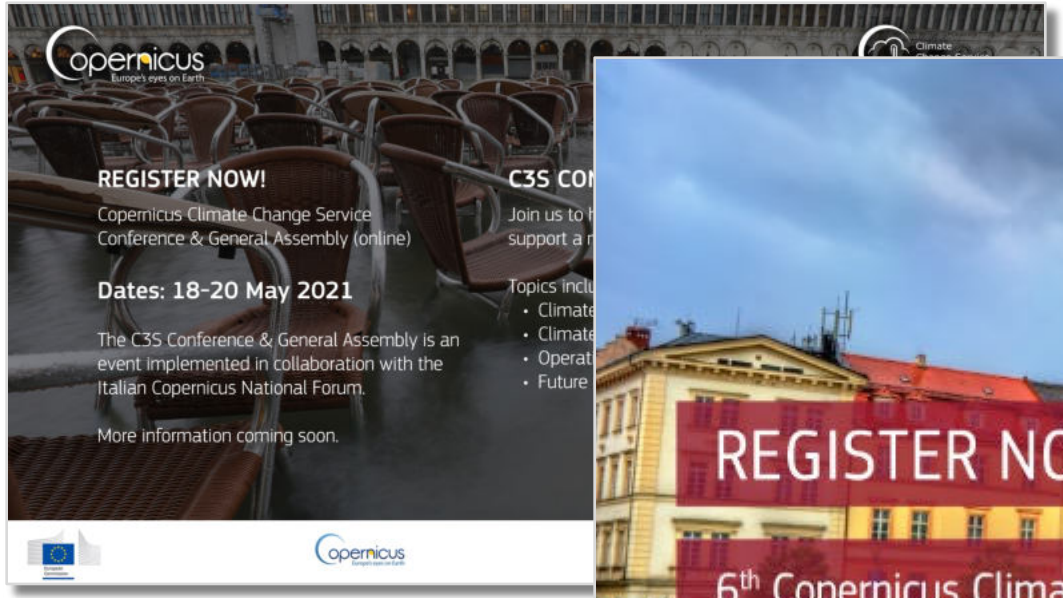


Sectoral Information





General Assemblies



https://climate.copernicus.eu/c3s-conferen
(Presentations, video-posters & registration

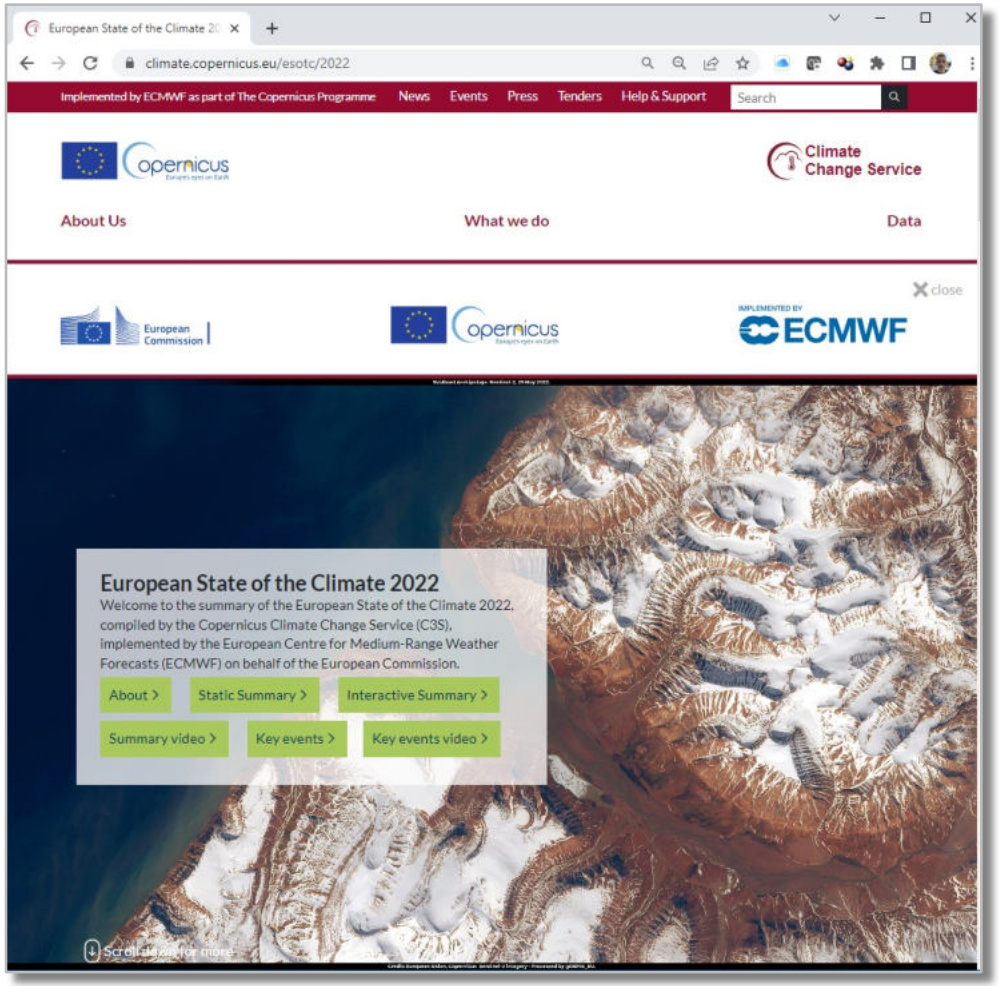
https://climate.copernicus.eu/6th-c3s-general-assembly

Thematic meetings and workshops

- https://climate.copernicus.eu/events
- https://climate.copernicus.eu/past-events

European State of the Climate

- The **ESOTC-European State of the Climate** is the CS3 annual report that provides an **analysis of climate trends** during the last year, with descriptions of climatic conditions and events occurred, and explores the **variations found** for those that are considered the key climatic variables.
- The ESOTC presents an overview of the global context and the European context (the latter, with greater details) and a focus on the Arctic (similar to what is reported in the monthly Climate Bulletins and in the C3S Climate Indicators).
- **The report is essentially based on C3S products**. Data and reports from other monitoring activities are also included when considered informative and complementary.
- Data used to produce the ESOTC statistics as well as the statistics themselves are freely available to users through the C3S website and then **they can be downloaded and deployed to derive the same analysis at the local level and/or to compare them against the information available at the local level**.



ESOTC 2022 is the 6th in a series of annual reports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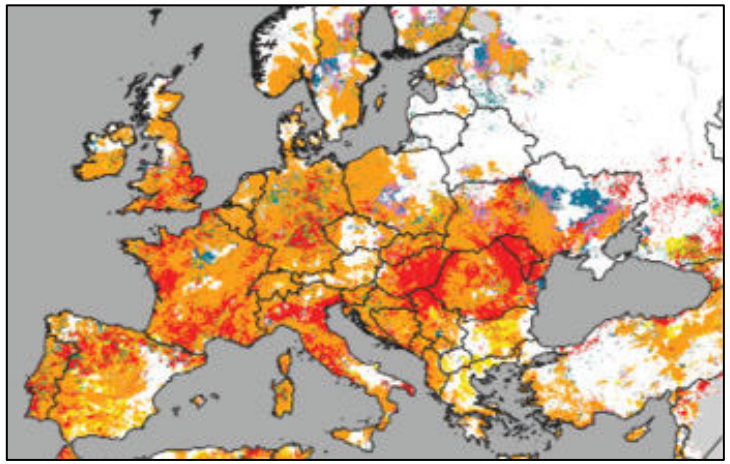
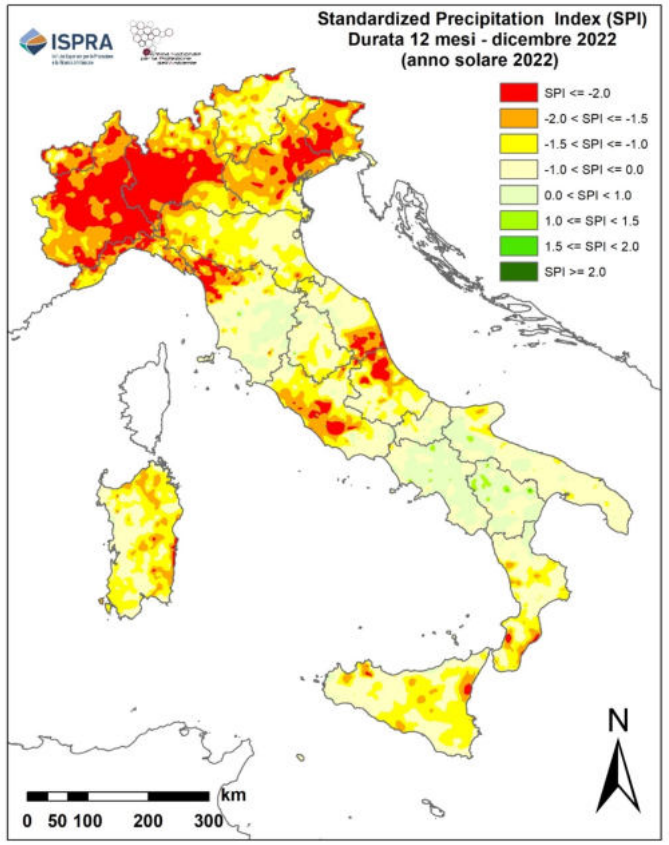
Europe's eyes on Earth
C3S-based applications: present & future

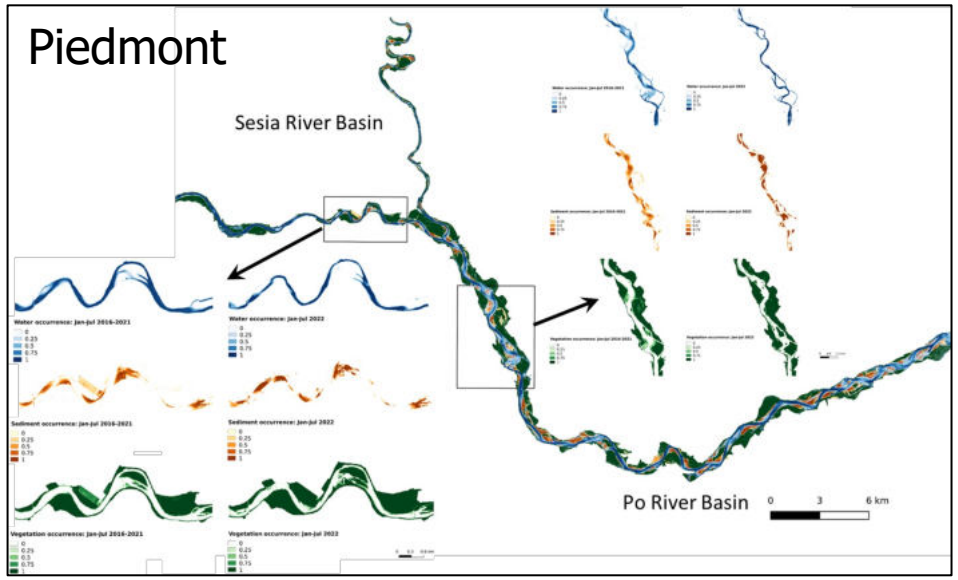
Integrating ESOTC info with local detailed analyses



Drought analysis over EU, based on data & model at the EU-spatial scale



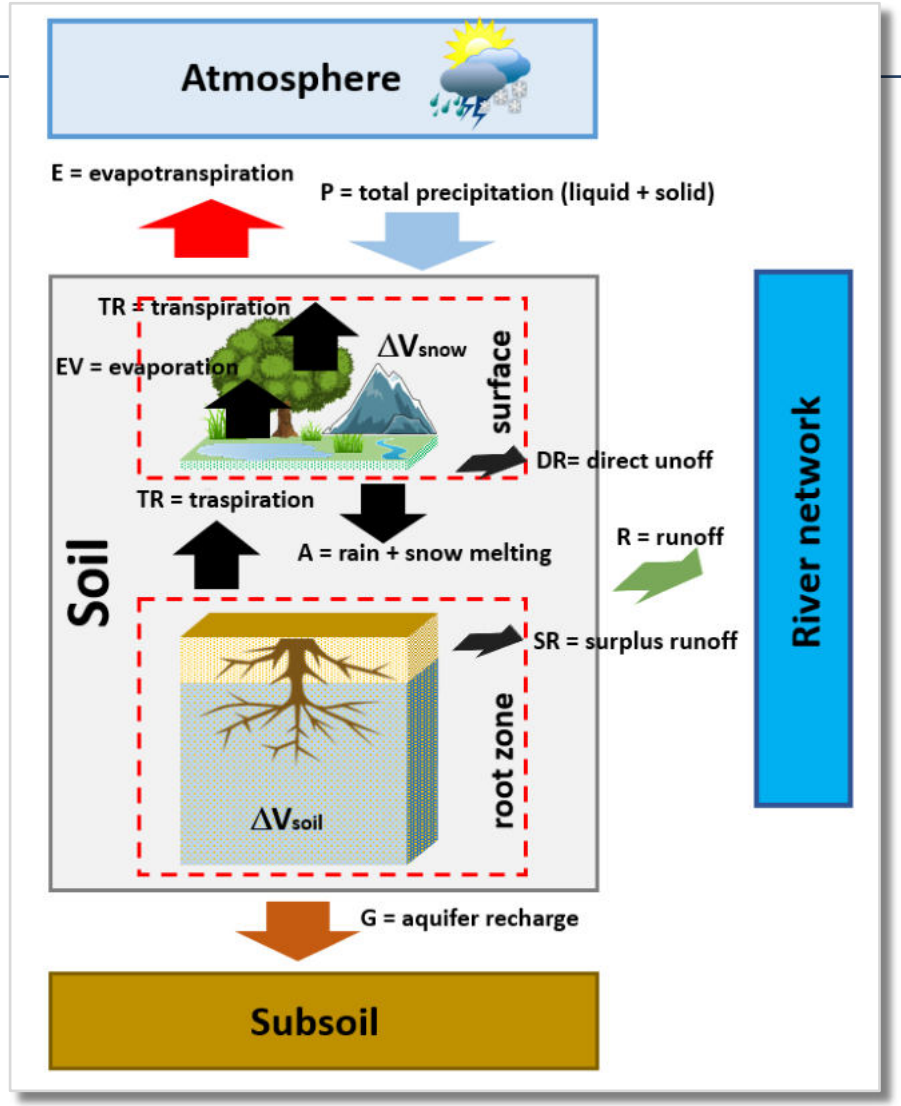
Drought analysis over IT, based on rain gauge data / BIGBANG elaborations



Local qualitative-quantitative assessment of drought impacts on hydromorphological classes derived from Sentinel-2 data (JAN-JUL 2022 vs. JAN-JUL 2016–2021)

- I Servizi nazionali del Mirror Copernicus – Ecoscienza n. 5/2021
- Dall'elaborazione statistica di immagini Sentinel-2 al monitoraggio quantitativo della siccità: primi risultati di ISPRA

BIGBANG: Hydrological water budget model

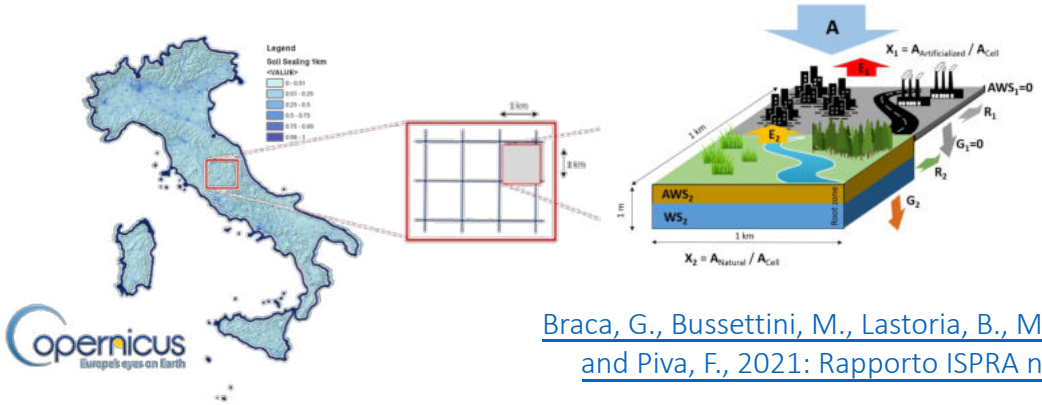


BIGBANG provides 1-km monthly GIS-based estimates over Italy of water budget components and hydrological variables (currently from 1951 to 2022).

HYDRO-METEO DATA FROM REGIONS & AUT. PROVINCES + HYSTORICAL DATA FROM SIMN

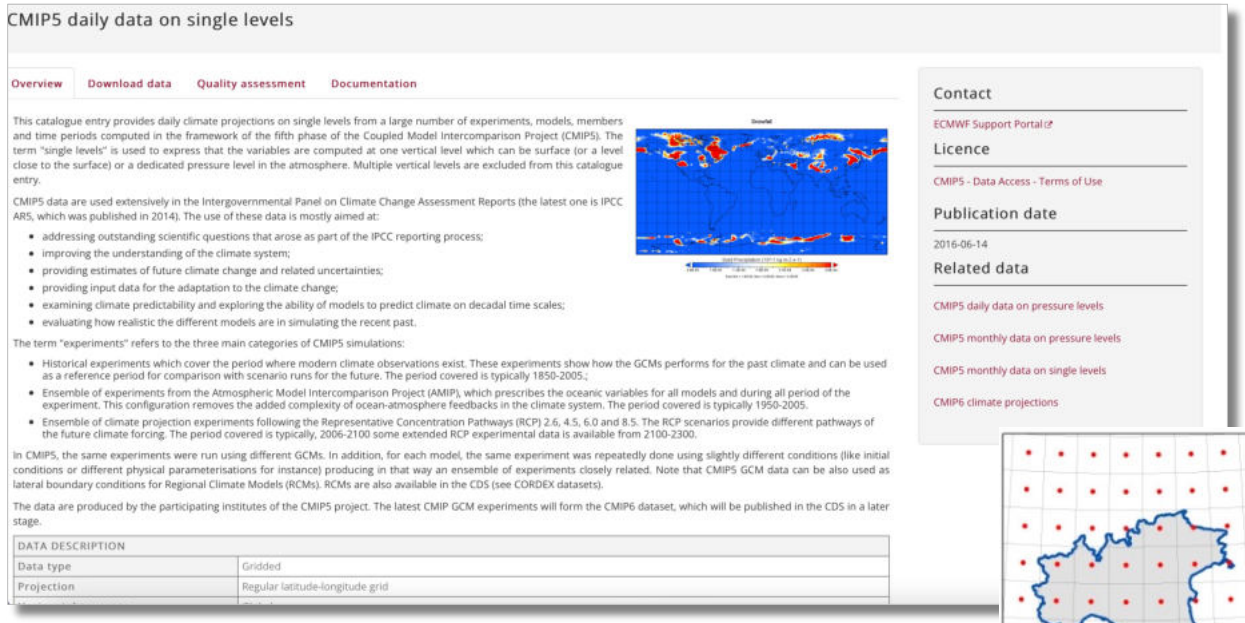
TEMPERATURE LAYERS FROM ISPRA SCIA SYSTEM

NATIONAL LAYERS FOR SOIL AND HYDRO-GEOLOGICAL CHARACTERISTICS & *SOIL-SEALING RATE* LAYER BASED ON COPERNICUS DATA



Braca, G., Bussettini, M., Lastoria, B., Mariani, S., and Piva, F., 2021: Rapporto ISPRA n. 339/21.

Using climate projections to evaluate future renewable water resource (RWR) availability in Italy



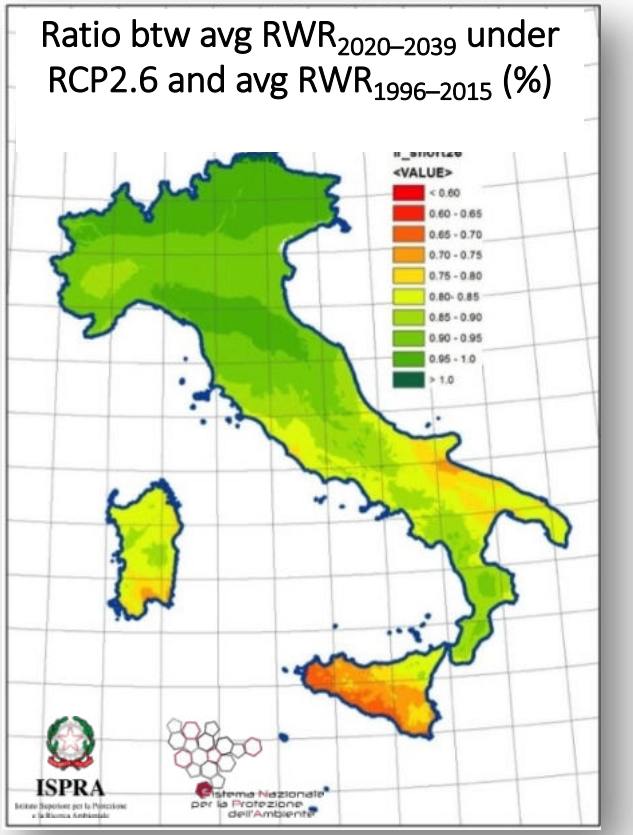
Name	Radiative forcing	CO_2 equiv (p.p.m.)	Temp anomaly (°C)	Pathway	SRES temp anomaly equiv
RCP8.5	8.5 Wm^2 in 2100	1370	4.9	Rising	SRES A1F1
RCP6.0	6 Wm^2 post 2100	850	3.0	Stabilization without overshoot	SRES B2
RCP4.5	4.5 Wm^2 post 2100	650	2.4	Stabilization without overshoot	SRES B1
RCP2.6 (RCP3PD)	3Wm^2 before 2100, declining to 2.6 Wm^2 by 2100	490	1.5	Peak and decline	None

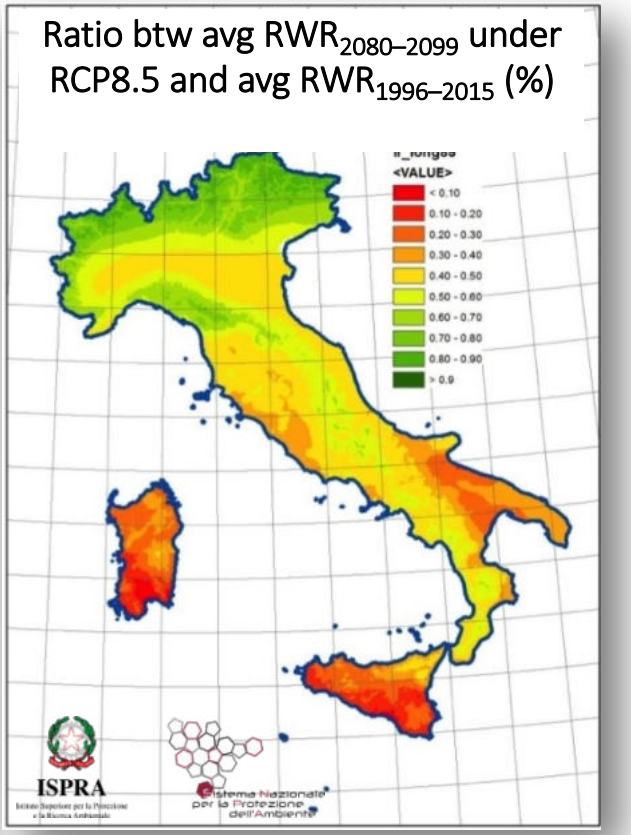
- ISPRA (Braca et al., 2019) conducted by means of the BIGBANG model a "proof of concept" study to address, at the national level, the possible impacts on water balances and on renewable water resource (RWR) for future situations in which global changes may affect the hydrological cycle.
- Ensemble average simulations (temp & precip) provided by the IPCC AR5 CCSM4 model according to 4 different future GHG emission scenarios (RCP2.6, RCP4.5, RCP6.0, RCP8.5) and 3 time horizons (2020–2039, 2040–2059 and 2080–2099) were considered.

Use of climate projections to evaluate the renewable water resource (RWR) availability in Italy

- RWR reduction in terms of RCP2.6 is quite constant over Italy for all time horizons: ≈10% avg. RWR reduction by 2040.
- RWR reduction is critical for the RCP8.5 scenario, the worst in terms of GHG emissions: ≈40% avg. RWR reduction at long-term time horizon (> 90% over Southern IT).

Work under consideration: Using different high-res GCMs projections available through C3S to addressed uncertainty and to improve temporal and spatial variability. This will provide a robust evaluation of CC potential impacts on RWR to better respond to water managers' needs.

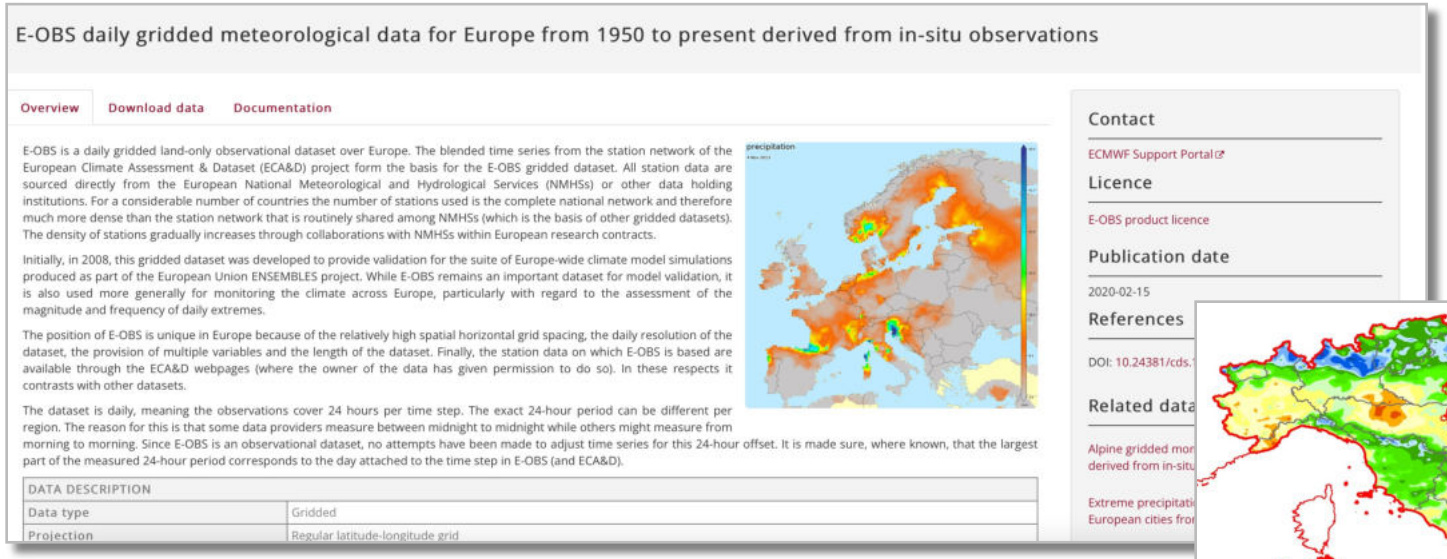




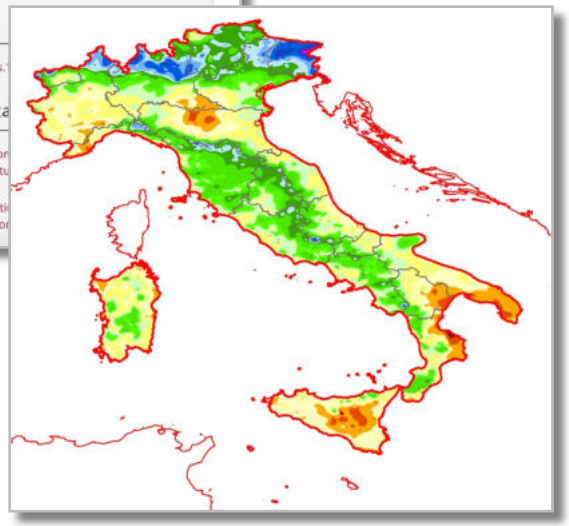
Braca et al., *Rend. Fis. Acc. Lincei*, 2019, DOI:10.1007/s12210-018-00757-6
Mariani et al., GL on drought & water scarcity, 2020, https://bit.ly/3gtId3e

Extension of the BIGBANG analyses over transnational basins

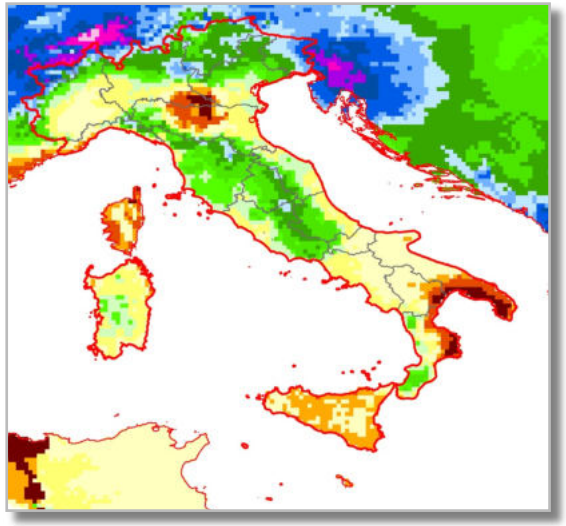
Need to collect precipitation and temperature data on territories outside the Italian territory.



For Italy, E-OBS dataset may be useful for collecting gridded data over foreign territories (**PROS**), but it may not be equally useful for detailed analyzes at the national/sub-national level (**CONS**), as the ground stations considered (to generate the products) are not uniformly distributed throughout the country → Under-sampling issue/lack of data.



Precipitation over Italy in April 1970
ISPRA BIGBANG gridded data (1 km x 1 km)

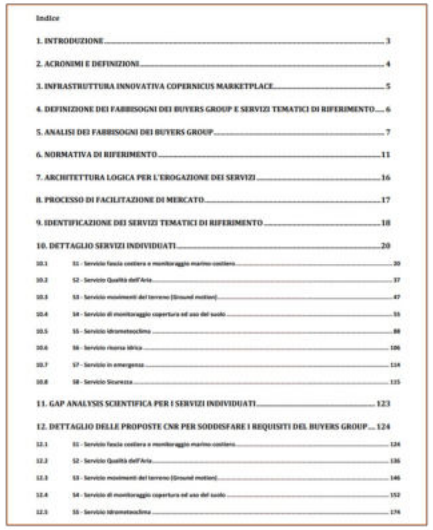


Precipitation over Europe in April 1970
E-OBS gridded data (10 km x 10 km)

User needs & climate services already available

MIRROR COPERNICUS

Analisi dei fabbisogni del buyers group: Identificazione dei servizi tematici di riferimento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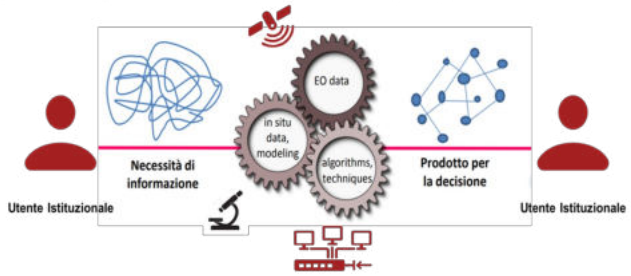
12. DETTAGLIO DELLE PROPOSTE CNR PER SODDISFARE I REQUISITI DEL BUYERS GROUP 124

- Mappatura dei **potenziali buyers del settore privato** presenti sul mercato (attuali e prospettici).
- Individuazione dei **possibili "Use Cases"** abilitati dai prodotti/servizi.
- Analisi degli **fabbisogni richiesti dai potenziali buyers privati.**



- Costituisce la base dei fabbisogni identificati dagli utenti istituzionali nazionali ai fini dell'ottemperamento della normativa di riferimenti;
- Individua specifici Servizi operativi di interesse nazionale, i relativi obiettivi funzionali ed operativi, lo stato dell'arte ed i requisiti minimi.

CENSIMENTO SERVIZI CLIMATICI

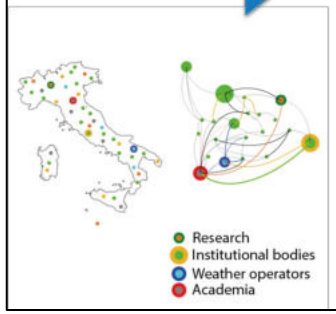
IL TAVOLO CLIMATOLOGIA OPERATIVA DELLO USER FORUM COPERNICUS

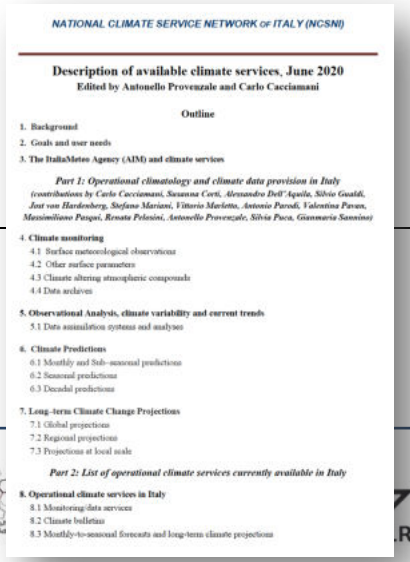
Gruppo Clima

Survey (aggiornamento al 2020) dei servizi e dei prodotti di climatologia operativi a livello nazionale e regionale

Censiti:
- 23 Monitoring/data services
- 26 Climate bulletins
- 17 Monthly-to-seasonal forecasts and long-term climate projections

Scheda di dettaglio per ciascun prodotto e servizio




NATIONAL CLIMATE SERVICE NETWORK OF ITALY (NCSNI)

Description of available climate services, June 2020
Edited by Antonello Provenzale and Carlo Cacciamani

Outline

1. Background
2. Goals and user needs
3. The ItaliaMeteo Agency (AIM) and climate services

Part 1: Operational climatology and climate data provision in Italy
(contributions by Carlo Cacciamani, Susanna Corti, Alessandro Dell' Aquila, Silvio Gualdi, Jost von Hardenberg, Stefano Mariani, Vittorio Marletto, Antonio Parodi, Valentina Pavan, Massimiliano Pasqui, Renata Pelosini, Antonello Provenzale, Silvia Puca, Gianmaria Sannino)

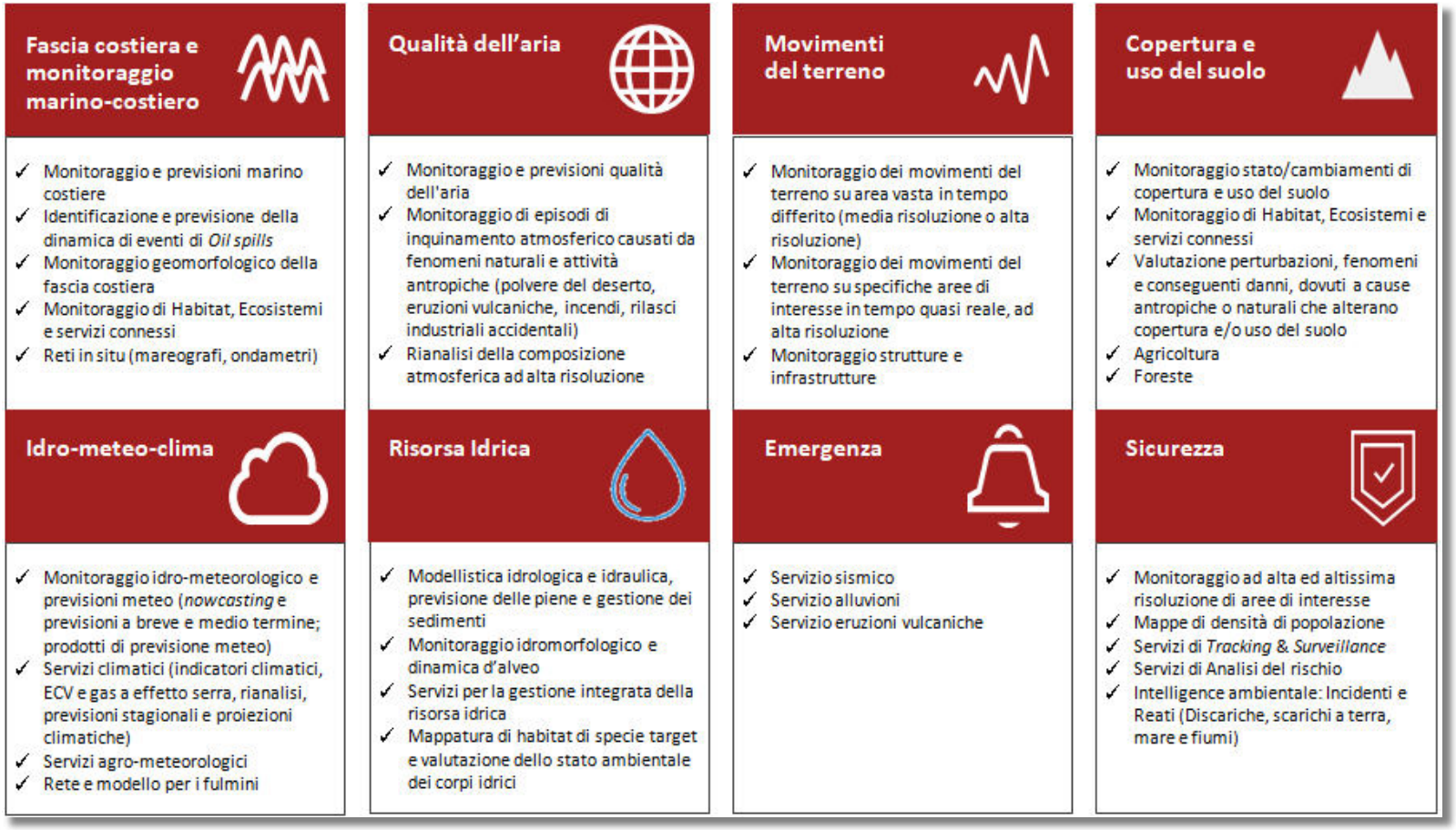
4. Climate monitoring
   4.1 Surface meteorological observations
   4.2 Other surface parameters
   4.3 Climate altering atmospheric compounds
   4.4 Data archives
5. Observational Analysis, climate variability and current trends
   5.1 Data assimilation systems and analyses
6. Climate Predictions
   6.1 Monthly and Sub- seasonal predictions
   6.2 Seasonal predictions
   6.3 Decadal predictions
7. Long-term Climate Change Projections
   7.1 Global projections
   7.2 Regional projections
   7.3 Projections at local scale

Part 2: List of operational climate services currently available in Italy

8. Operational climate services in Italy
   8.1 Monitoring/data services
   8.2 Climate bulletins
   8.3 Monthly-to-seasonal forecasts and long-term climate projections

Mirror Copernicus

- Definition of 8 thematic services at national level to support Italian public institutions and agencies.
- One service devoted to hydro-meteorological and climate products.
- Links among services and some sub-services are based on climate change scenarios.
- Services (mainly) under development through PNRR initiatives (PNRR IRIDE; PNRR SIM; PNRR MER).



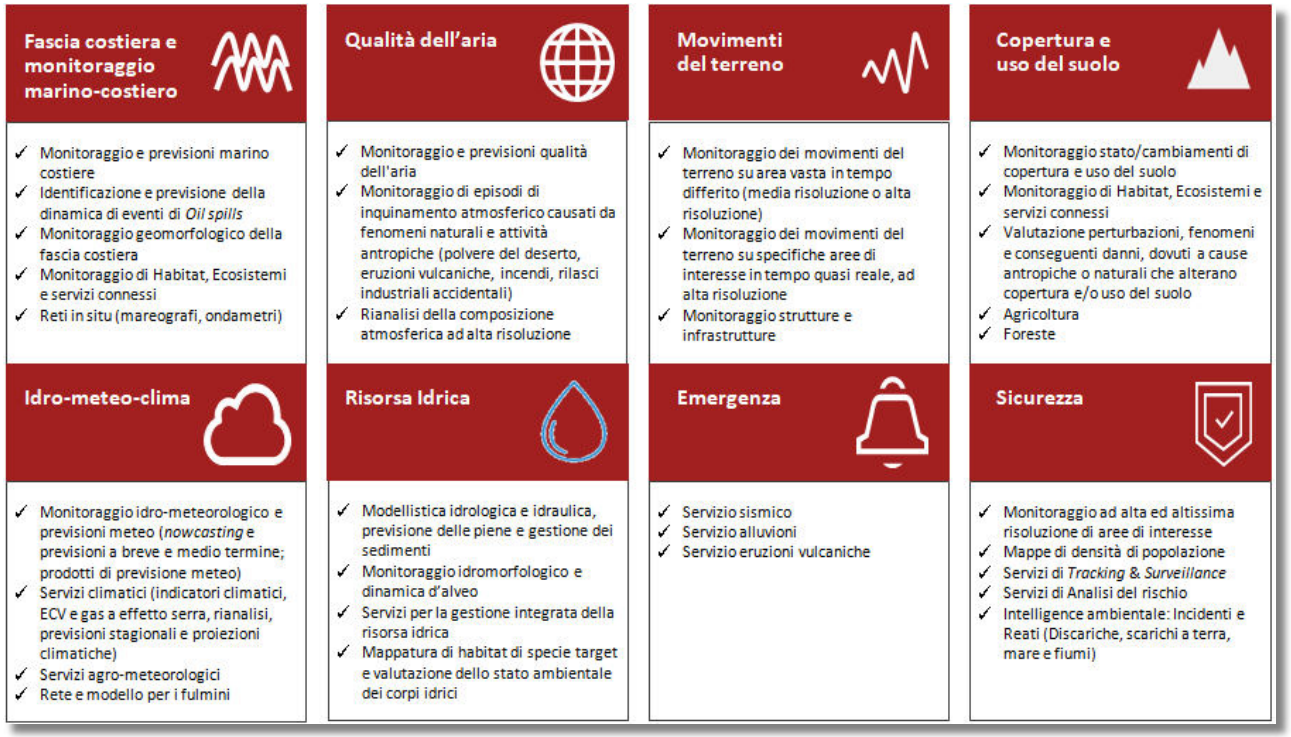
MoU UFN Copernicus & ECMWF

Stipulato il 24 ottobre 2022 un ***Memorandum of Understanding*** tra l'Italia, attraverso lo UFN Copernicus, e l'ECMWF in qualità di *Entrusted Entity* del C3S e del CAMS–Copernicus Atmosphere Monitoring Service.

L'obiettivo è il supporto dell'ECMWF come "Market uptake Advisory Expert" per lo sviluppo dei Servizi del Mirror Copernicus e, in particolare, per quanto relativo a:

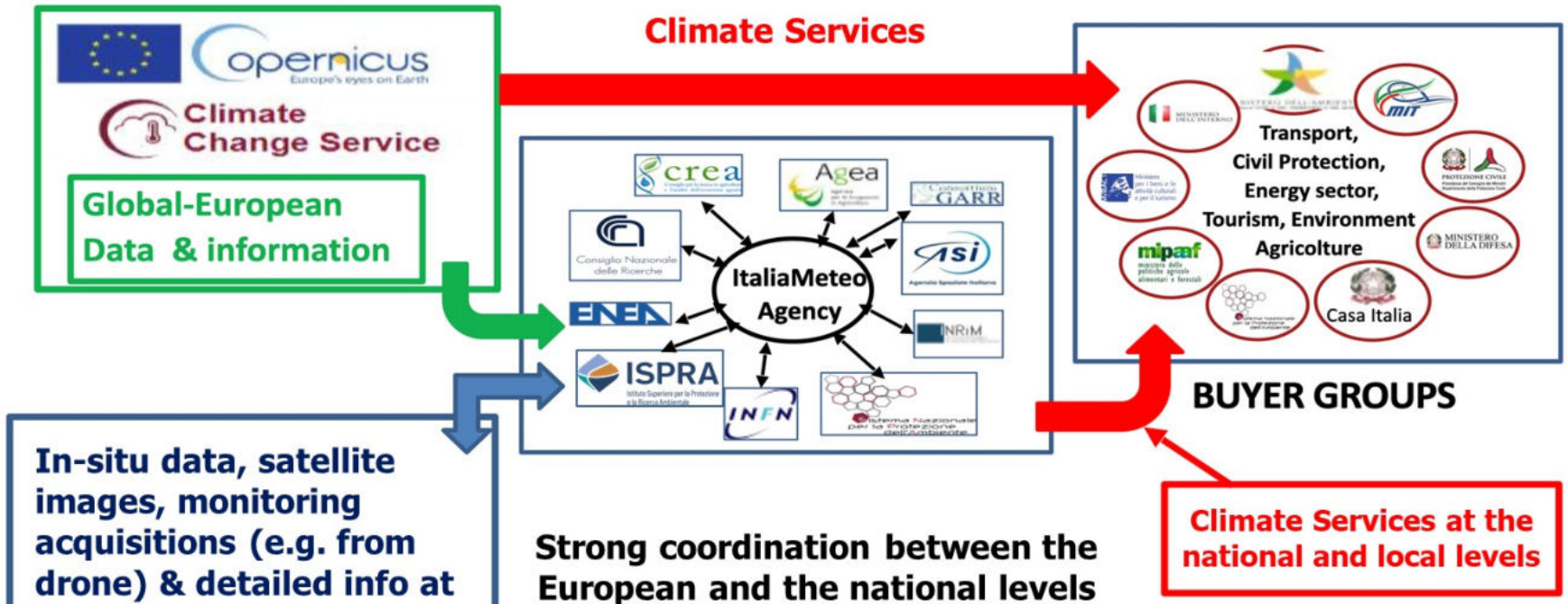
- ❑ idro-meteo-clima (indicatori, previsioni, proiezioni climatiche, servizi climatici, ecc.);
- ❑ composizione atmosferica (qualità aria);
- ❑ monitoraggio delle emissioni dei gas serra;
- ❑ valutazioni sulla risorsa idrica (e.g., impatto cambiamenti climatici sulla disponibilità di risorsa) e sul ciclo idrologico e i suoi estremi;
- ❑ attività di emergenza.

→ Next step: **National Collaboration Program** con ECMWF, strumento finalizzato all'uptake nazionale dei Climate Services erogati dal Servizio C3S



Towards a new cooperation

USER FORUM NAZIONALE DI COPERNICUS / MoU con ECMWF
TAVOLO CLIMATOLOGIA



COMITATO DI INDIRIZZO PER LA METEOROLOGIA E LA CLIMATOLOGIA

Thanks for your kind attention

Stefano Mariani – stefano.mariani@isprambiente.it

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