



Climate Change

A Copernicus Climate Change operational windstorm service & extreme events catalogues

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3 June 2021

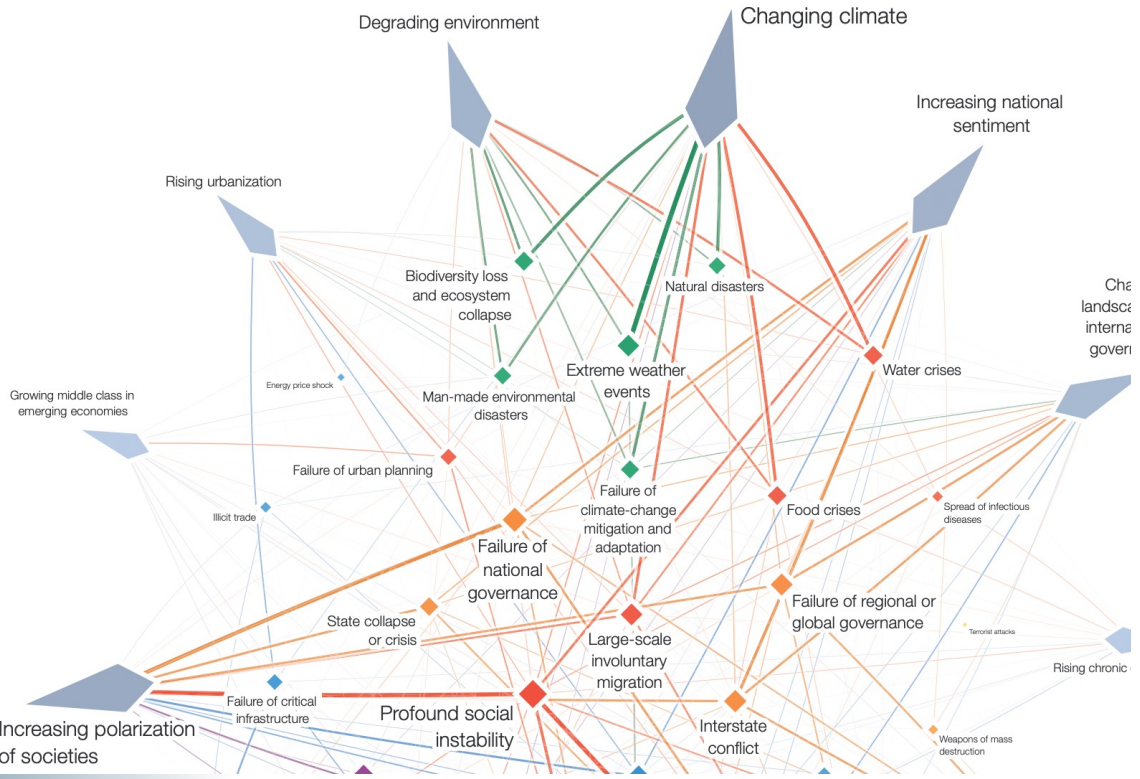




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Why Extreme Events ?

From 1970 to 2012, **8 835 weather-climate and water-related disasters** were reported globally. Together they caused the loss of **1.94 million lives** and economic damages of **US\$ 2.4 trillion (*)**



Top Risks by likelihood

by likelihood

- 1 Extreme weather
- 2 Climate action failure
- 3 Human environmental damage
- 4 Infectious diseases
- 5 Biodiversity loss
- 6 Digital power concentration
- 7 Digital inequality
- 8 Interstate relations fracture
- 9 Cybersecurity failure
- 10 Livelihood crises

Top Risks by impact

by impact

- 1 Infectious diseases
- 2 Climate action failure
- 3 Weapons of mass destruction
- 4 Biodiversity loss
- 5 Natural resource crises
- 6 Human environmental damage
- 7 Livelihood crises
- 8 Extreme weather
- 9 Debt crises
- 10 IT infrastructure breakdown

(*) ATLAS OF MORTALITY AND ECONOMIC LOSSES FROM WEATHER, CLIMATE WATER EXTREMES (1970–2012), WMO 2014



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Extreme Events information in the CDS catalogue and downstream services

- OPERATIONAL WIND STORM SERVICE
- PLUVIAL FLOOD RISK ASSESSMENT
- EXPERT TEAM ON CLIMATE CHANGE DETECTION AND INDICES (ETCCDI) & HEAT STRESS INDICES



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Operational Windstorm Service for Insurance

Objective

- to provide **authoritative** and **up to date** windstorm data to insurers to support risk and loss assessments

Why

- European Winter Windstorms are a major cause of insurance sector losses.

How

- To help the sector better understand this risk, C3S carried out a Sectorial Information Service Proof of Concept project (“WISC”) from 2016 to 2018 to provide improved information about European Windstorms. WISC relied on **ERA-INT** input



<https://climate.copernicus.eu/operational-windstorm-service-insurance-sector>

Key features of the operational service:

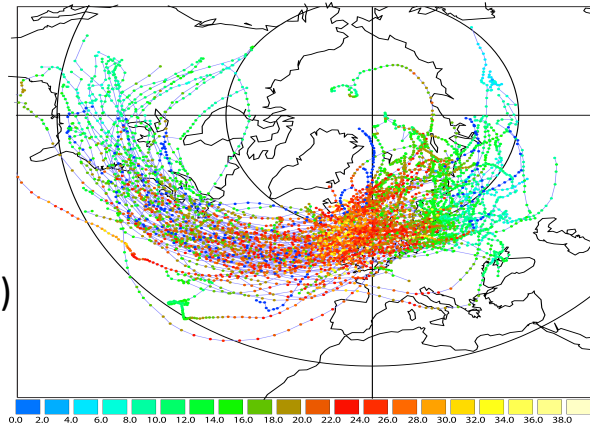
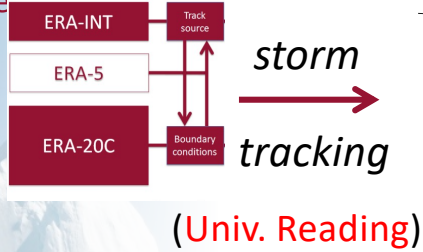
- operational tracking and footprinting of **ERA5** data.
- ERA5 based data will be used to update risk and loss indicators.
- New products will be available from the climate data store (CDS) alongside the existing WISC data at <https://wisc.climate.copernicus.eu>





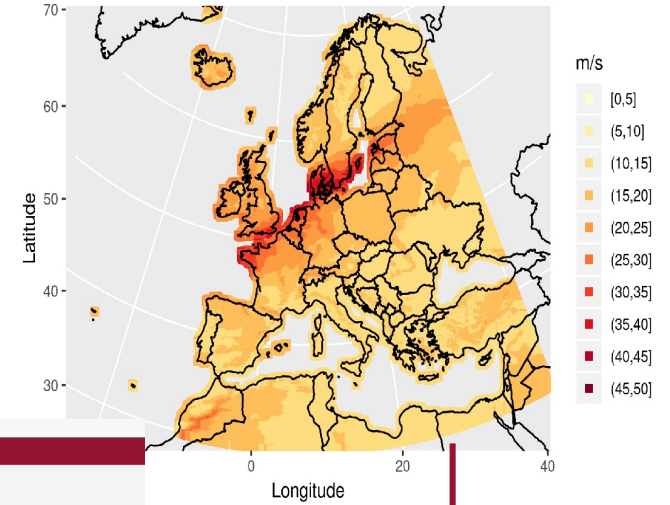
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Data chain: Track -> Footprint -> Losses

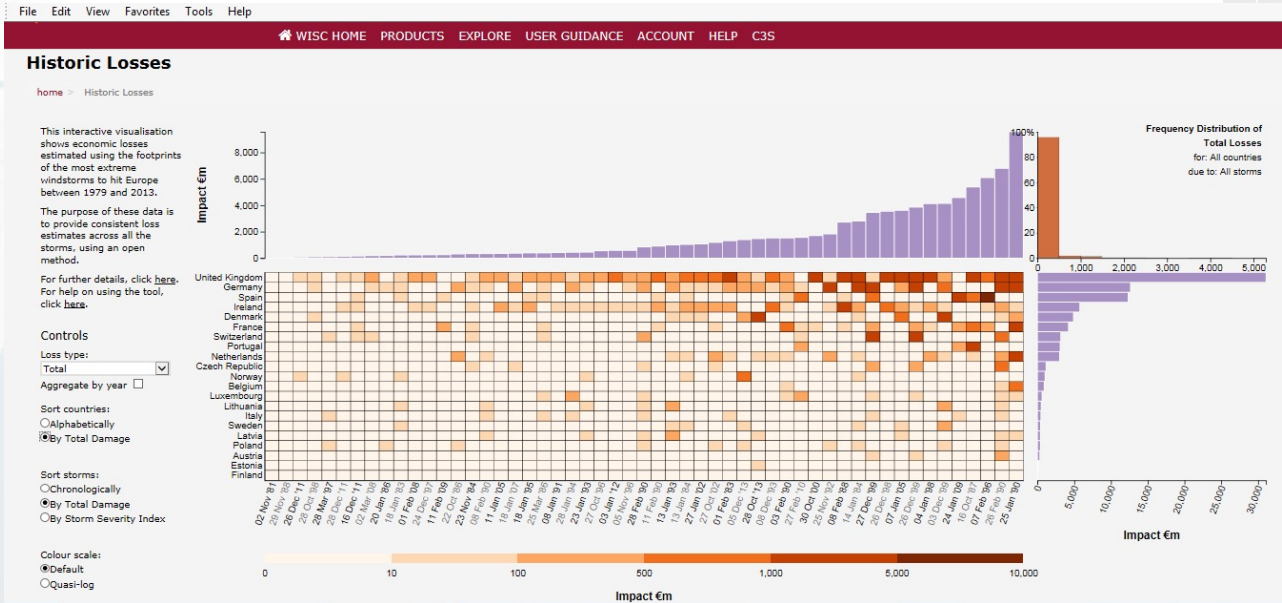


storm footprint
(UKMO/KNMI)

MLR: Maximum Wind Gust
Track Number: 87 (2013-10-28)



Economic loss calculations
(VU Amsterdam)

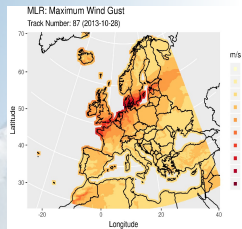




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Vulnerability and Loss Data

ERA based storm footprints



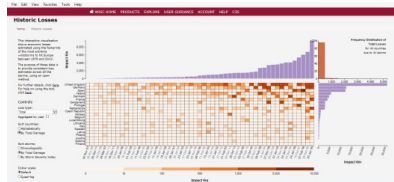
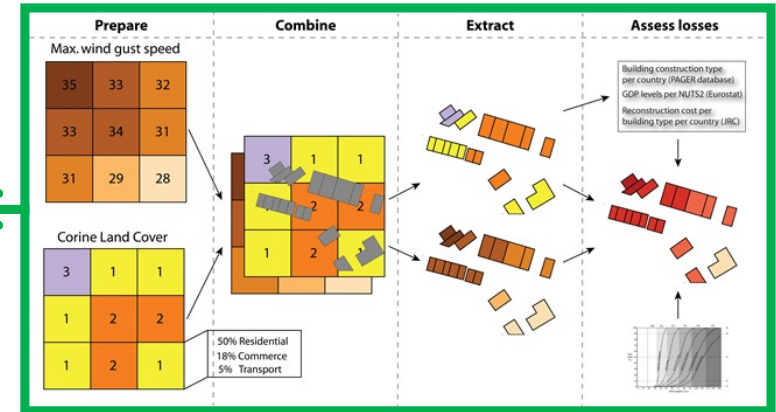
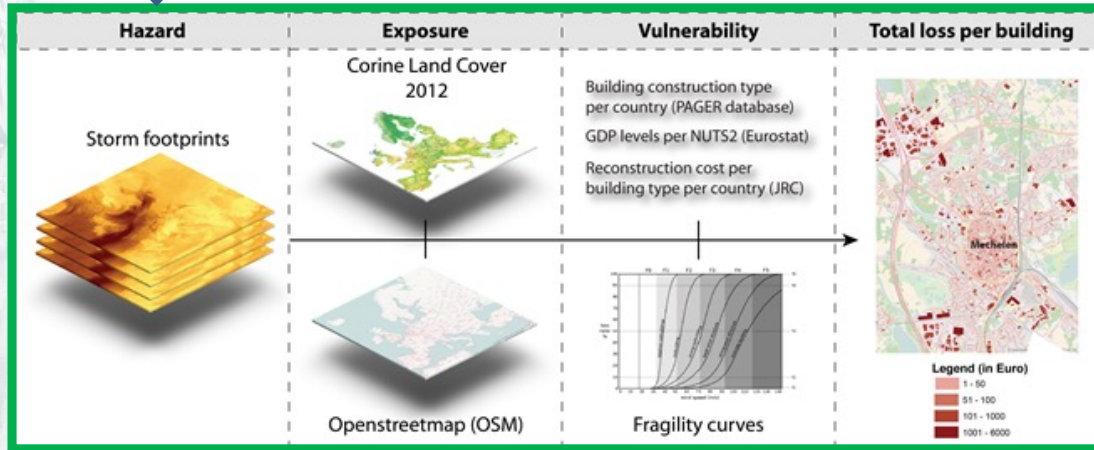
(from previous slide)

Exposure / Vulnerability

- CORINE – 45 land classes
- PAGER – 106 construction types – aggregated to 6 types
- Fragility curves applied for these 6 types
- Fragility to vulnerability curves via reconstruction costs
- GDP per NUTS3 region applied

Process for Loss Assessment

- Datasets clipped to NUTS3 regions before loss calculations applied
- Loss per hazard (max gust speed) from fragility curves
- Loss ratio multiplied by reconstruction cost per building type
- Losses adjusted by GDP per region
- Validate losses vs actuals



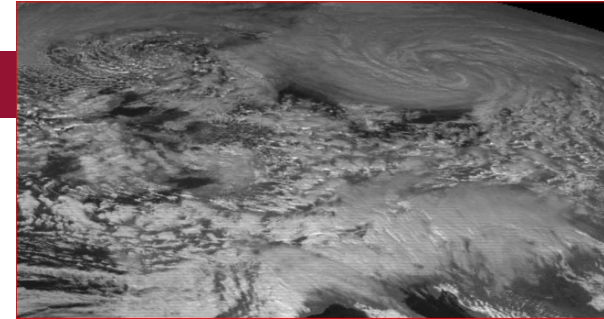
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Revised risk and loss estimates



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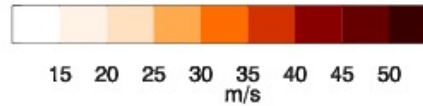
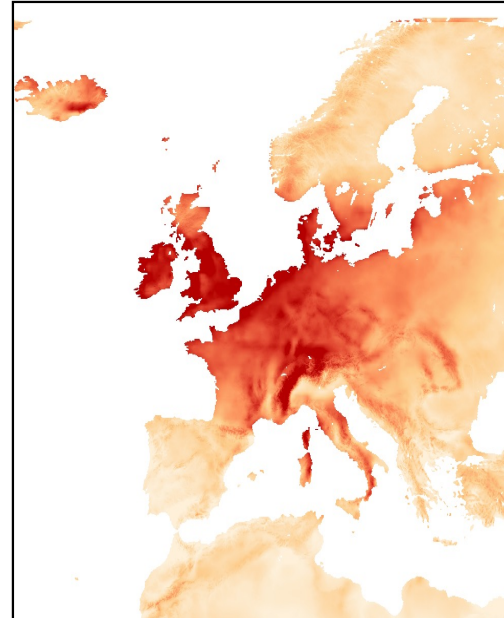
From footprint to economic loss



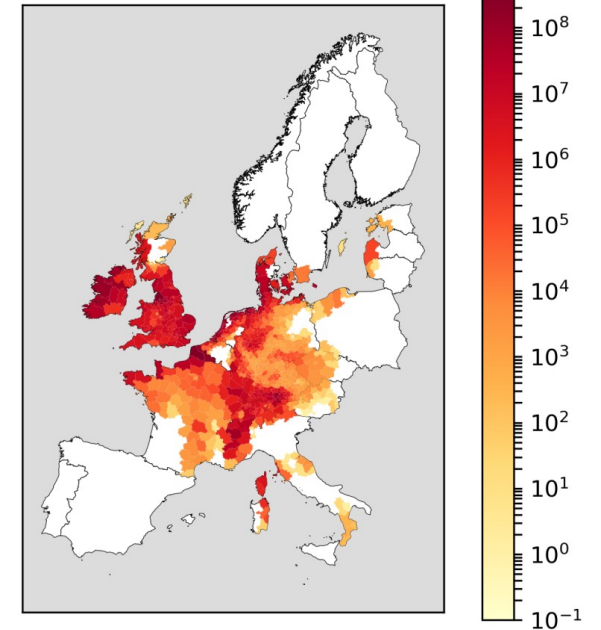
Vivian (26-02-1990)

Extra-tropical cyclone

Max winds 120-160 km/hr



Footprint



Reported loss: 5.6bn

Calculated loss: 4.5bn



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PLUVIAL FLOOD RISK ASSESSMENT

PLUVIAL FLOOD RISK ASSESSMENT in urban areas is a Copernicus Climate Change Service Sectoral Information System

to support

different communities in the assessment of risks associated to **extreme precipitation events** in Europe with user-friendly queries to visualize and download several tipologies of information (for example from precipitation intensity to the flooded areas and average economic damages)





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Dataset and Applications

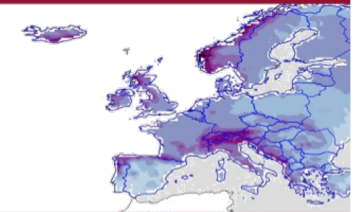
Datasets

Extreme precipitation indicators for Europe and European cities from 1950 to 2019

Flood indicators for European cities from 1989 to 2018

Applications

Extreme Precipitation Statistics for Europe explorer



Catalogue of Past Extreme Precipitation Events for Europe



Urban Pluvial Flood Risk Analysis



Application 1: Extreme Precipitation Statistics for Europe Explorer

Selection criteria

- > Source dataset (ERA5 or E-OBS)
- > Extreme Precipitation Indicators
- > Temporal aggregation (monthly, yearly, 30-yrs)
- > Temporal period

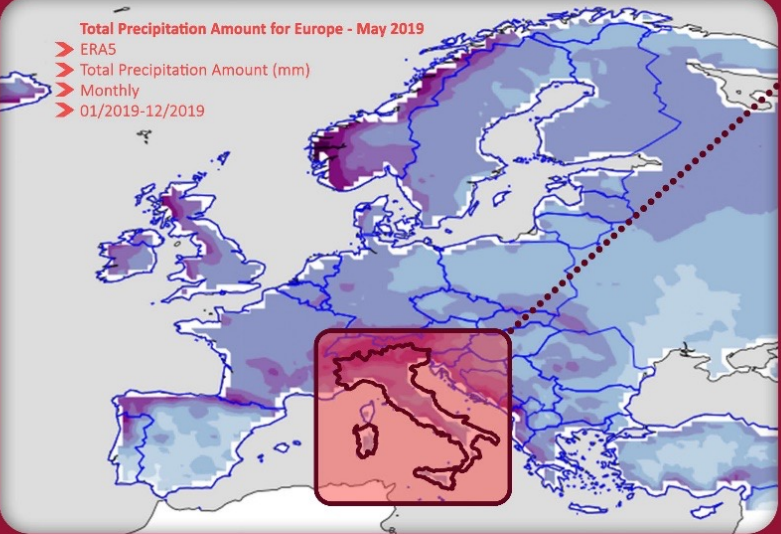
Visualization of interactive livemap


The map shows the average value of the indicator computed assuming NUTS 0 as territorial unit. The user can change NUTS level by zooming on the map.

Extraction and visualization of results

Total Precipitation Amount for Europe - May 2019

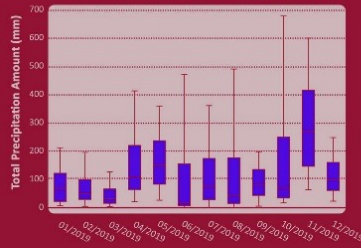
- > ERA5
- > Total Precipitation Amount (mm)
- > Monthly
- > 01/2019-12/2019





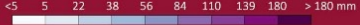
NUTS 0 - Italia

Interactive box plot - spatial statistics



<https://bit.ly/3cUdev2>

<5 5 22 38 56 84 110 139 180 > 180 mm



Application enables the User to easily access, analyse and/or compare information extracted from the **Extreme precipitation indicators for Europe and European cities from 1950 to 2019** dataset available in the CDS.

Application 2: Catalogue of past extreme precipitation events for Europe

Query request reports for selected area and period, features of the occurred extreme precipitation event(s).

Query provides information on magnitude, percentage of area potentially affected and, when available, information related to damages recorded from external repositories.

Selection criteria

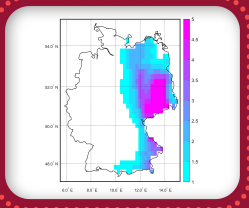
- > Source dataset (ERA5 or E-OBS)
- > Extreme Precipitation Indicators

Extraction of information

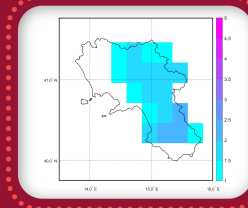
- > Temporal aggregation (monthly)
- > Territorial units (NUTS 0-2)
- > Scrollable list of maps of the selected territorial unit
- > Table reporting information about the extreme events for each day

	A	M	R	Start date	End date	Type	Flood source	Regions affected	Fatalities	Persons affected	Losses (mln EUR, 2019)
Deutschland											
11/08/02	0.2	1.8	0.3	11/08/02	20/08/02	River	Elbe, Danube, Mulde	DE141; DE218; ...; DEF06	27	330,000	11,404.815
12/08/02	0.4	2.7	1.1	11/08/02	20/08/02	River	Elbe, Danube, Mulde	DE141; DE218; ...; DEF06	27	330,000	11,404.815
13/08/02	0.1	2.2	0.2	11/08/02	20/08/02	River	Elbe, Danube, Mulde	DE141; DE218; ...; DEF06	27	330,000	11,404.815
20/08/02	0.07	1.3	0.1	11/08/02	20/08/02	River	Elbe, Danube, Mulde	DE141; DE218; ...; DEF06	27	330,000	11,404.815
Campania (IT)											
10/10/15	1	2.1	2.1								
14/10/15	0.2	1.8	0.3	14/10/15	16/10/15	Flash	nan	ITF11; ITG11; ...; ITF32; ITI43	4	nan	127.972
15/10/15	0.8	1.6	1.3	14/10/15	16/10/15	Flash	nan	ITF11; ITG11; ...; ITF32; ITI43	4	nan	127.972
30/10/15	0.05	1.8	0.1								

A [-] = area potentially affected by the event over the selected NUTS (from 0 to 1)
M [-] = magnitude of the event over the selected NUTS (higher than 1)
R [-] = rank of the event over the selected NUTS
Start date [dd/mm/yy] = first day of the recorded event
End date [dd/mm/yy] = last day of the recorded event
Type = "flash" for pluvial or "river" for fluvial flood
Flood Source = if recorded, water bodies that gave rise to the flood
Regions affected = NUTS3 regions reported as affected
Fatalities = number of casualties/deaths attributed to the event
Persons affected = number of people affected attributed to the event
Losses (mln EUR, 2019) = deflated reported economic damage



Deutschland 2002-08-12



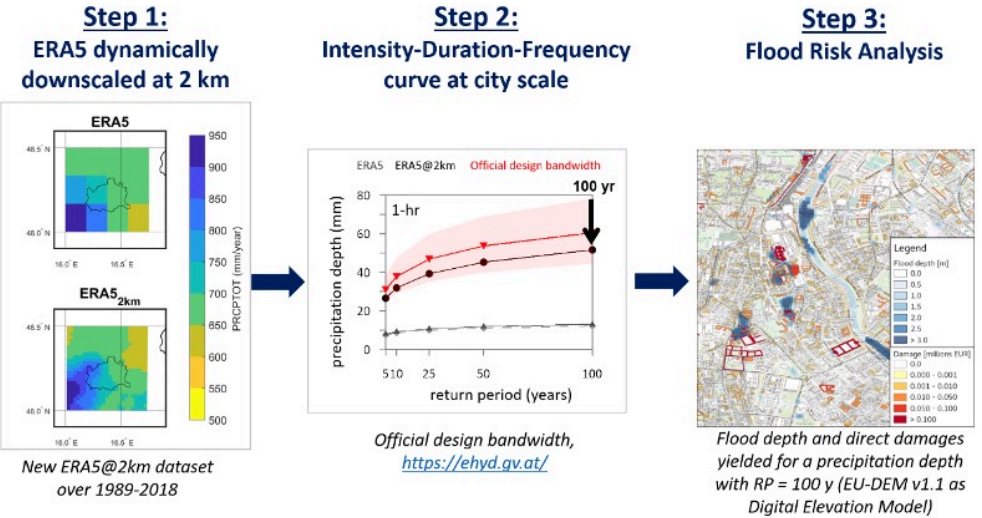
Campania (IT) 2015-10-15

<https://bit.ly/3cUdev2>



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Application 3: Urban Pluvial Flood Risk Analysis



Application provides a scenario-based assessment of hazard and potential damage related to urban pluvial flooding for the current climate.

The application is based on **flood indicators for European cities from 1989 to 2018.**

Return period (y)	Precipitation (mm/h)	Flooded area (%)	Average water depth (m)	Average damages (€/m ²)
5	22.83	2.5	0.29	32.9
10	26.94	2.9	0.30	34.9
25	32.46	3.3	0.32	37.6
50	36.81	3.6	0.33	39.7
100	41.34	3.9	0.34	41.6



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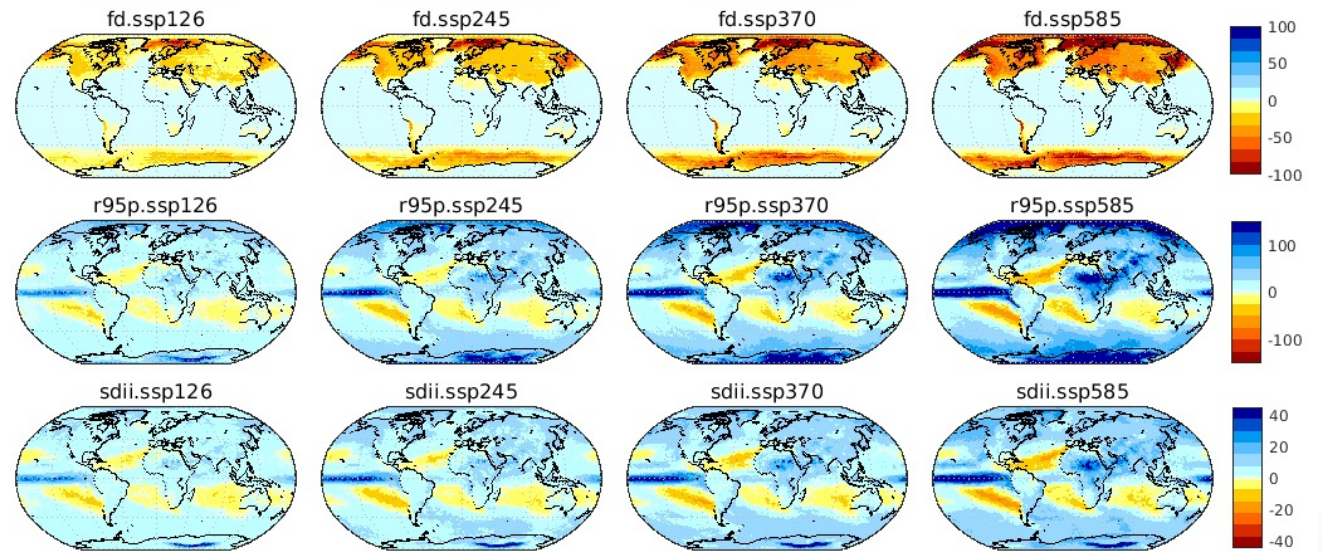
Expert Team on Climate Change Detection (ETCCDI) & Heat Stress Indices

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Climate extreme value indices and heat stress indicators derived from climate projections

[Overview](#) [Download data](#) [Documentation](#)

This dataset provides extreme temperature and precipitation indices (ETCCDI and selected heat indices) for historical and future projection (ssp126, ssp245, ssp370, ssp585) runs included in the AR6, CMIP6 datasets.



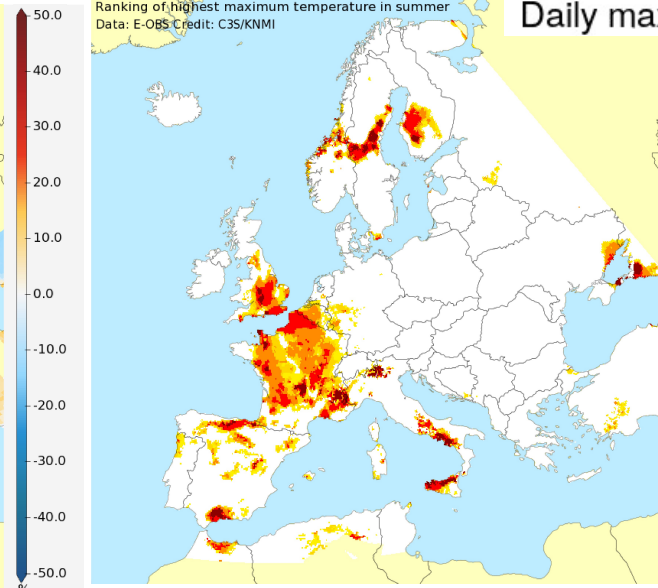
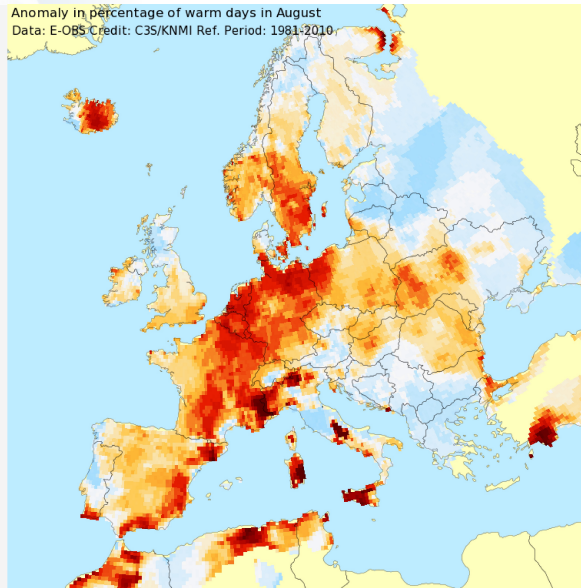


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C3S value chain: ESOTC 2020

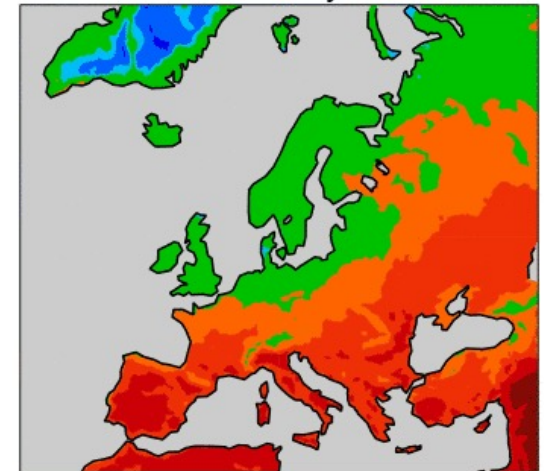
ESOTC 2020 | EUROPE | THEMATIC

Heatwaves and warm spells



Daily maximum UTCI during heatwave periods of 2020

29 July



- extreme cold stress
- very strong cold stress
- strong cold stress
- moderate cold stress
- slight cold stress
- no thermal stress
- moderate heat stress
- strong heat stress
- very strong heat stress
- extreme heat stress



Copernicus Climate Change Service
European State of the Climate | 2020



Copernicus
Europe's eyes on Earth

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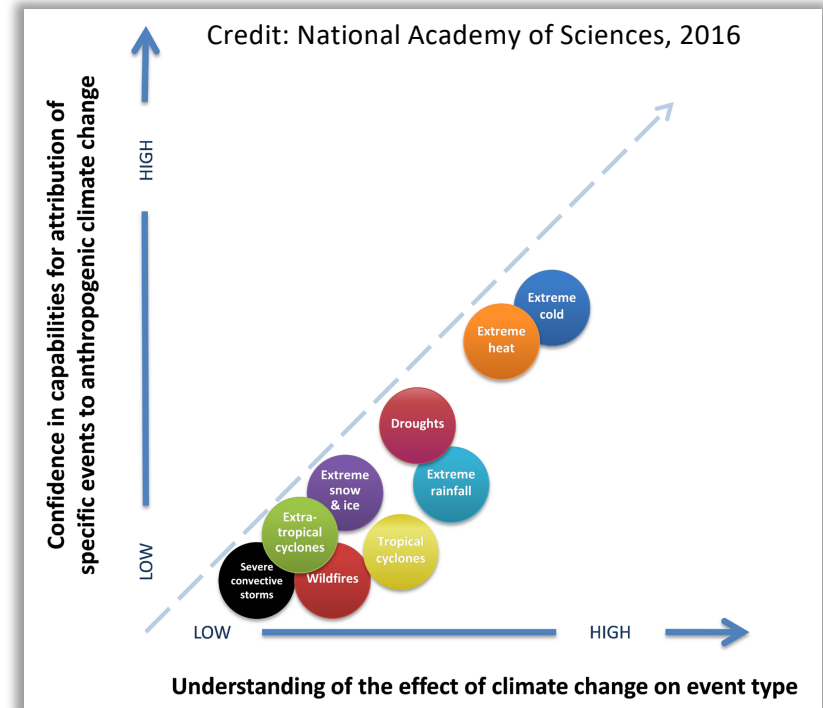
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Attribution & Extremes



Extreme event happens

Provide information about event in the context of climate change with as short a delay as possible
→ “Rapid service”
A response to user requirements at various levels



Thank you for your attention



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