REACH OUT

shaping climate resilient cities

CHALLENGES in URBAN TRANSFORMATION

Crafting Logroño's climate narrative

March 12th 2024

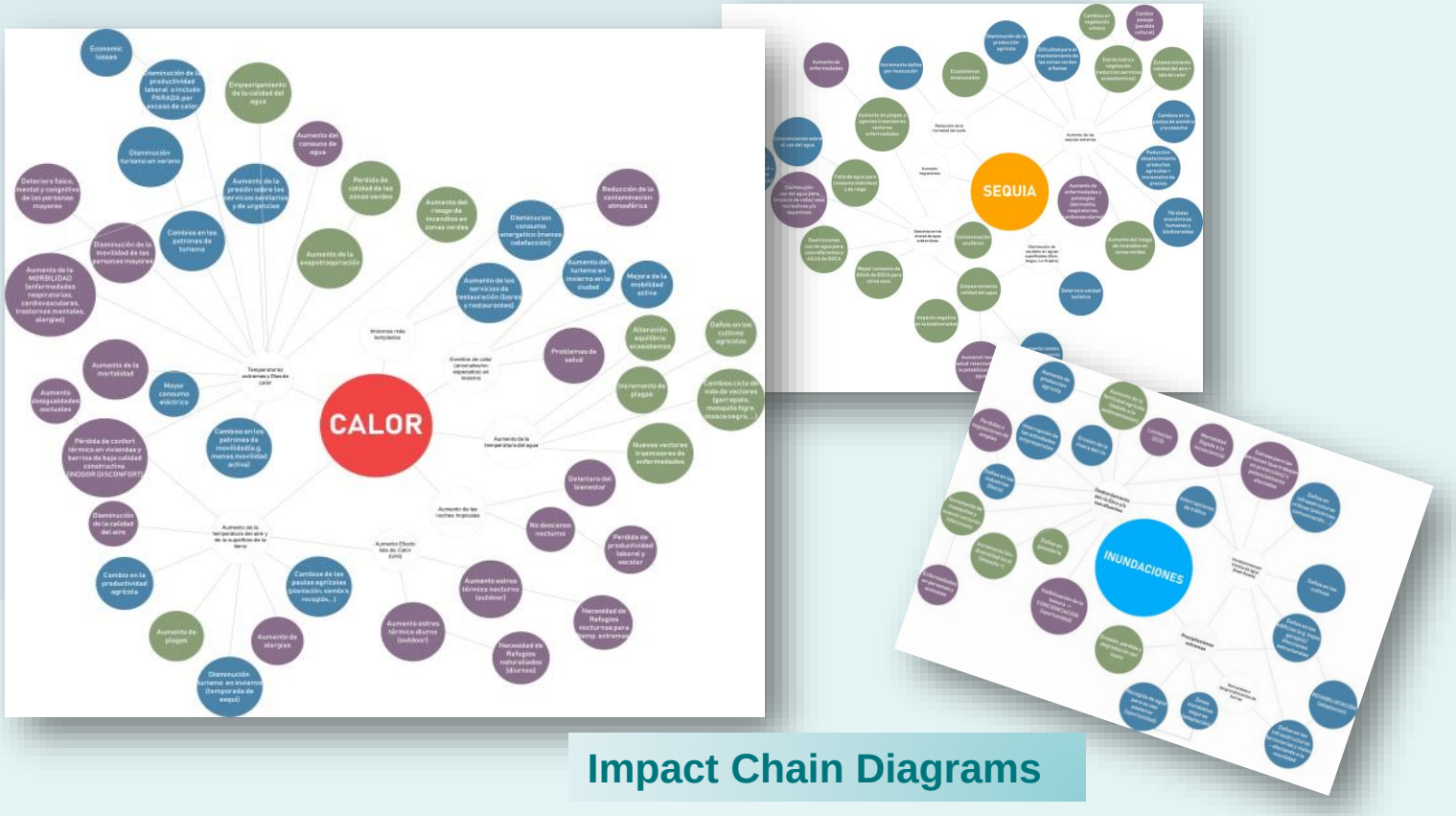
LOGROÑO, Elena Garrido

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036599.

1. Main adaptation challenges in the city of Logroño

We start the process....

Relevant climatic drivers



Impact Chain Diagrams

SECAP (Sustainable Energy and Climate Action Plan) in Logroño

Realistic and specific urban adaptation solutions

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1. Main adaptation challenges in the city of Logroño

Define an adaptation policy framework

Alignment with city priorities

Effective integration of adaptation solutions into urban policies.

Move towards **real implementation**

How to get the adaptation solutions to be used by the city Council??

Agenda Urbana Logroño Próximo

LOGROÑO URBAN AGENDA

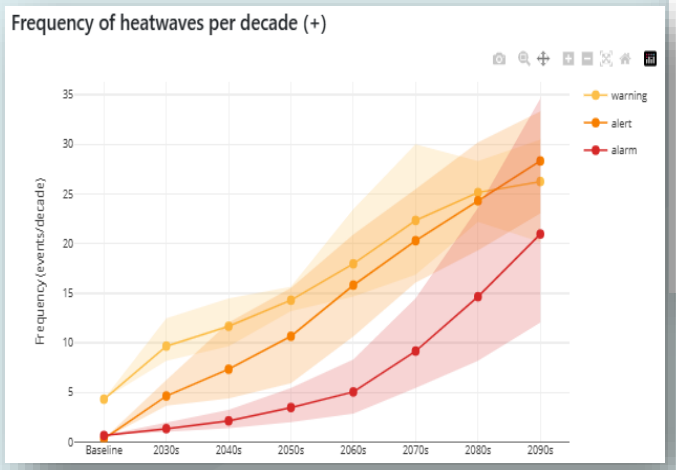
Build new city models

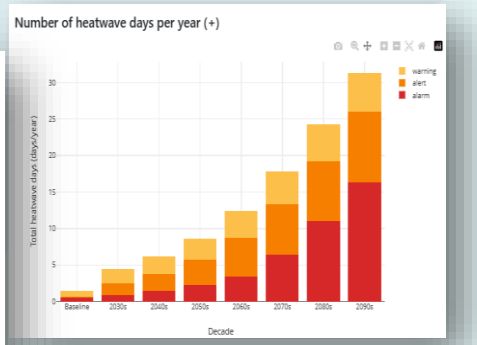
REACH OUT

2. Support from climate services on city challenges

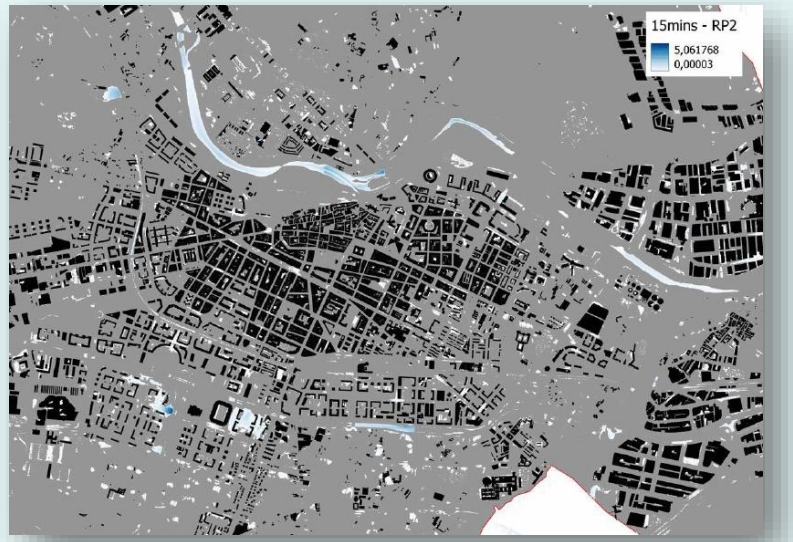
Urban challenges identified……What next?

Thermal Assessment Tool

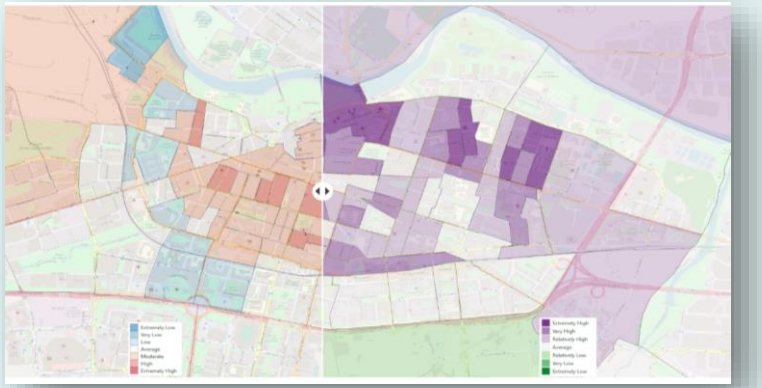




Pluvial Flood Hazard, Risk Assessment and Adaptation Tool



Social Vulnerability Tool



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2. Support from climate services on city challenges

Climate services for urban adaptation

- *Heatwave service*
- *Heatmaps service*
- *Social Vulnerability Index*

Visual **summary** of the climate change **impacts by sector**

Boards to easily visualize **frequency and severity of past experienced and future projected heatwaves**

Assessment of **SUHI phenomenon**

Vulnerability maps to identify the most vulnerable areas

HEAT hazard

Urban measures ecosystem

- Planning of planting and afforestation
- Specific restrictions on urban water needs
- Design of healthy routes in the city
- Definition of climate resilient building regulations
- Improving action protocols to respond to warnings

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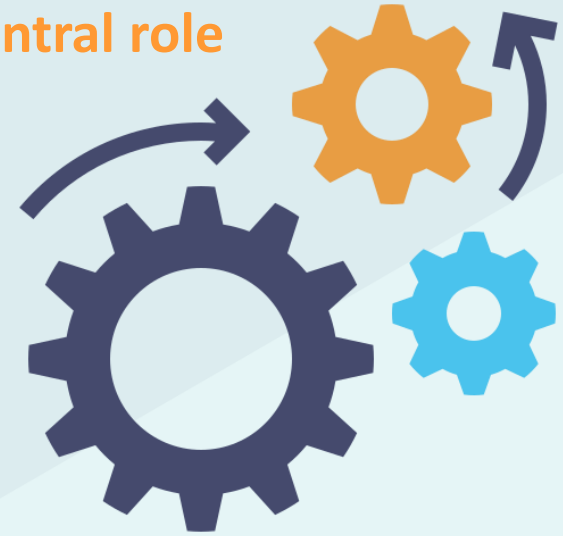
3. Governance & Communication

Addressing adaptation strategies requires……

A participative climate governance

Citizens should play a central role



A cultural and behavioral change at all levels

Cities should be able to: mobilise, motivate and involve citizens and urban stakeholders

Arising awareness to generate changes

Dissemination and Communication strategies

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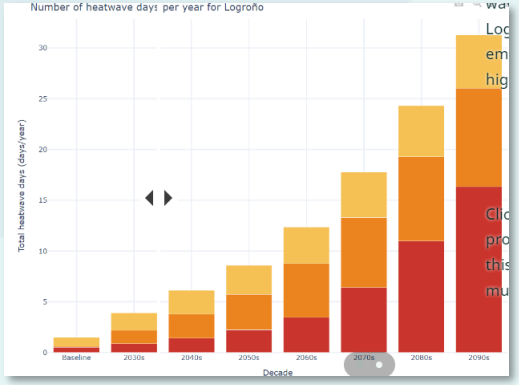
3. Governance & Communication

We build our climate story…….



Link to Logroño Climate Story

LOGROÑO CLIMATE STORY

- **Integrate** different **tools/climate services. Translate technicalities** into **easy-to-understand visuals**
- Foster **cross-sectoral collaboration**
- Strengthen the **visibility** of the **adaptation measures.** Think about **actions to be taken**
- **Generate** a sense of **urgency**. **Show negative effects** in citizens' lives

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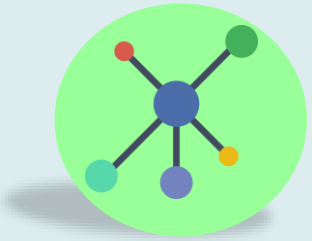
4. Some key learnings on adaptation in Logroño

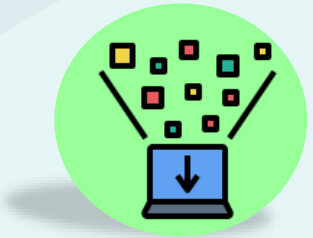
Adaptation team



Actively participate in **co-creation processes**

Skills to coordinate necessary adaptation actions

Collaborate for collecting information



Build a reliable **dataset. Value of data**

Common digital space: **Urban** data + **Environmental** parameters + **Climate** data (National an European)

Effective ways to connect and inform

Identify **strong messages** to communicate adaptation

Find the **appropriate channels to raise citizens awareness**

Joint approach for taking climate measures

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Thank you for attention!!

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reachout-cities.eu

Building resilience: Milan's strategy for climate adaptation and sustainability

Uniting science, services, and standards for a climate resilient future

12/03/2023

Simone Nardicchia

Urban Resilience Department | Milan Municipality

The Urban Resilience Department

Established in 2017, with the responsibility of developing and coordinating all the activities connected to resilience to drive a risk-informed decision-making process at the Municipal level.

The Department operates within the **Green and Environment Department**:

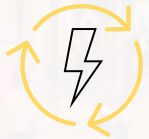
Water Resources and Waste Management

Environmental protection and pollution mitigation policy planning and implementation

Green Area

Coordination and supervision of public green planning, management and monitoring

Climate and Energy Area



Implementation of environmental and energy policies

Urban Resilience Department

Coordination of activities on urban resilience and climate change adaptation

Comune di Milano

The Urban Resilience Department

VISION

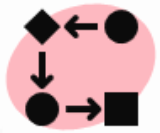
Starting from the Administration's strategic and policy documents, the Department defines its primary long-term purpose: reading the city's challenges through the resilience lenses.

GOALS

To ground this vision and to achieve the Municipality's (sustainable) goals, we identified 4 strategic objectives.

RESEARCH AND INNOVATION

In-house expertise participation in international networks and European projects enables us to:
- collect new data
- do thematic research and analysis on the issues of our interest
- experiment innovative solutions to face the city's challenges.



PLANNING

Through the research and analysis phase, the Department offers the opportunity to promote risk-informed urban planning and decision-making processes.

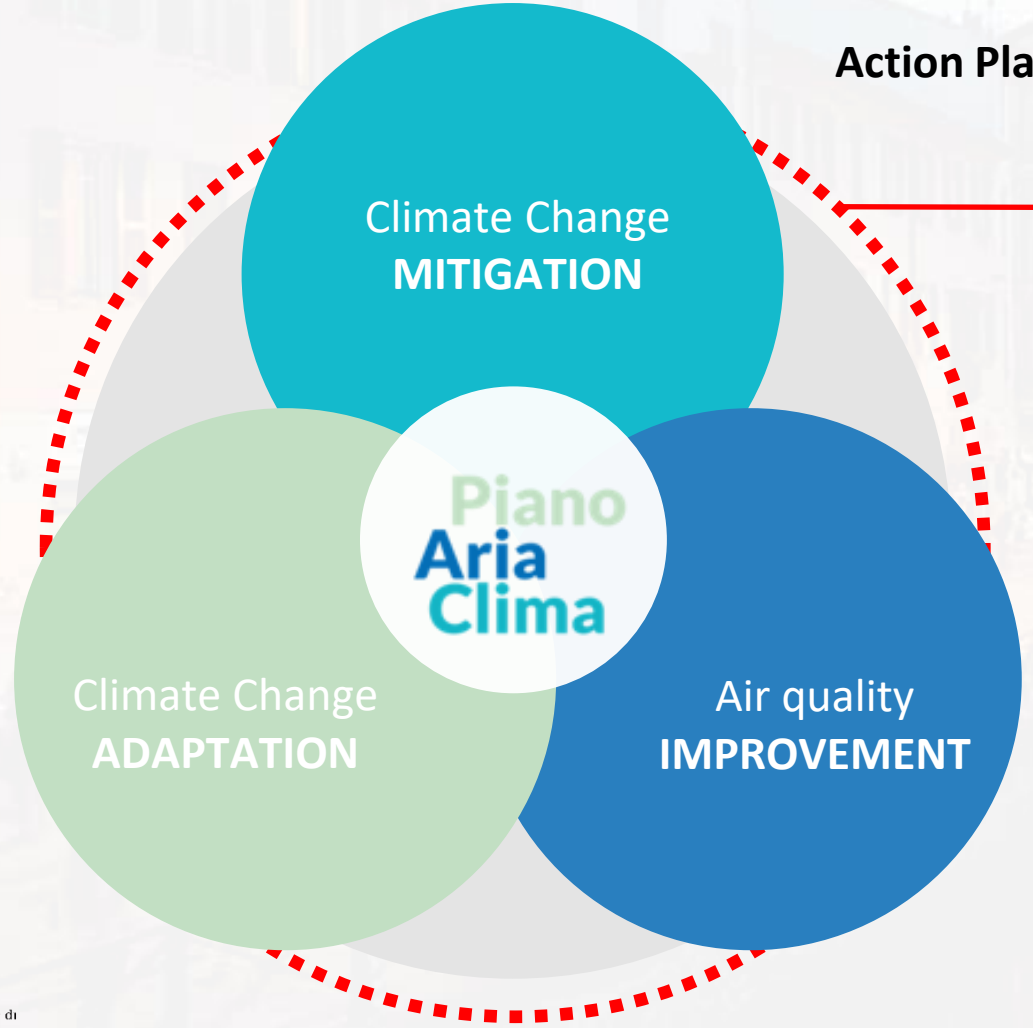
OUTPUT

The outcome of the process is the update of the strategic documents that generated the vision, as well as the creation and adoption of additional documents that improve the integration of resilience into the city's plans.

Comune di Milano

Air and Climate Plan

Adopted the February, 21st 2022



Action Plan adopted voluntarily by the local Administration to face the climate crisis and improve air quality.

A vision for **Milan by 2050**, where the **3 components** of the plan (mitigation, adaptation, air quality) integrate to **implement the environmental transition** process, combining social sustainability and equity.

Comune di Milano

5 Scopes for the Air and Climate Plan

The Plan provides 5 scopes and 49 actions to set the intermediate goals for 2030 and to reach carbon neutrality in 2050.

1_**INCLUSIVE MILANO**
a healthier, safer and fairer city

2_**SLOW MILANO**
a city that moves in a fluid, flexible and sustainable way

3_**POSITIVE ENERGY MILANO**
better and lower use of energy

4_**COOL MILANO**
A city that cools down

5_**INFORMED CITIZENS**
shared aims

Comune di Milano

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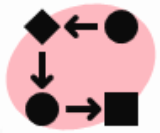

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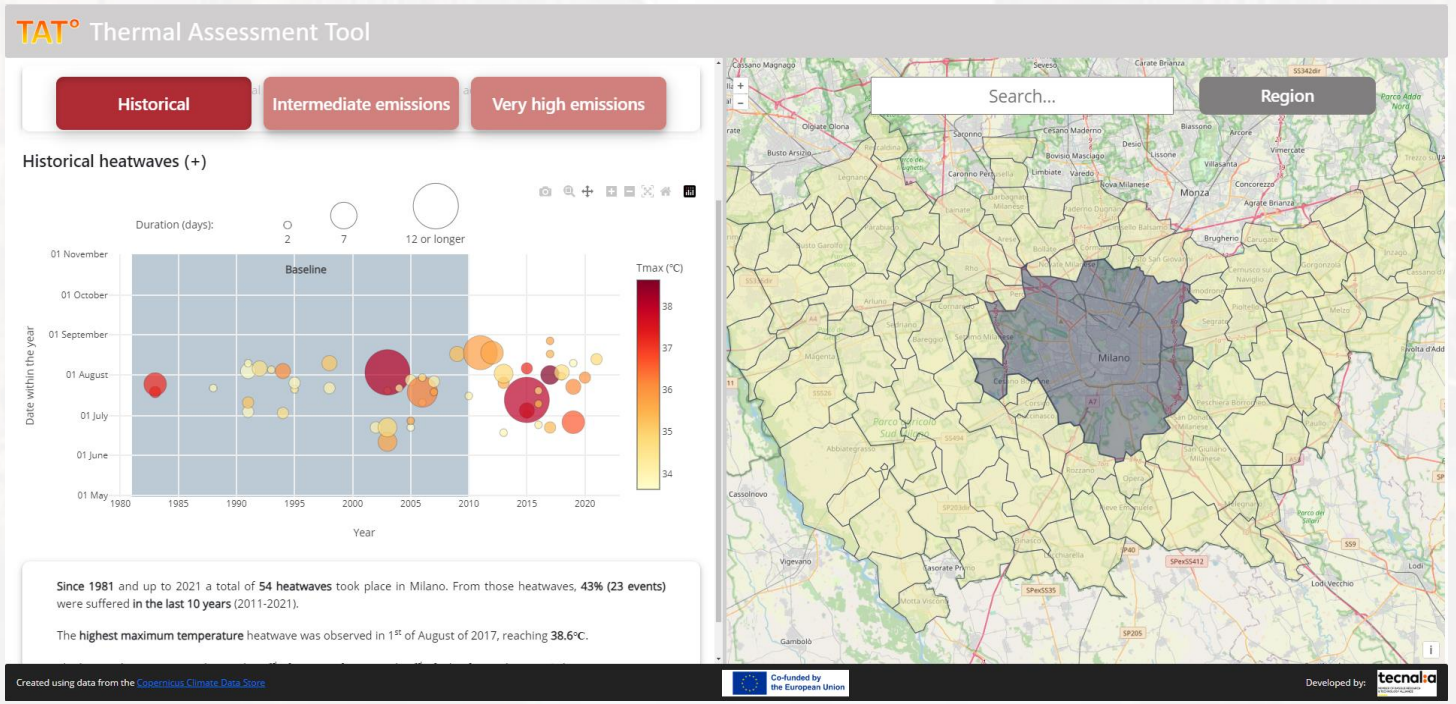
Comune di Milano

Internal workshops and co-design processes

Through participation in local and international projects, the Department acquires the tools and resources to conduct internal workshops aimed at:

- Identifying and resolving the obstacles to the implementation of resilience
- Mapping ongoing activities that can be related to resilience
- Offer a new resilient-perspective on existing plans and projects
- Prioritize areas exposed to high climate risk for urban development plans and regeneration interventions.



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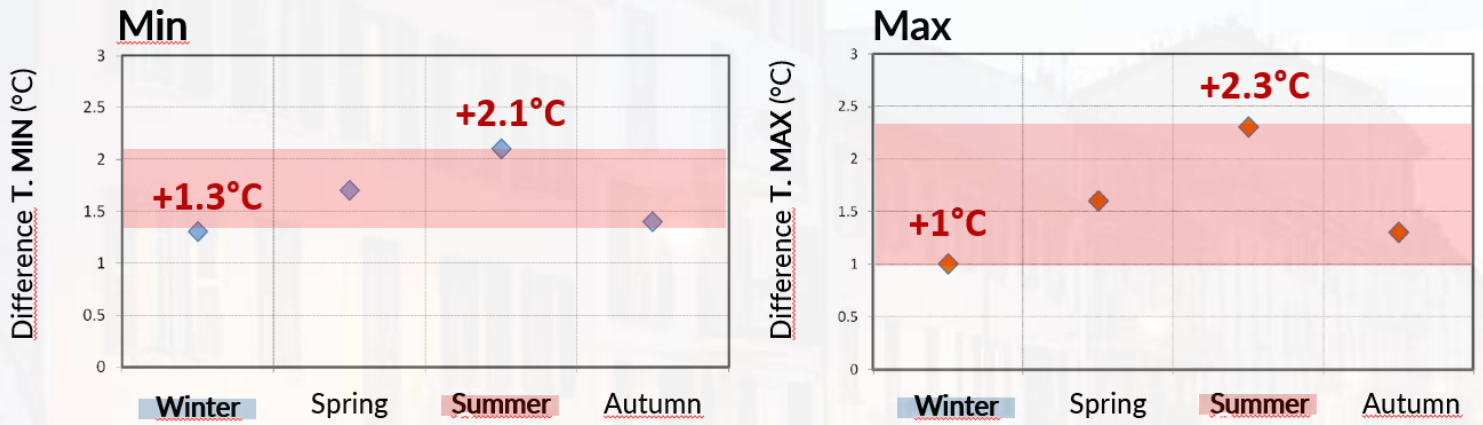
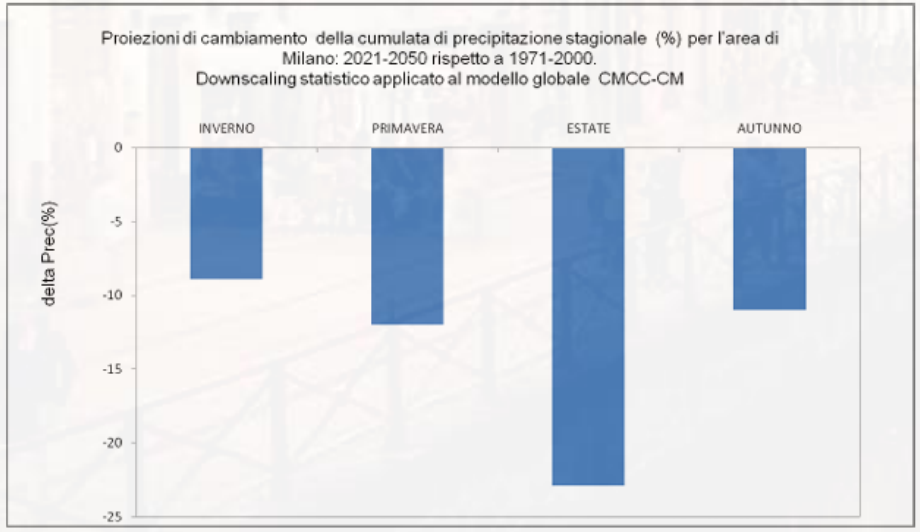
Local Climate Profile

Study of future climate change over the period 2021-2050 compared to the period 1971-2000.



Seasonal temperature change projections for the Milan area: Ensemble Mean of the CCAReg model applied to the CMCC-CCM, MPI, CNRM global models; RCP4.5 scenario.



Scenarios of change in seasonal precipitation cumulative (%): period 2021-2050 compared to the period 1971-2000, emission scenario RCP4.5; Milan area.

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Citizen engagement

- The **Permanent Citizens' Assembly on Climate** is a civic participation body that engages citizens and involves them in activities and workshops related to Municipal climate change policies, air quality and ecological transition.

- **Climate story on heat waves in Milan** is an interactive digital tool - developed by REACHOUT H2020 project - that aims to illustrate how heat will impact everyday life in the city and communicate the urgency of taking action.

- **Climate Campaigners app** – developed by CAMPAIGNers H2020 project – helps the Municipality promote carbon-friendly lifestyles among citizens, contributing to climate change mitigation.

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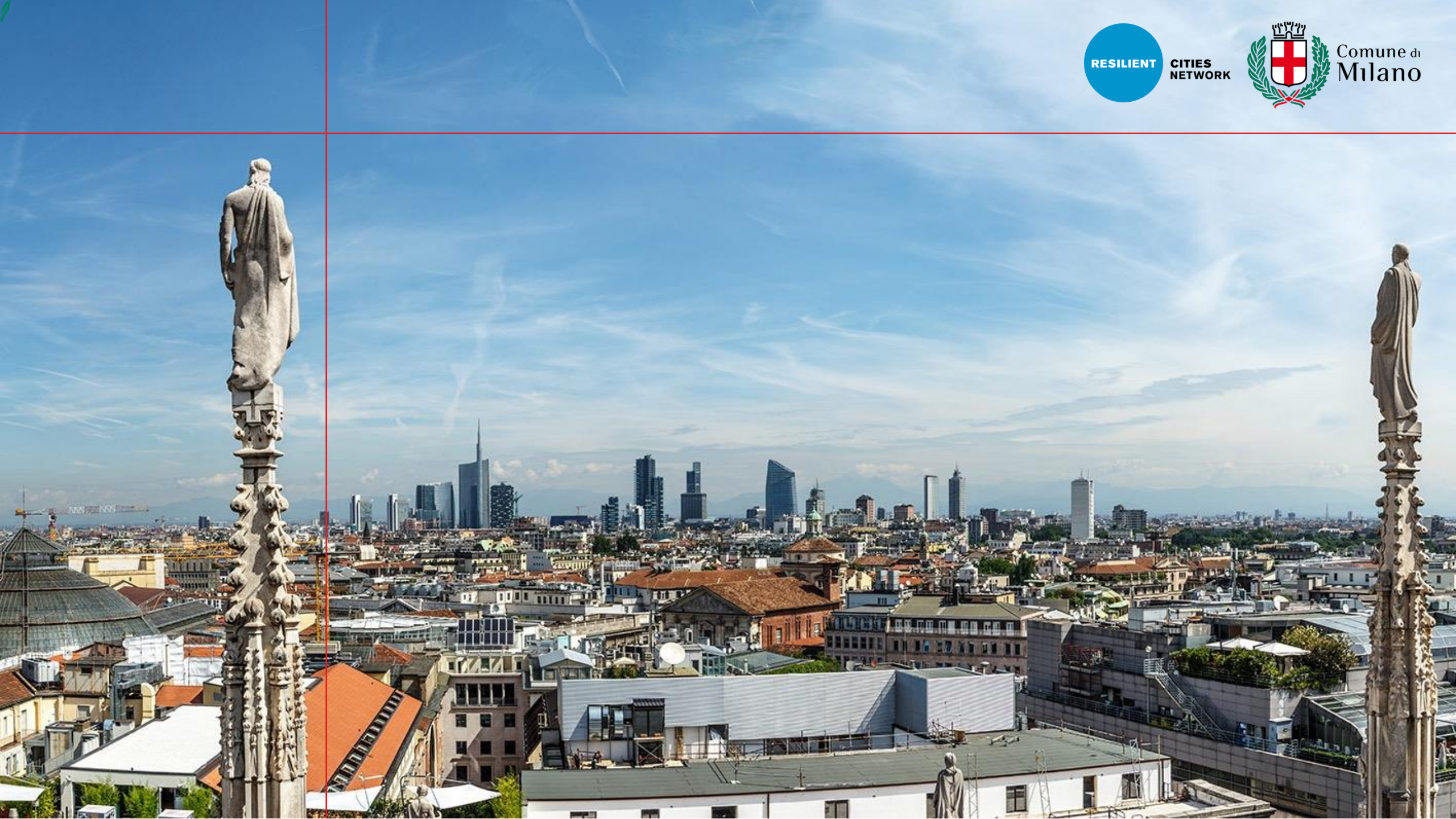
RESILIENT
CITIES
NETWORK
Comune di
Milano

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Urban Adaptation Challenges

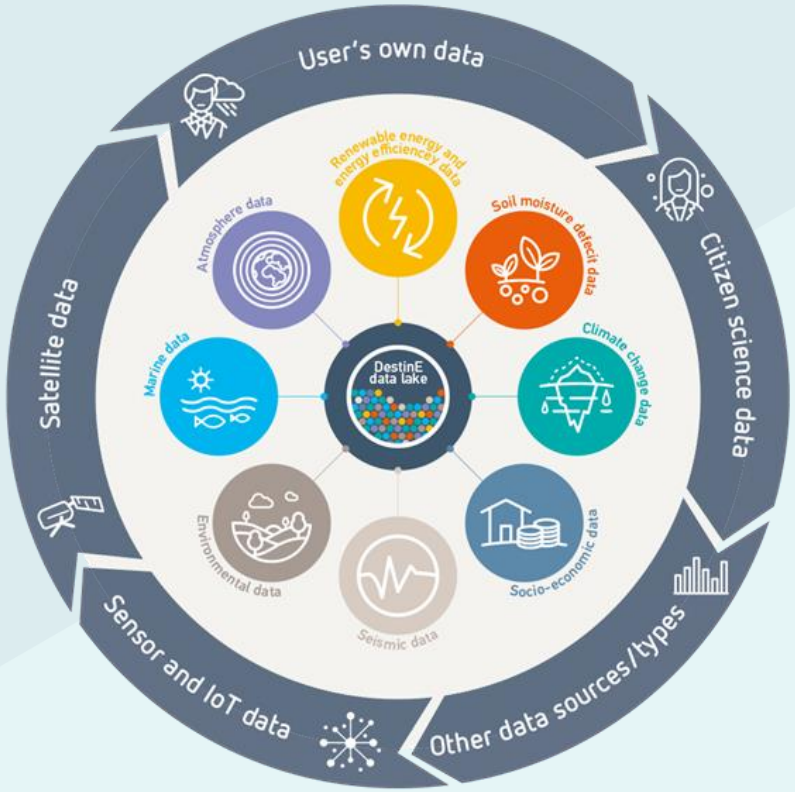
TECNALIA

March 12th, 2024

Nieves Peña

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036599.

Challenge #1. Data availability and integration



Policy context
Governance

CityHubs
Shaping ambitions, enabling analysis and guiding action

Promoting interoperability and usability of existing datasets, tools and climate services

Funded by the European Union
Destination Earth
IMPLEMENTED BY EUMETSAT

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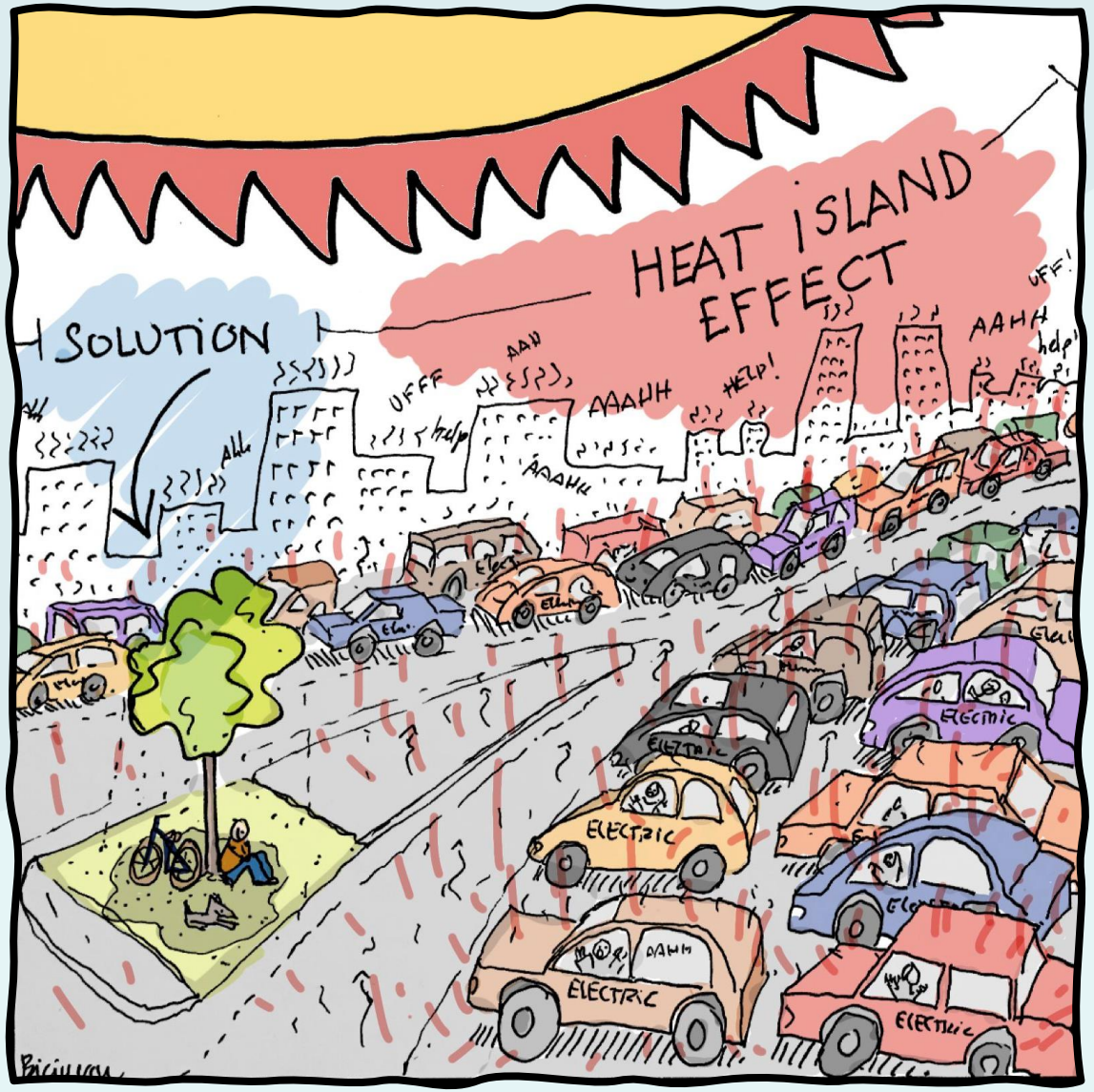
Challenge #2. Mainstreaming adaptation



- ✓ Mobility
- ✓ Urban development
- ✓ Secure, sustainable and affordable energy
- ✓ Equity and social justice
- ✓ Ecosystem health
- ✓ Sustainable Development
- ✓ Mitigation (emission reduction targets)

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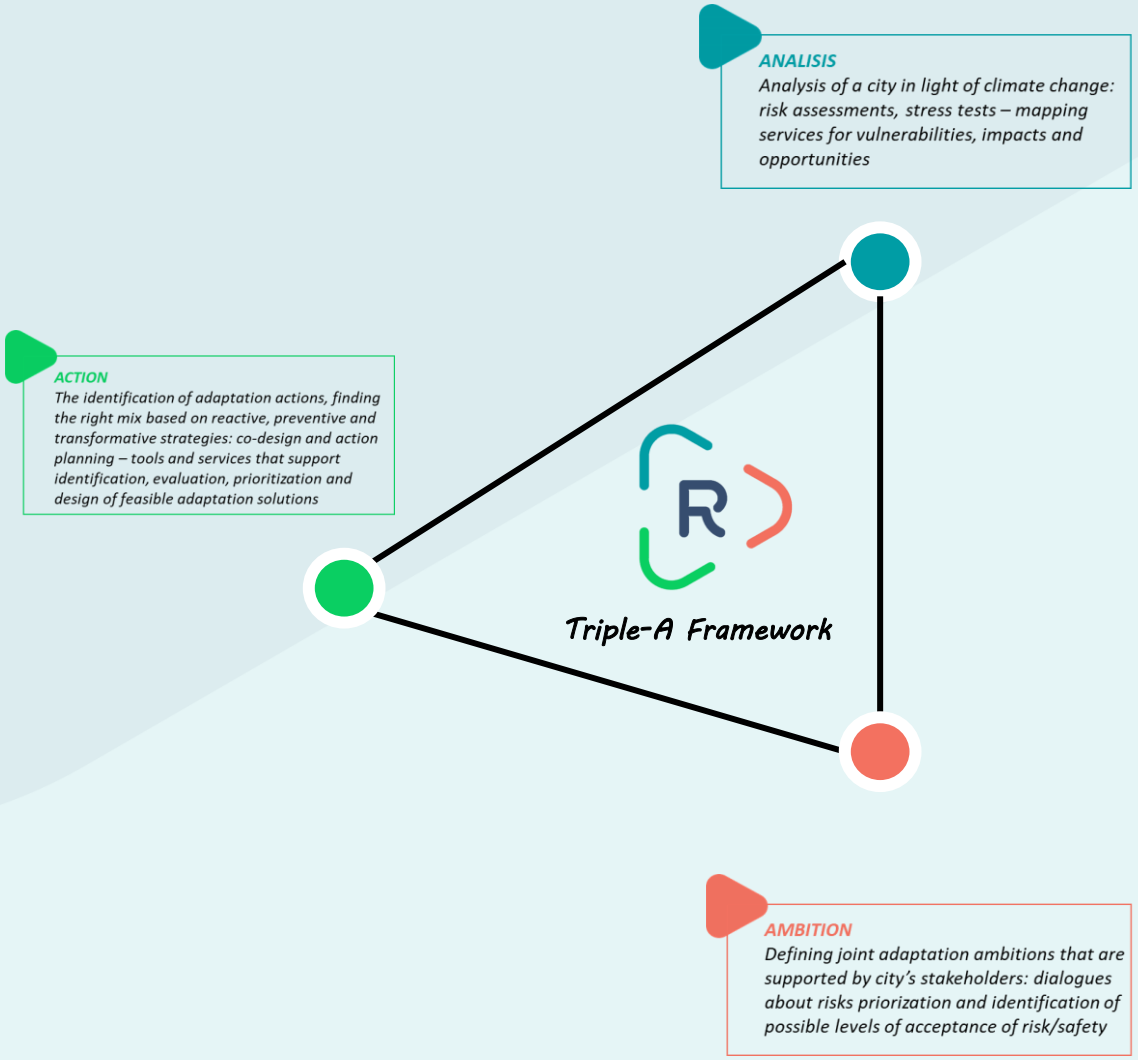
Challenge #3. REACHOUT Adaptation Framework



- to empower urban decision makers and support regional stakeholders in all steps of the adaptation cycle.
- to provide also a way to integrate adaptation across diverse policy areas.
- to provide cities with the necessary resources to accelerate urban adaptation to climate change.

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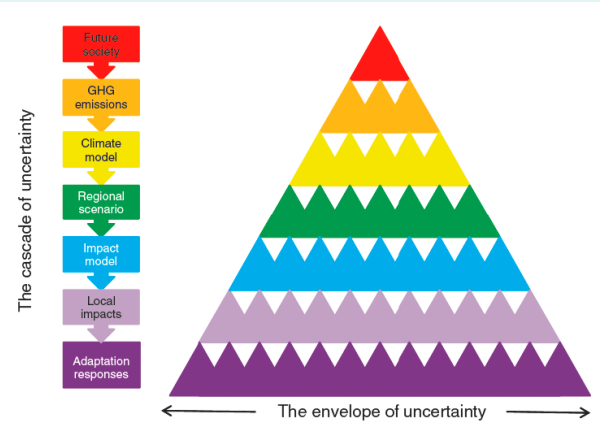
Challenge #4. Adaptation Pathways

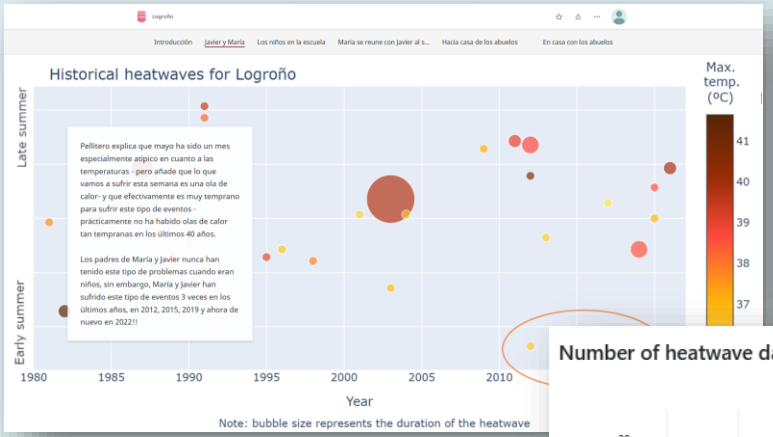
What to do?
Not too much or too little

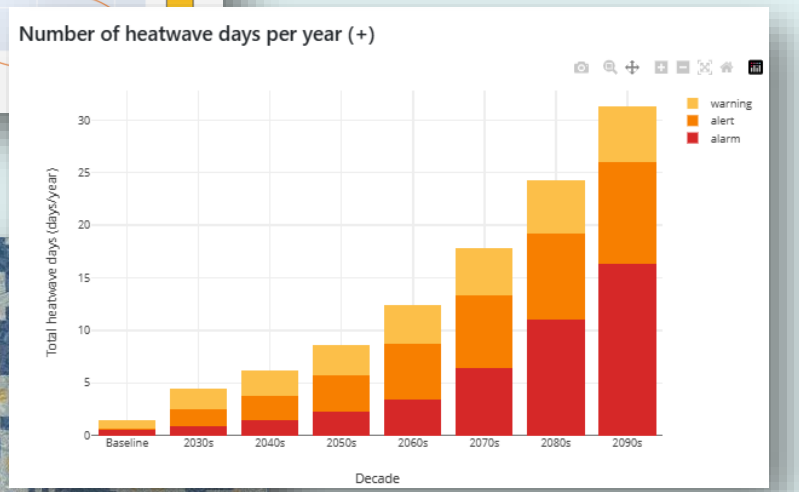
When to do it?
Not too early or too late

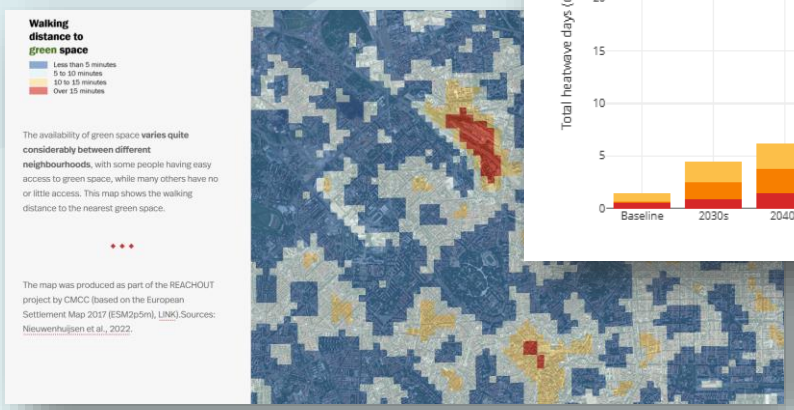


Challenge #5. Easy-to-use climate services

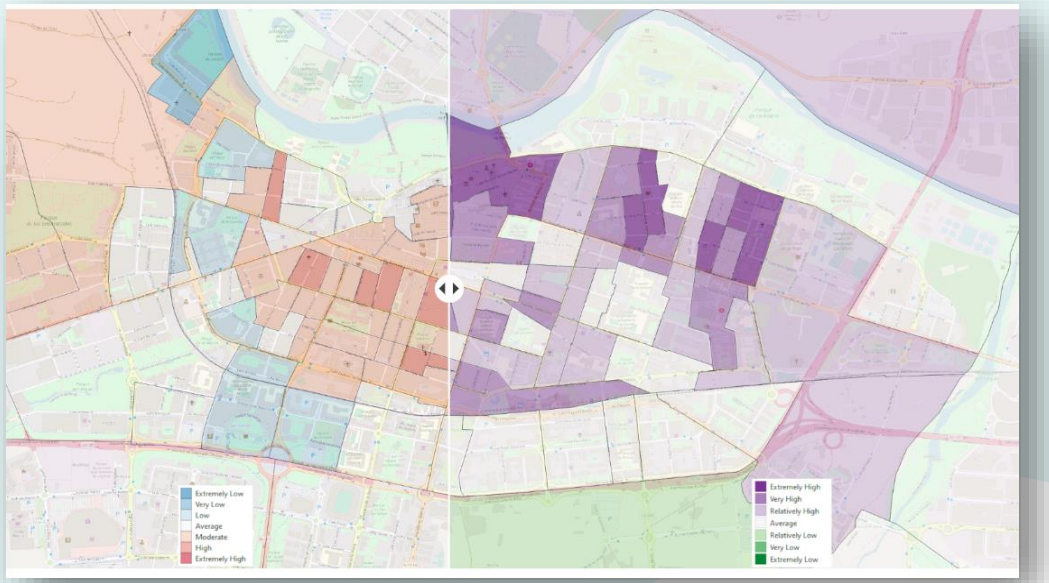
User-friendly representation







to support decision-making



Tailored and user-oriented **climate services**

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Challenge #6. Governance

Making climate adaptation a top political priority

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Thank you for attention!!

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reachout-cities.eu

SaferPlaces Global Platform

AI/EO-based Digital Twin Solution for Flood Risk Intelligence in Urban Areas

Climateurope2

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SaferPlaces

Our partners

eit Climate-KIC

Co-funded by the European Union

cmcc Centro Euro-Mediterraneo sui Cambiamenti Climatici

MEEO Meteorological Environmental Earth Observation

POLITÉCNICA

GFZ Helmholtz Centre Potsdam

ibh WASSER UMWELT INFRASTRUKTUR

opernicus masters

esa

NVIDIA. INCEPTION PROGRAM

AZO Space of Innovation

aws activate

THE PROBLEM

SaferPlaces

Are we ready to face the next flood event?

$651 B

Global economic losses (UNDDR)

THE PROBLEM

SaferPlaces

Current Market and Tech Gaps Flood Risk Intelligence

High-resolution data gaps

- Uneven global coverage

Complex tools for selected experts

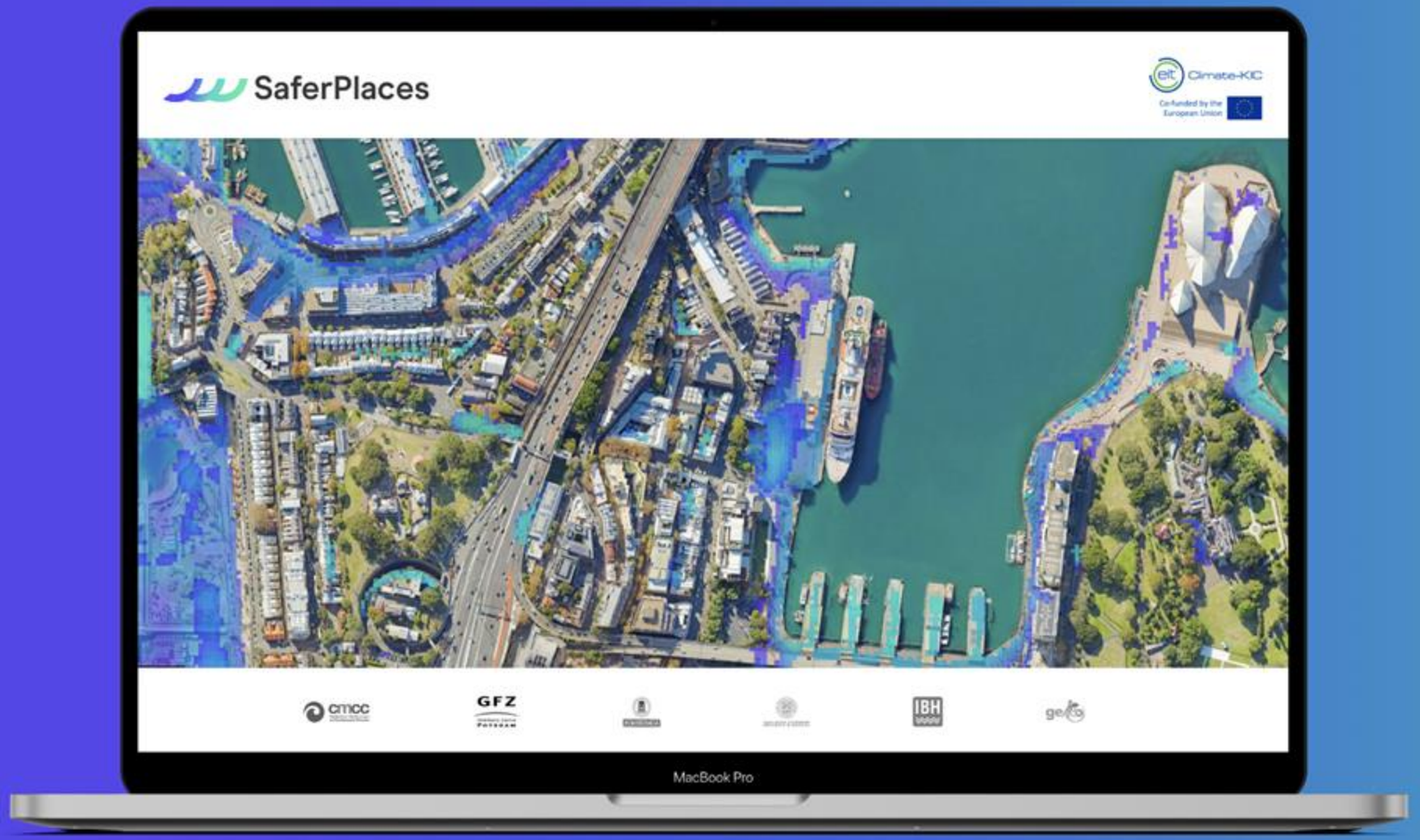
- Cost, time and CPU-intensive Solutions
- Highly skilled professionals

Static view of flood risk

- No dynamic climate and mitigation scenarios

The Solution

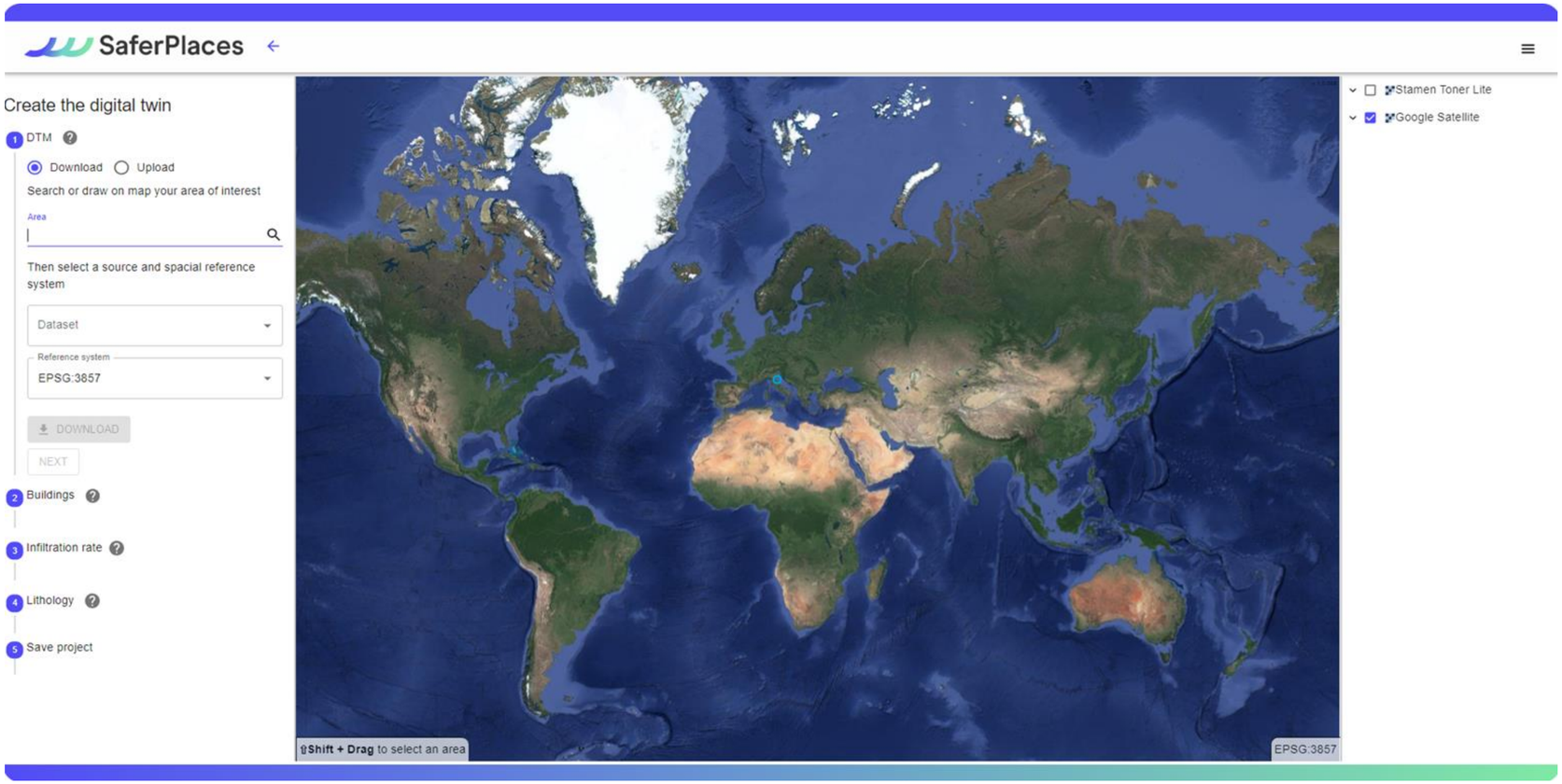
Digital Twin Solution

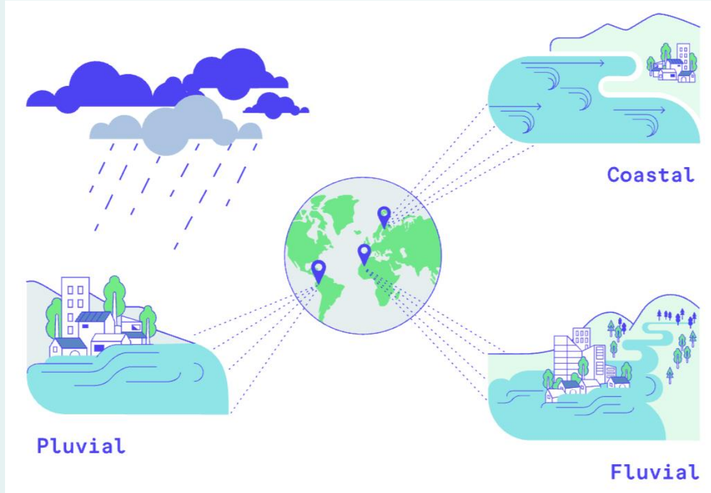


THE SOLUTION

SaferPlaces

Global Platform for Flood Risk Intelligence





SaferPlaces Teaser Video

Activation: 5 easy steps in less than 5 minutes

THE SOLUTION

Multiple flood and climate scenarios

- What can SaferPlaces do?
- Deploy cost-effective flood risk data **at parcel level with global coverage**
- Support Design of **adaptation and mitigation strategies** for a resilient city (add water barriers and tanks, change soil permeability)
- Support flood risk **early warning**

USE CASE

Design of Rimini’s “Sea Park”

Year 2050
Coastal Flooding Extension & Associated Damages

Without Parco del Mare (left) and with “Parco del Mare” (right)

- Nature-based solution
- Preventing and mitigating coastal flood risk
- Cost-benefit analysis
- Quantification of the avoided damages: **€32 M**

USE CASES

Supporting Early-Waring for Emilia-Romagna Civil Protection

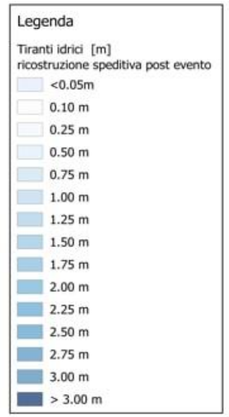
- Comparison between the high probability flooding areas predicted by SaferPlaces and the actual flooded areas in Cesena Municipality.

- During May 2023, in just under 20 days, as much rain as is usually seen in a year has fallen in Emilia-Romagna, originating floodings of unprecedented magnitude, within two weeks from each other.

SaferPlaces

Alluvione del 16-17 maggio 2023 a Cesena
Quartiere Oltresavio

Ricostruzione speditiva post evento



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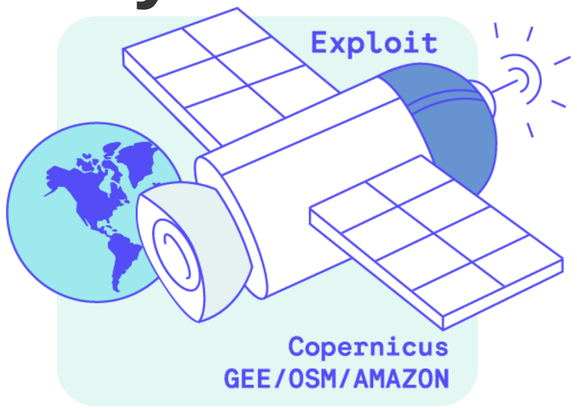
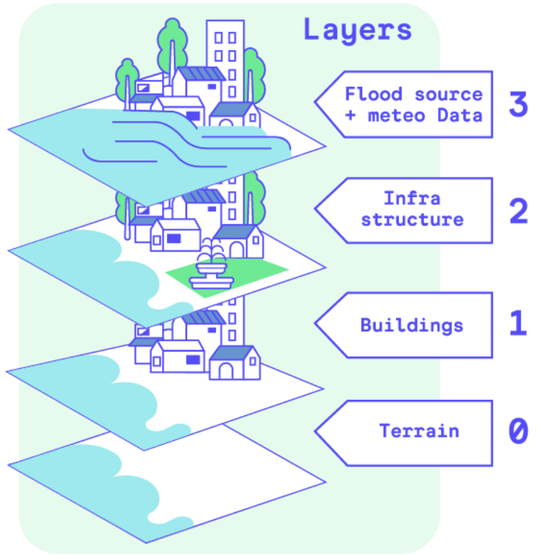
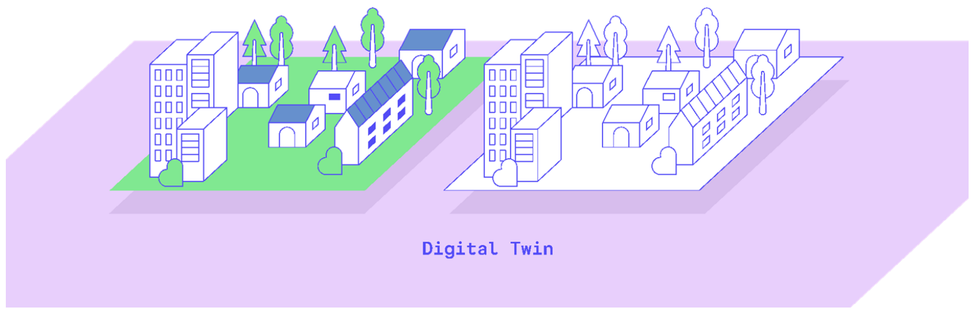
SaferPlaces
www.saferplaces.co

THE SOLUTION

High Resolution Digital Twin of the City



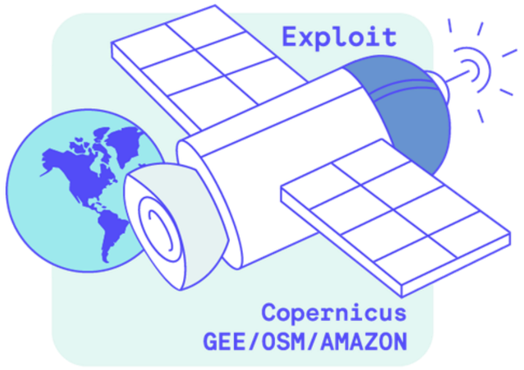


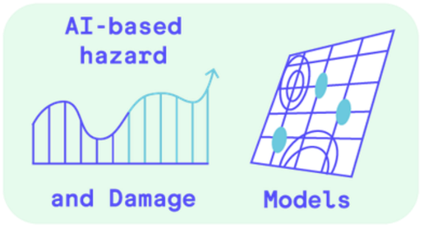


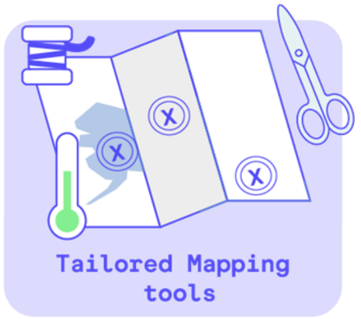
- High resolution geospatial, satellite and climate open data
  - Copernicus CDS
  - Sentinel
  - ESA
  - GEE,
  - OSM,
  - AMAZON,
  - Capella Space
- Both commercial and public satellite constellations
- Worldwide coverage
  - 90% US at 1 m
  - 100% US at 10m

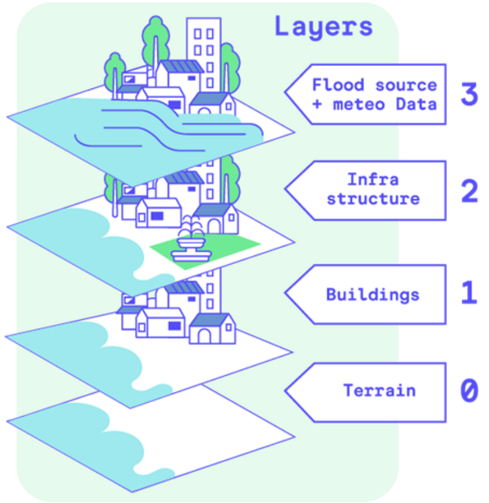
THE SOLUTION

AI-based Flood hazard and damage Models



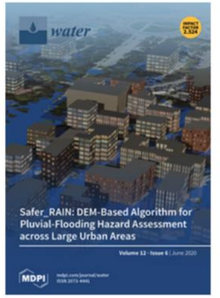






- Proprietary Innovative AI and physical-based flood hazard and damage models tailored for urban areas

- FULL LIST OF PUBLICATIONS



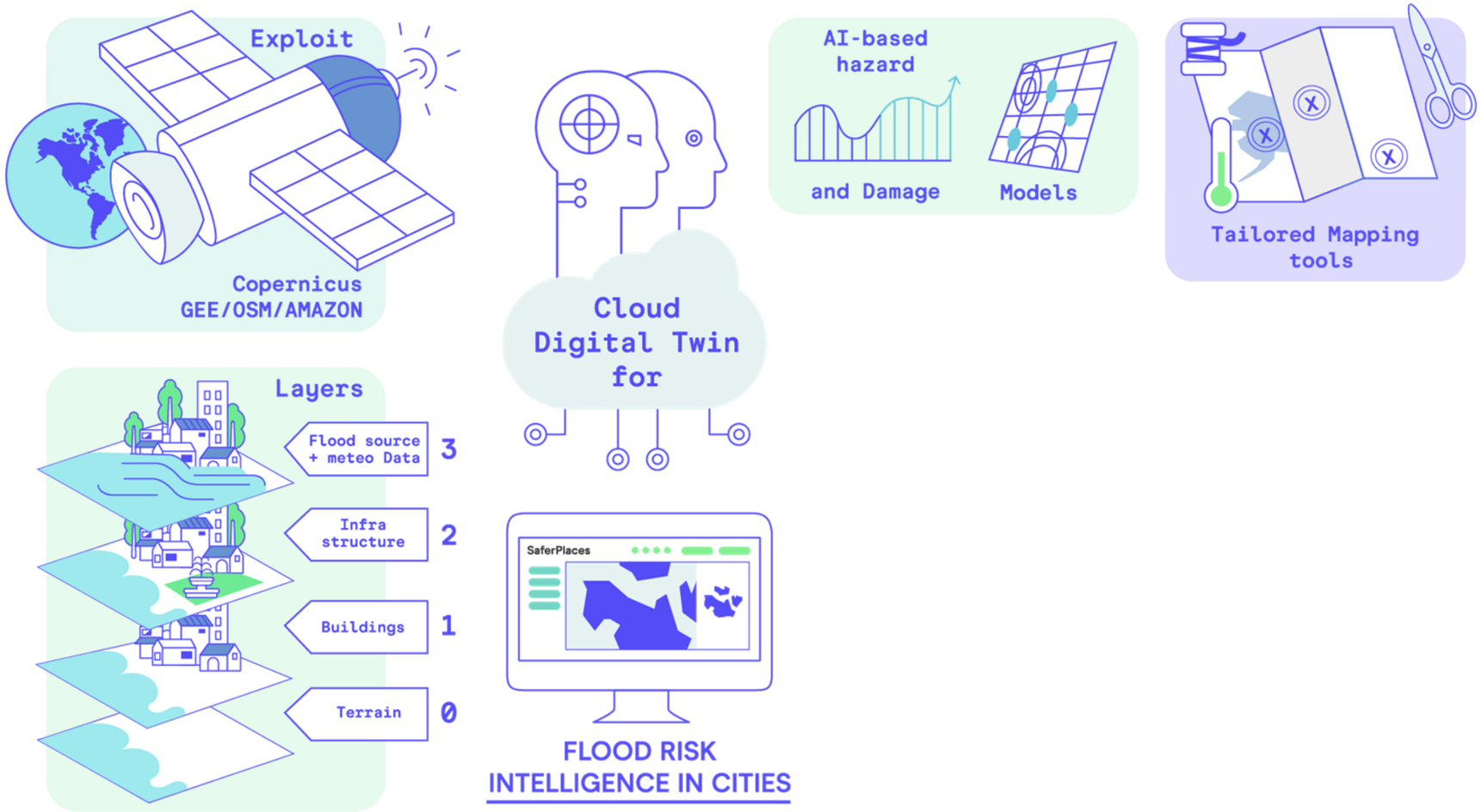
water

Safer_RAIN: A DEM-Based Hierarchical Filling-&-Spilling Algorithm for Pluvial Flood Hazard Assessment and Mapping across Large Urban Areas

Water, Volume 12, Issue 6 (June 2020)

THE SOLUTION

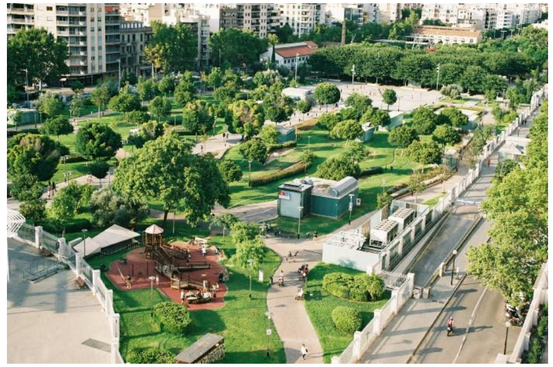
Scalable Powerful Cloud Computing

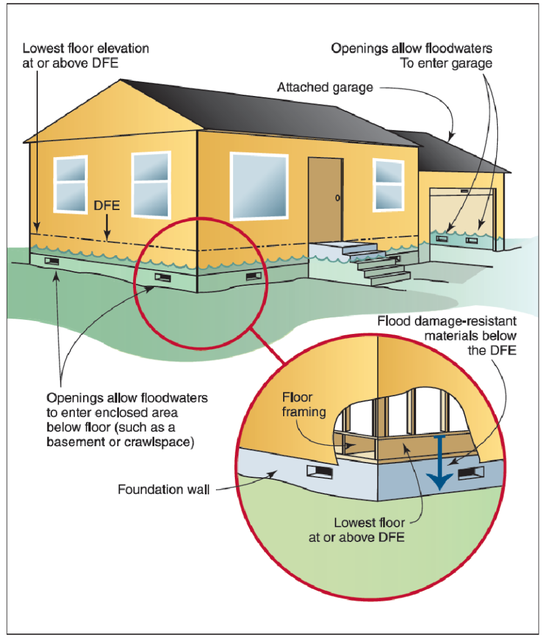


- **Cloud Based**
  Digital
  Twin for flood risk
  intelligence

SaferPlaces

Flood Adapation Models - SaferADAPT





- SaferADAP
  T

Flood Hazard Protection

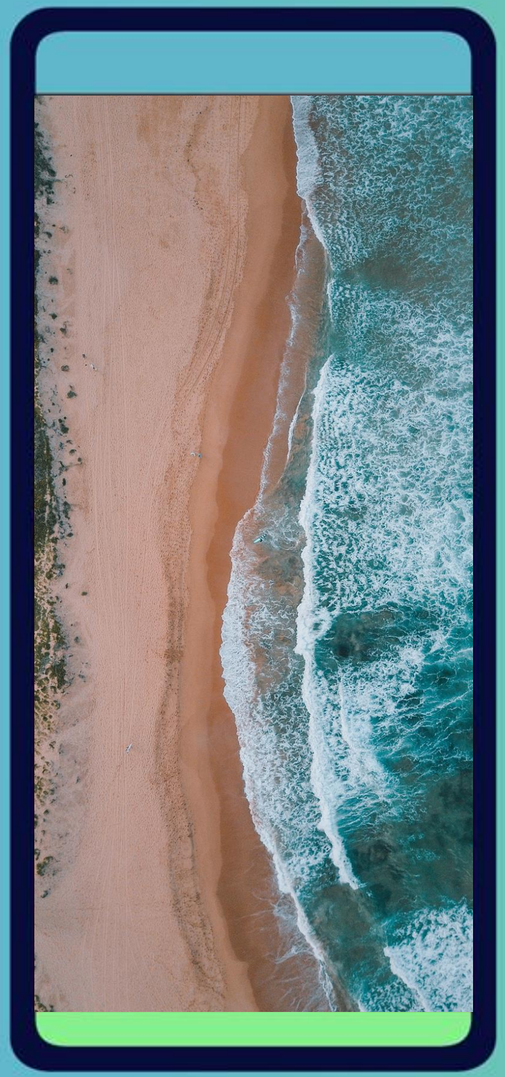
- Barriers (artificial dunes, levee)
- Sustainable (urban) drainage systems (SuDS)
- Infiltration ponds, green areas, permeable paving
- Green roof

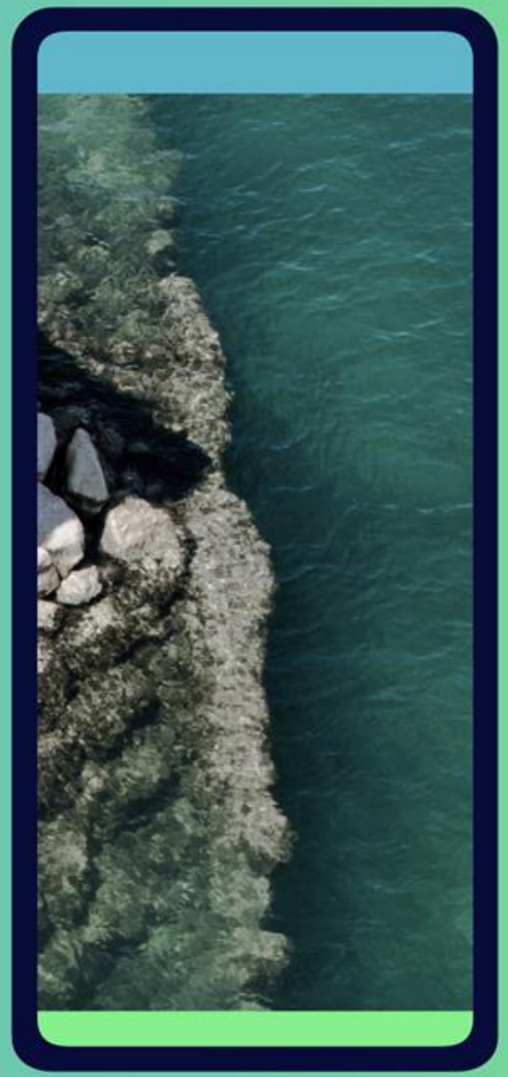
Building Flood Damage Protection

- Building dry/wet-proofing
- Building Flood barrier
- Adapted use of ground floor
- Vertical evacuation of assets
- Elevating the building

Case Studies

Rimini

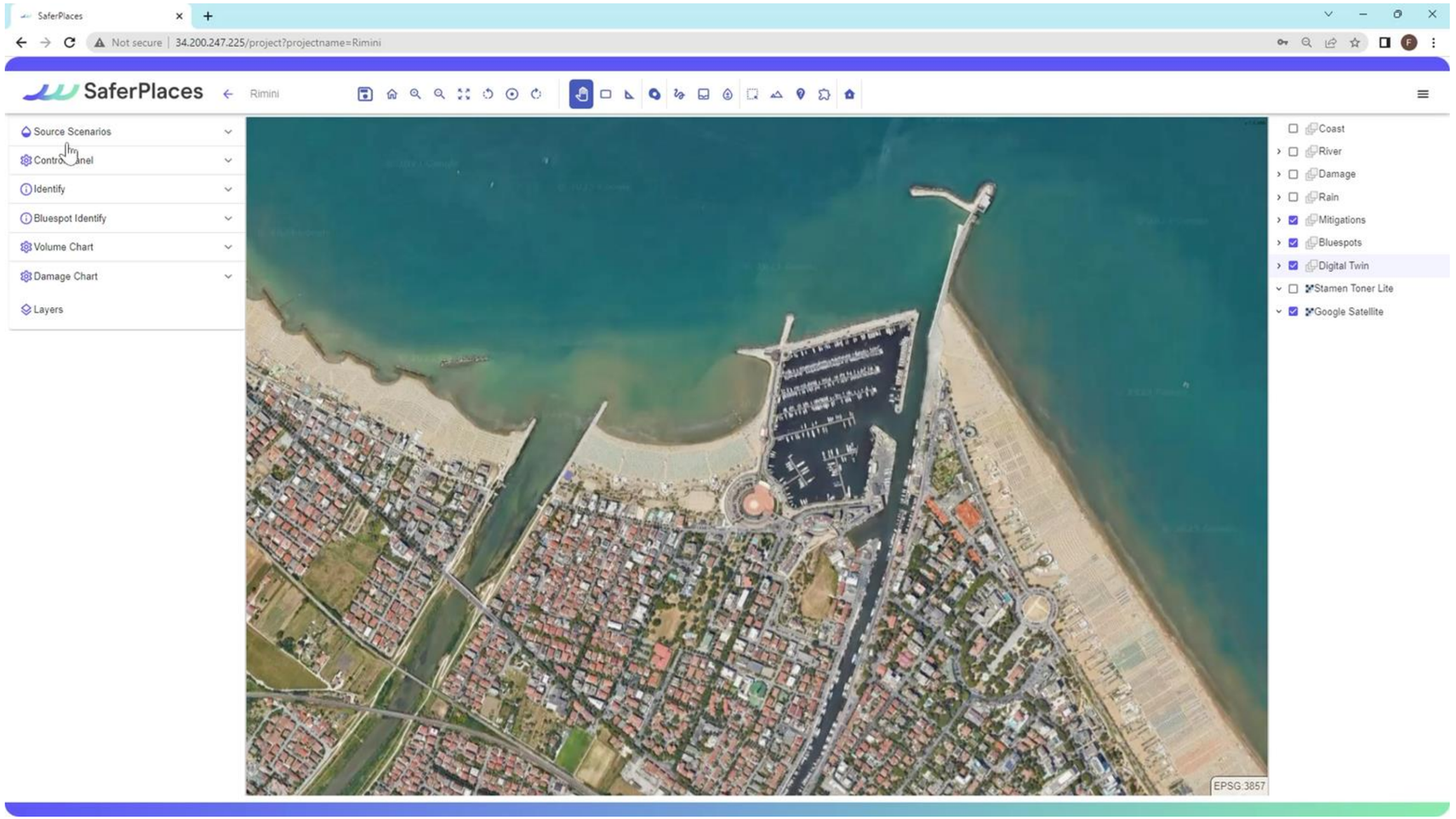




Parco del Mare
(Rimini)

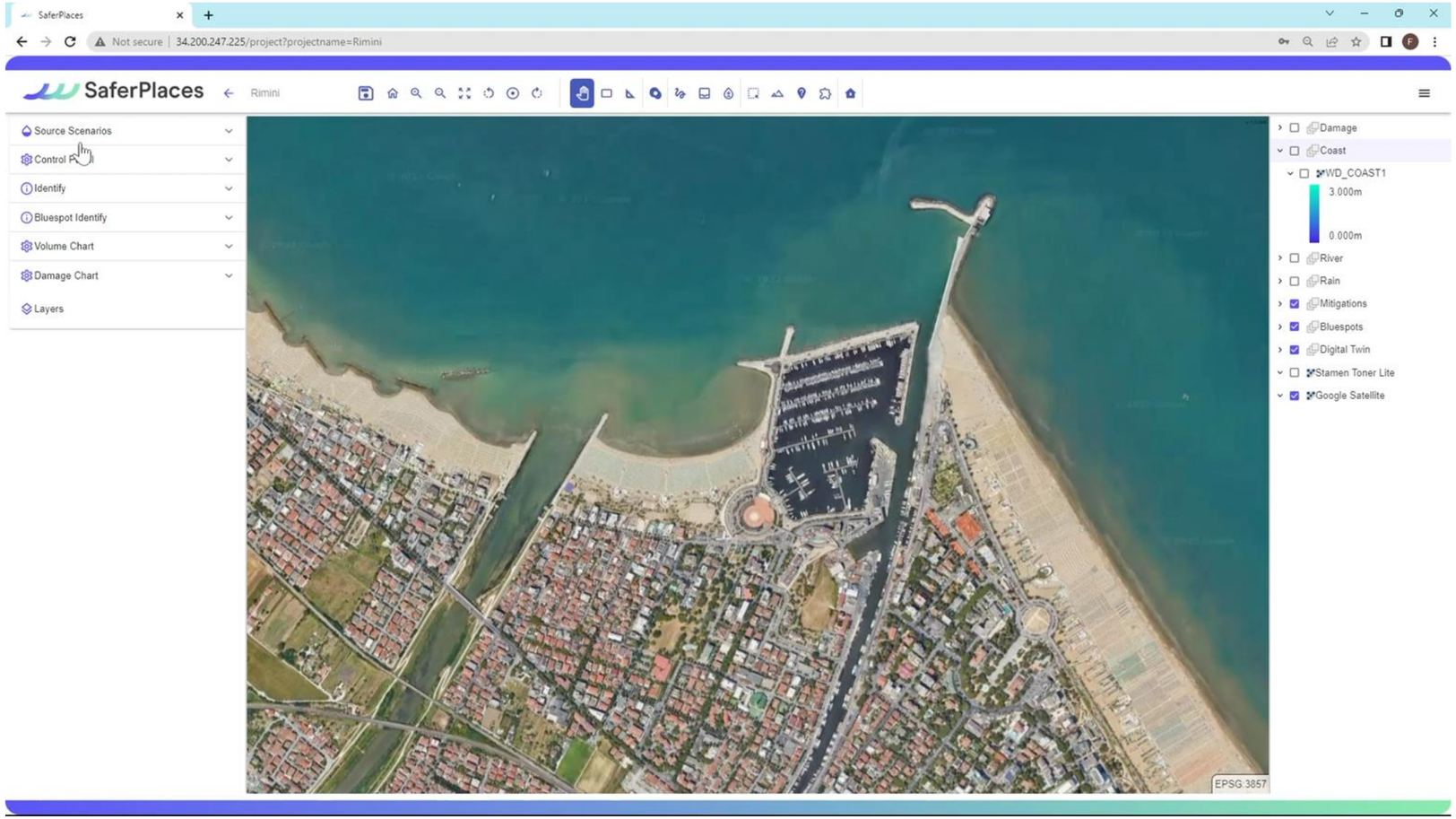
CASE STUDY

Case Study: Parco del Mare Rimini (Italy)



CASE STUDY

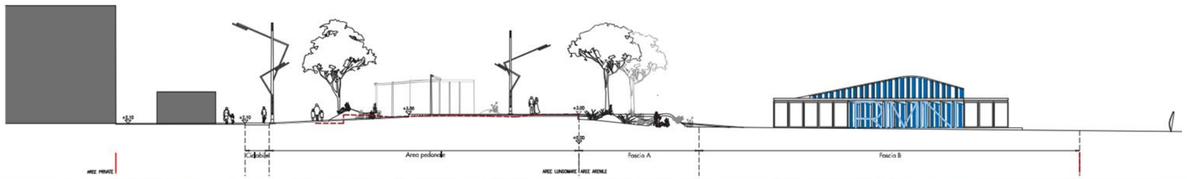
Case Study: Parco del Mare Rimini (Italy)

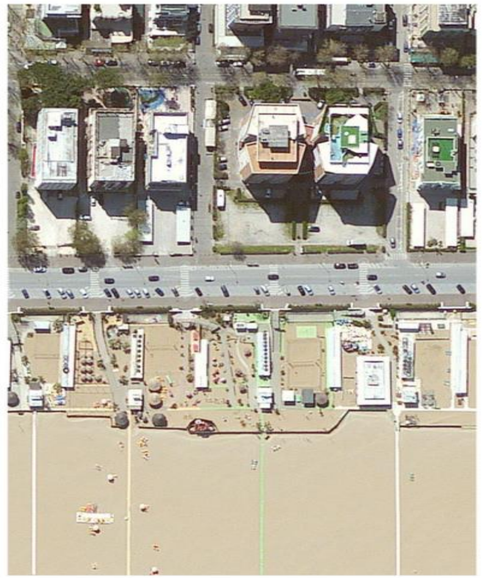


CASE STUDY

Case Study: Parco del Mare Rimini (Italy)

TRATTO 4





USE CASE

Design of Rimini’s “Sea Park”

Year 2050
Coastal Flooding Extension & Associated Damages

Without Parco del Mare (left) and with “Parco del Mare” (right)

- Nature-based solution
- Preventing and mitigating coastal flood risk
- Cost-benefit analysis
- Quantification of the avoided damages: **€32 M**

CASE STUDY

SaferPlaces

without Parco del Mare

with Parco del Mare

CASE STUDY

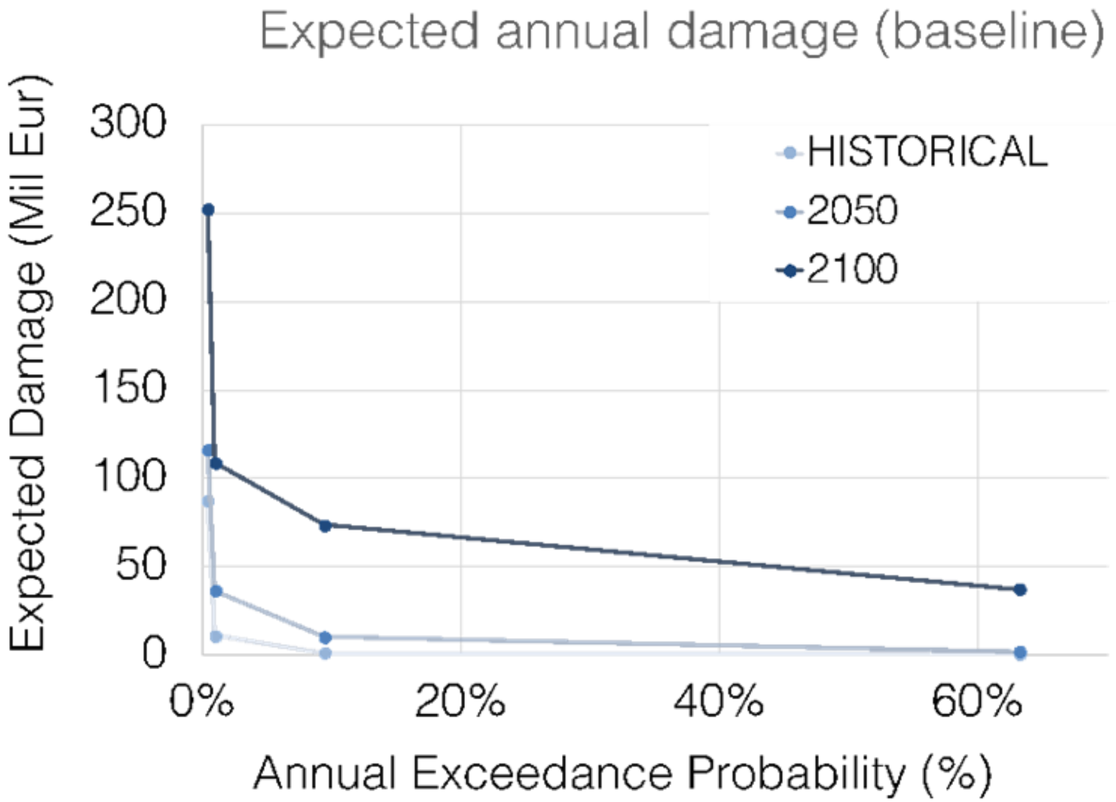
SaferPlaces

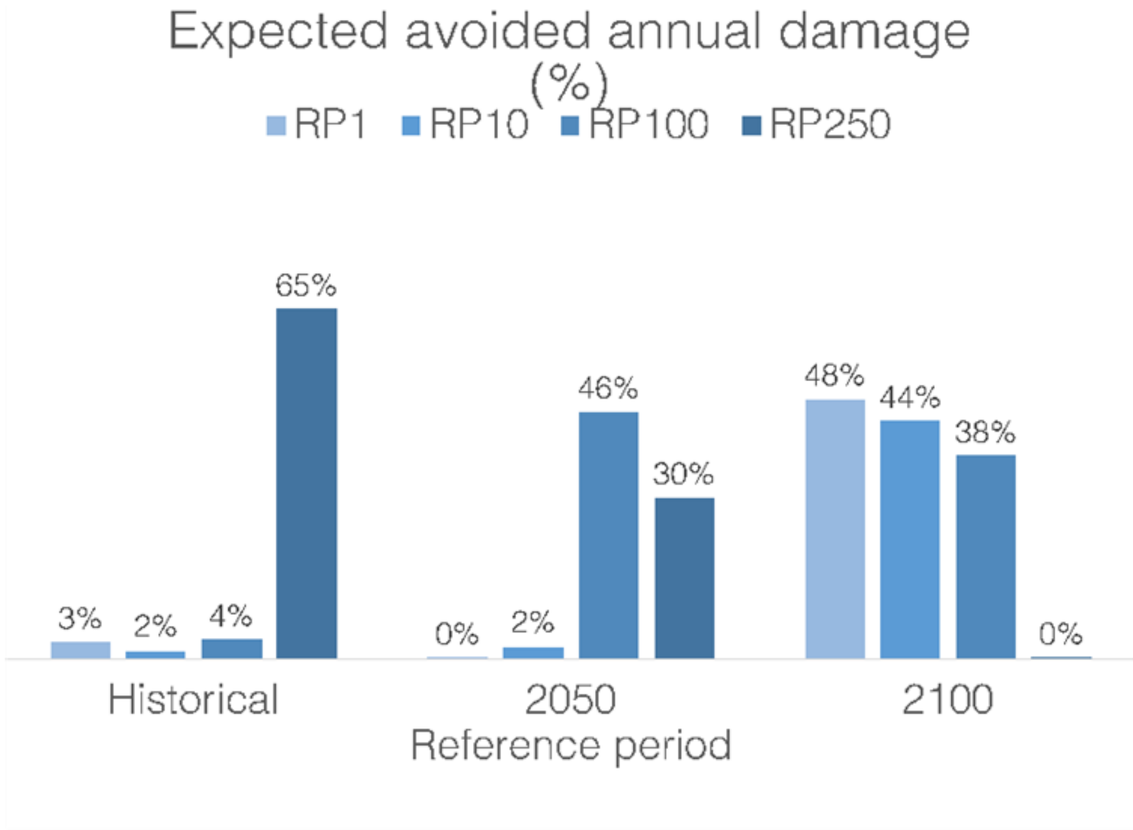
Rimini with Parco del Mare

CASE STUDY

SaferPlaces

Rimini with Parco del Mare



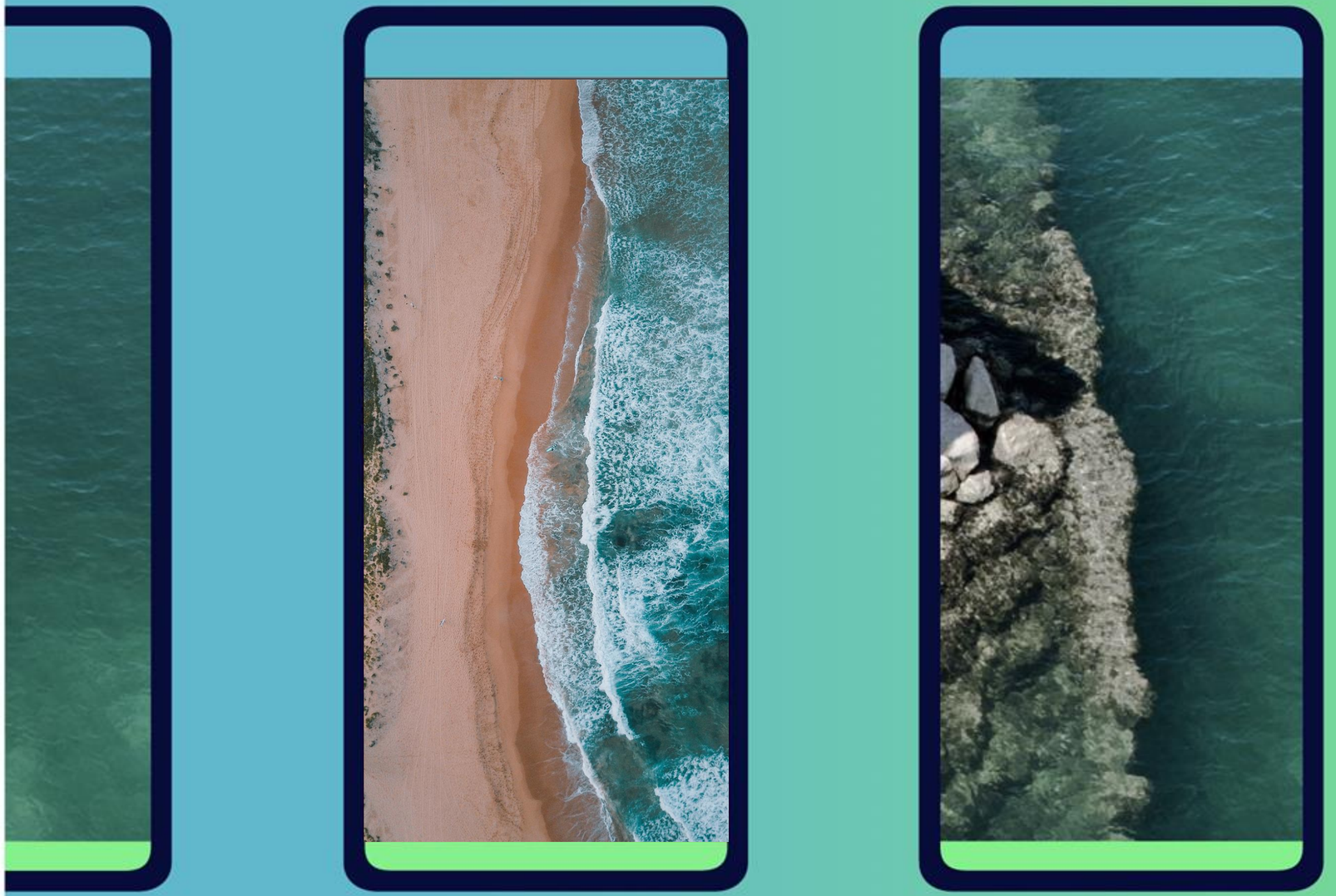


Case Studies

Rapid Flood Mapping

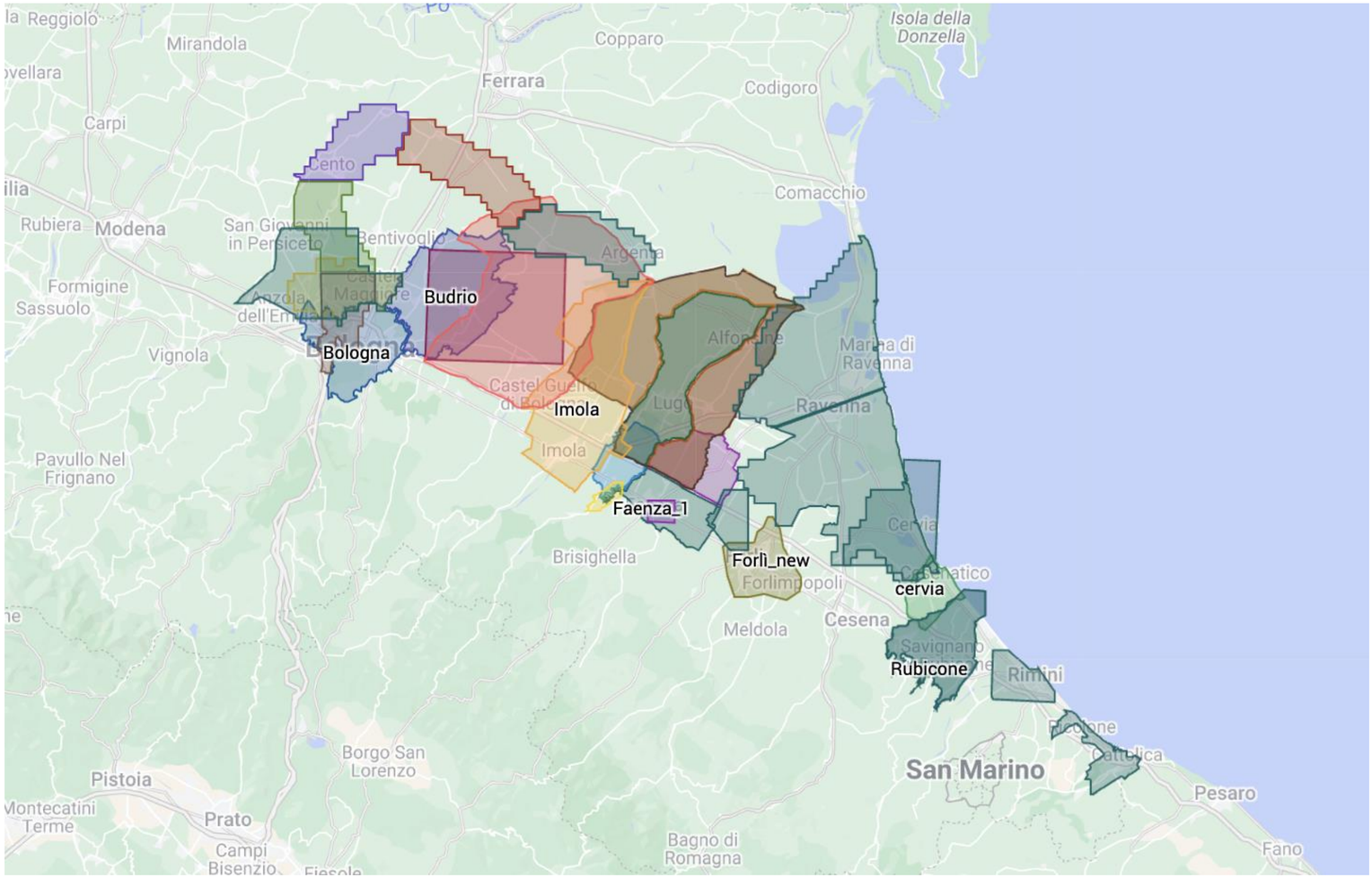
Emilia Romagna Event May 2023

Parco del Mare
(Rimini)



USE CASES

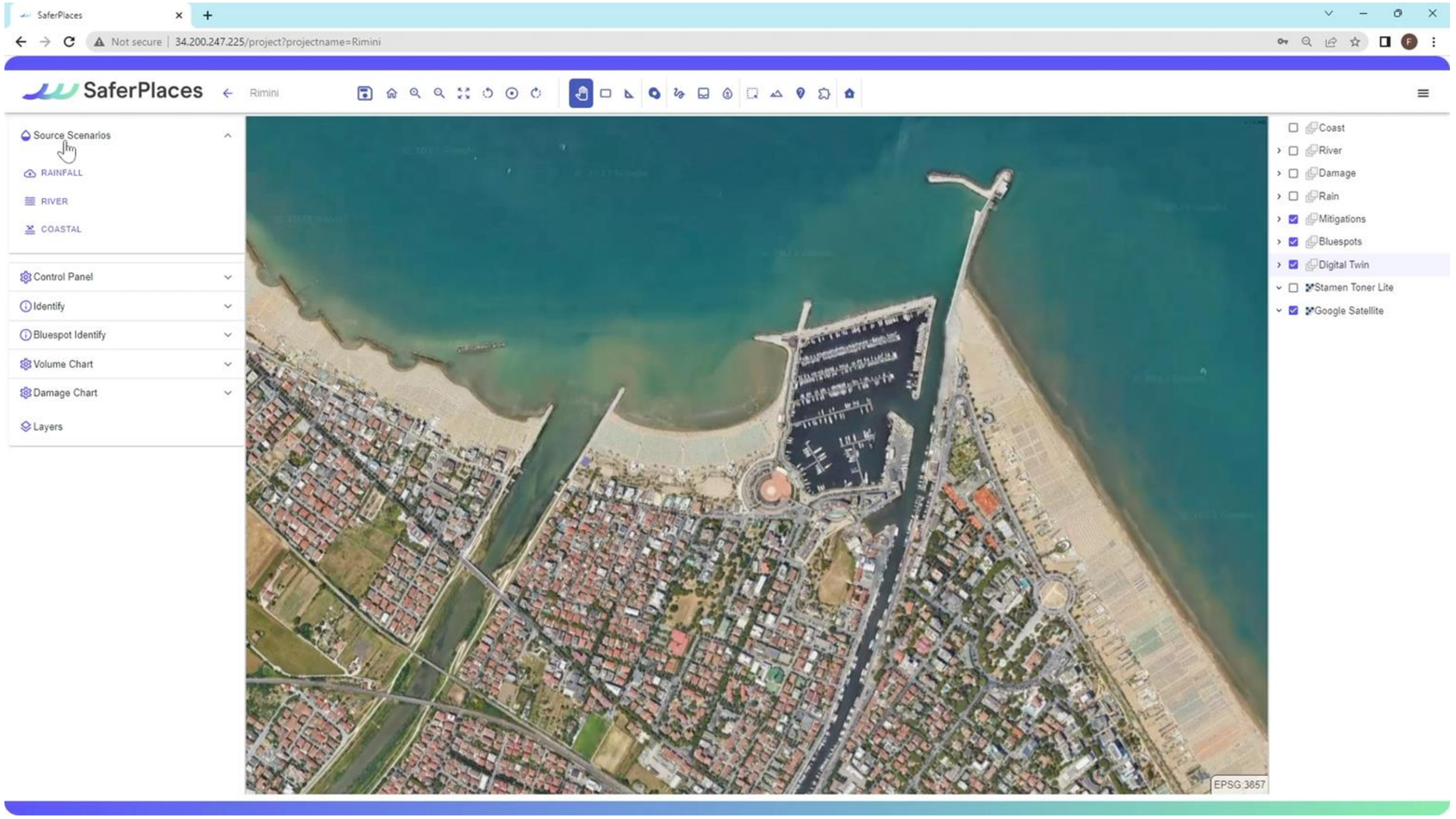
SaferPlaces Activation for Emilia Romagna Flood Event



- More than 20 areas activated.

USE CASES

Rapid Flood Mapping – River Flooding

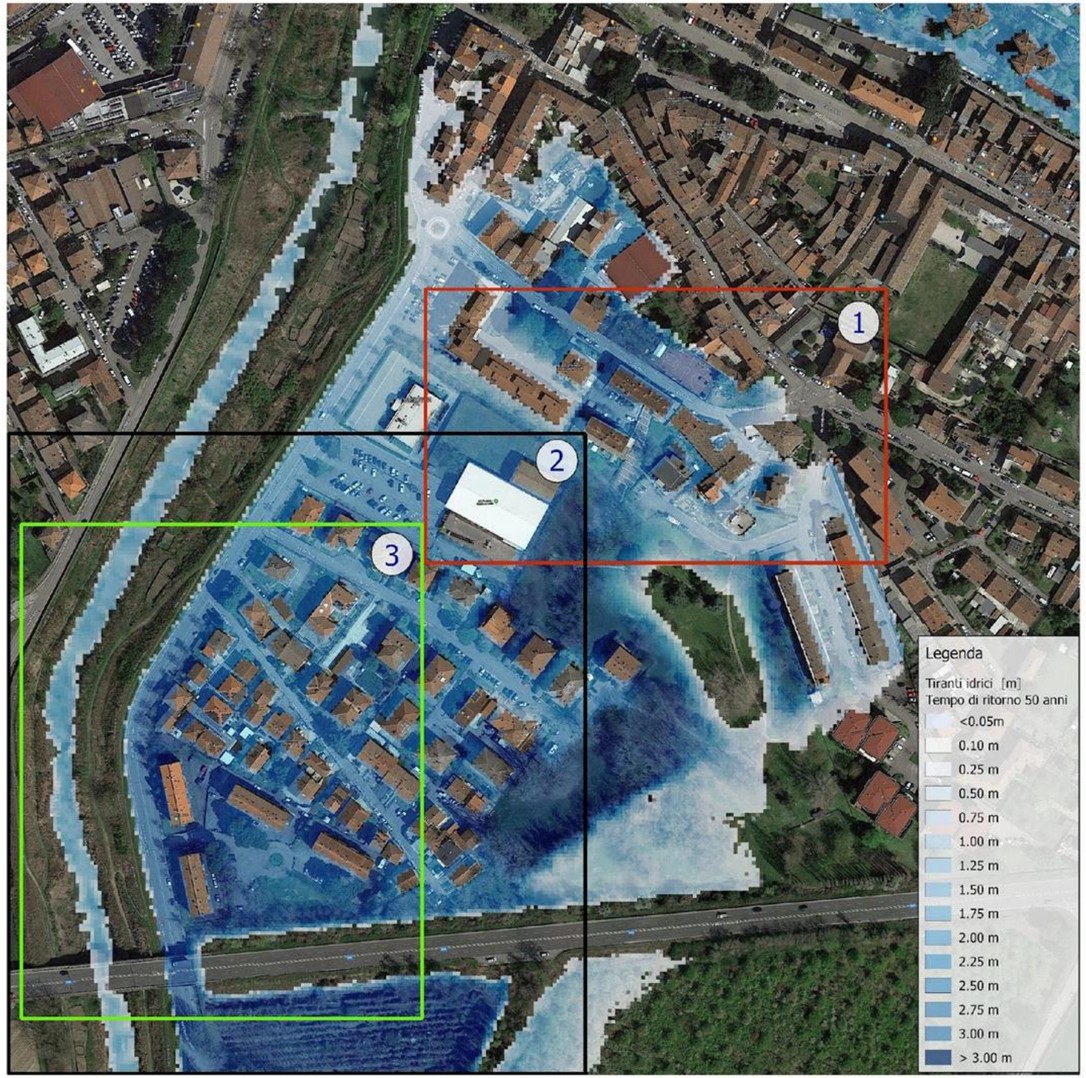


- Comparison between the high probability flooding areas predicted by SaferPlaces and the actual flooded areas in Faenza Municipality.

- The first days of May the region was hit by heavy rains that locally exceeded 150 mm in just 24 hours.

USE CASES

Supporting Early-Waring for Emilia-Romagna Civil Protection



SaferPlaces

Alluvione del 3 maggio 2023 a Faenza
località Borgo Durbecco

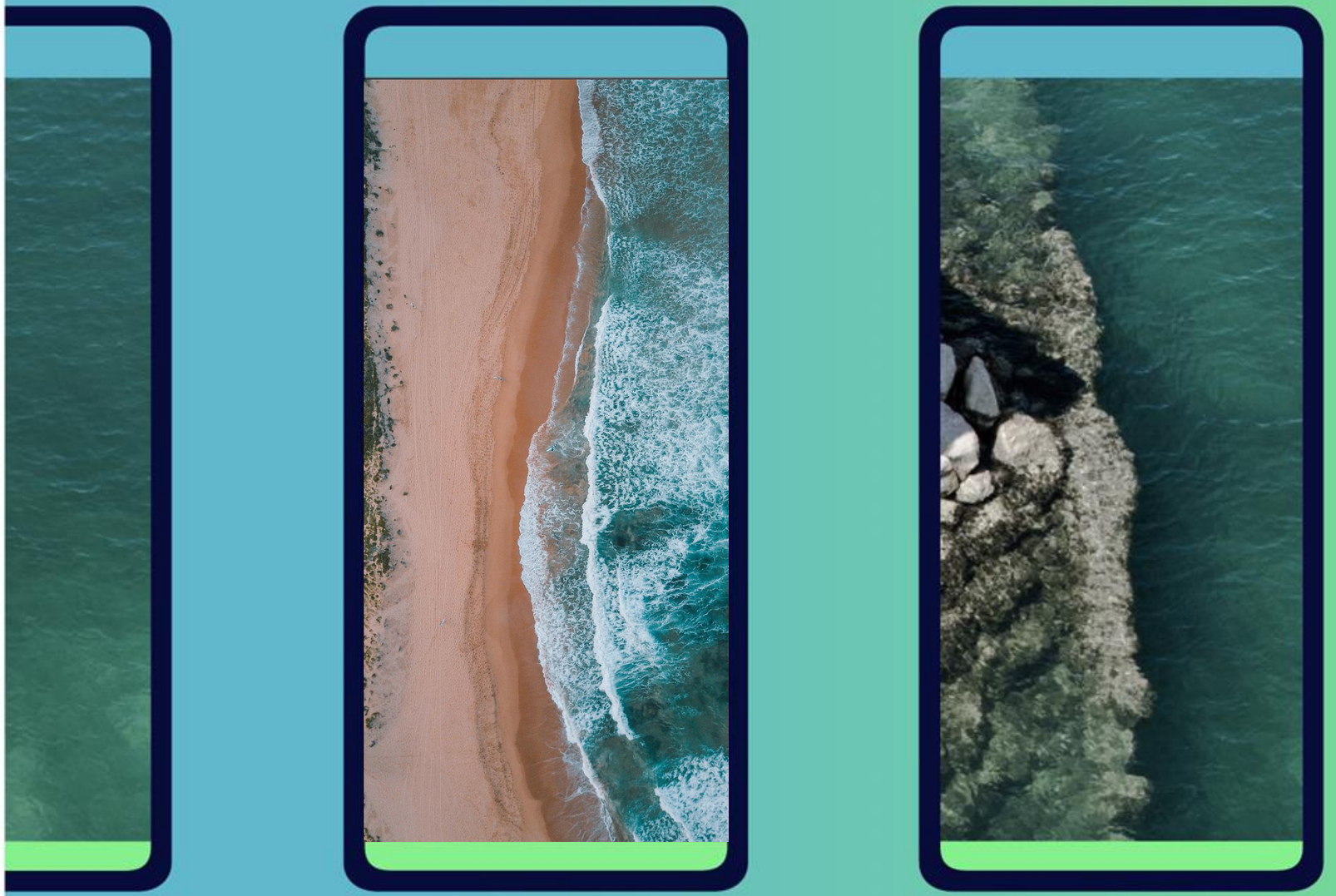
Confronto tra aree allagate da ripresa aerea e mappe dei tiranti idrici (tempo di ritorno 50 anni) prodotte dalla piattaforma SaferPlaces

- Comparison between the high probability flooding areas predicted by SaferPlaces and the actual flooded areas in Faenza Municipality.

- The first days of May the region was hit by heavy rains that locally exceeded 150 mm in just 24 hours.

SaferPlaces

New Satellite-based Functionalities



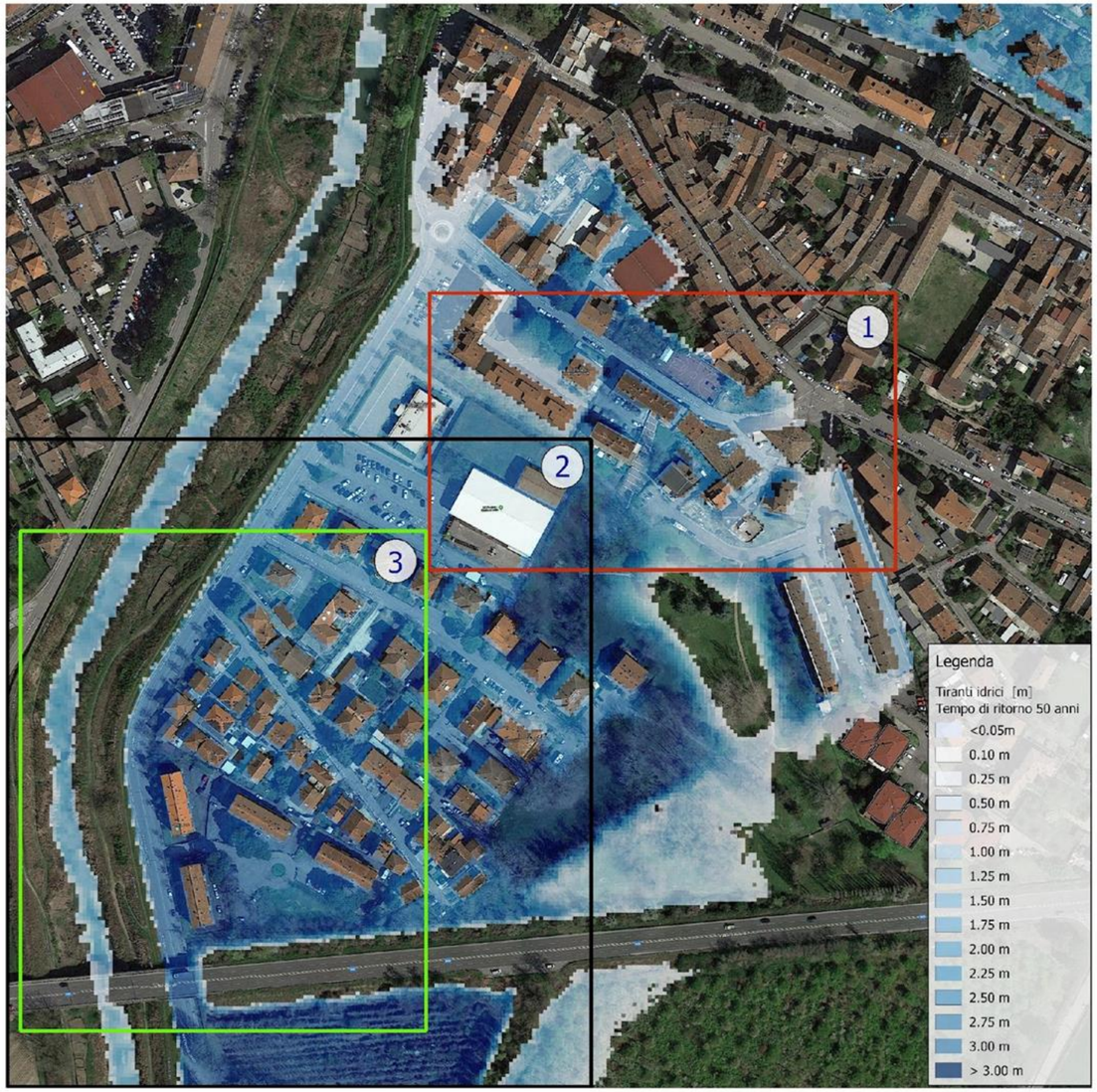
Parco del Mare
(Rimini)

USE CASE

Supporting Emilia-Romagna Civil Protection

During the flooding emergency in May 2023

- Early-warning
- Evacuation of people



SaferPlaces

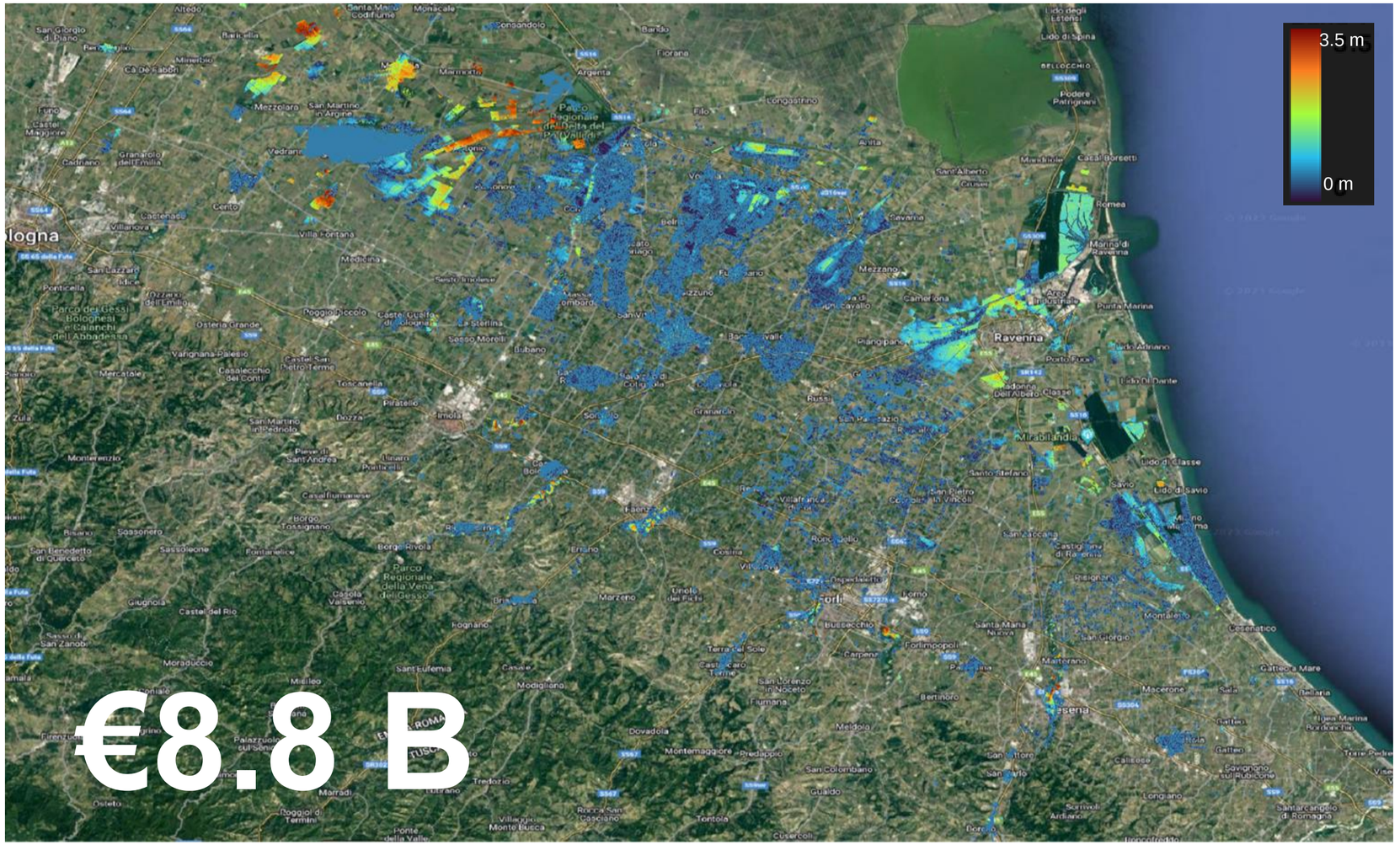
Alluvione del 3 maggio 2023 a Faenza
località Borgo Durbecco

Confronto tra aree allagate da ripresa aerea e mappe dei tiranti idrici (tempo di ritorno 50 anni) prodotte dalla piattaforma SaferPlaces

USE CASE

Supporting post-event analysis for Emilia-Romagna Civil Protection (Italy)

Water depth



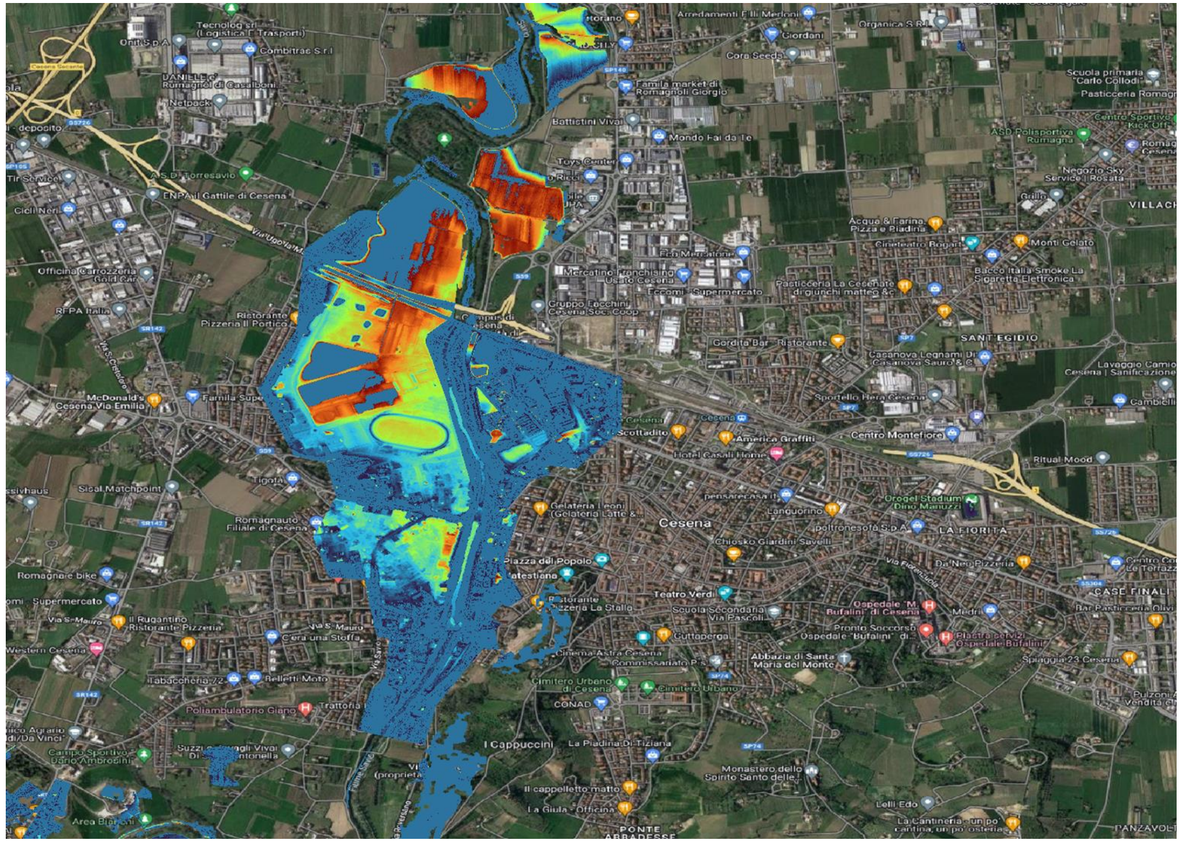
- Water depth from Copernicus Sentinel, commercial optical & SAR data
- Post-event estimation of damages

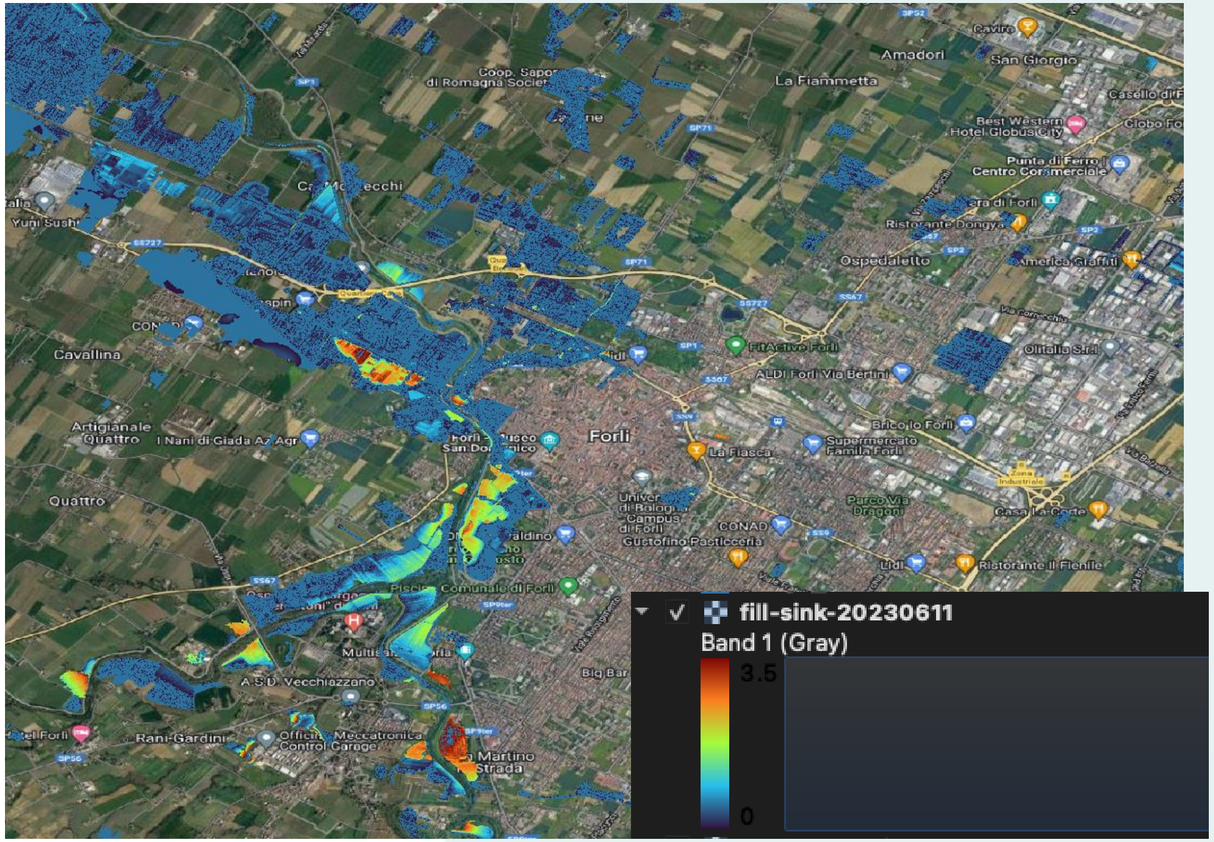
ESA NEWS

USE CASES

SaferPlaces

Supporting Post-Event Analysis for Emilia-Romagna Civil Protection





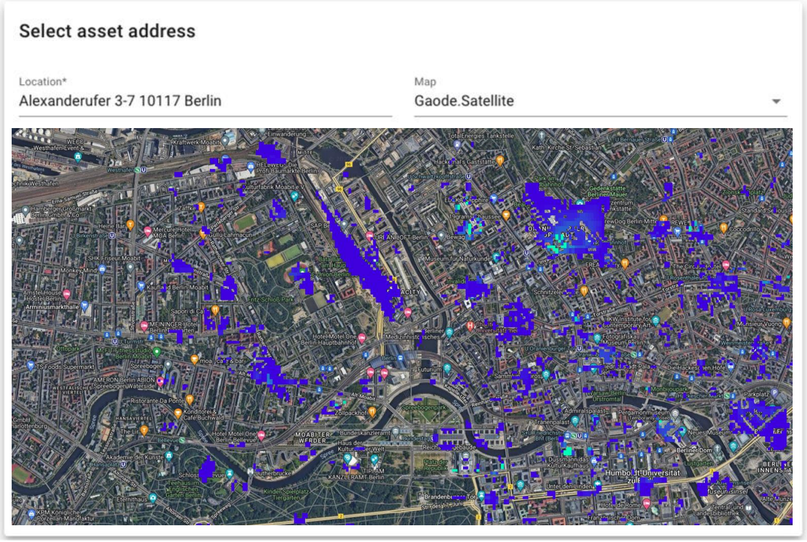
USE CASES

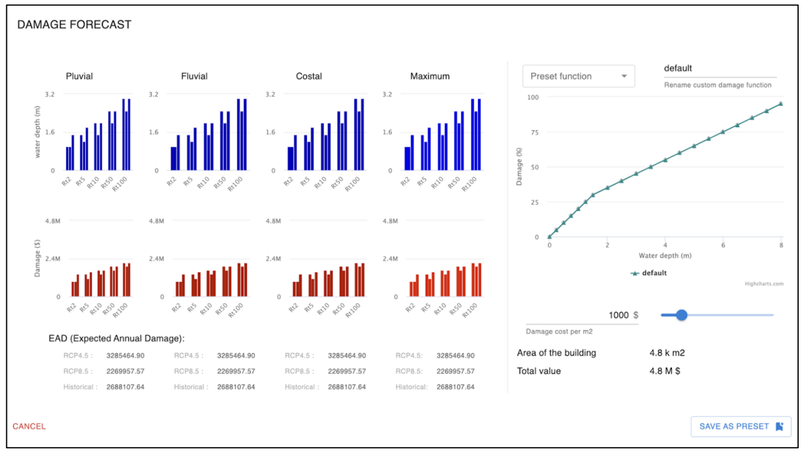
SaferPlaces is one of ESA's Applications for Observing the Earth in the aftermath of the Emilia-Romagna floods

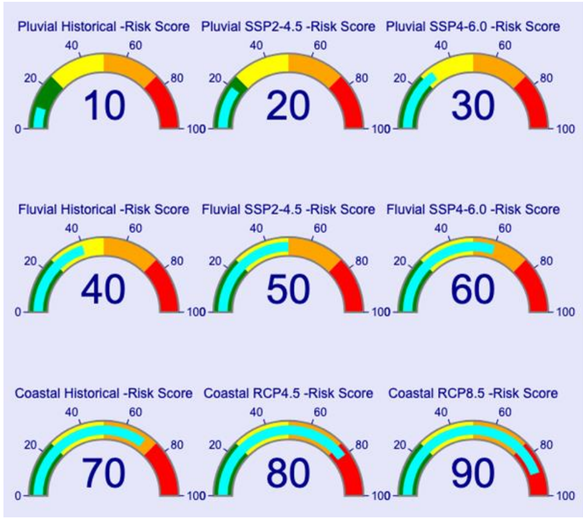
https://www.esa.int/Applications/Observing_the_Earth/Satellites_map_aftermath_of_Emilia-Romagna_floods

USE CASE

API - Flood Risk Score - ESG Disclosure







Main Indicators

-Flood damage losses ($)
-Flood water depth (m)
-Expected Annual Damage ($)
-Flood Risk Score

Flood Hazards

-Fluvial, pluvial, coastal

Return times

-2,5,10,50,100 years

Climate scenarios

-1 historical
-2 climate projections (RCP4.5/8.5 or CMIP6 SSP2-4.5/4-6.0) for 2050 or 2100.

The PROVIDE climate risk dashboard and services for urban adaptation

Quentin Lejeune & Sylvia Schmidt

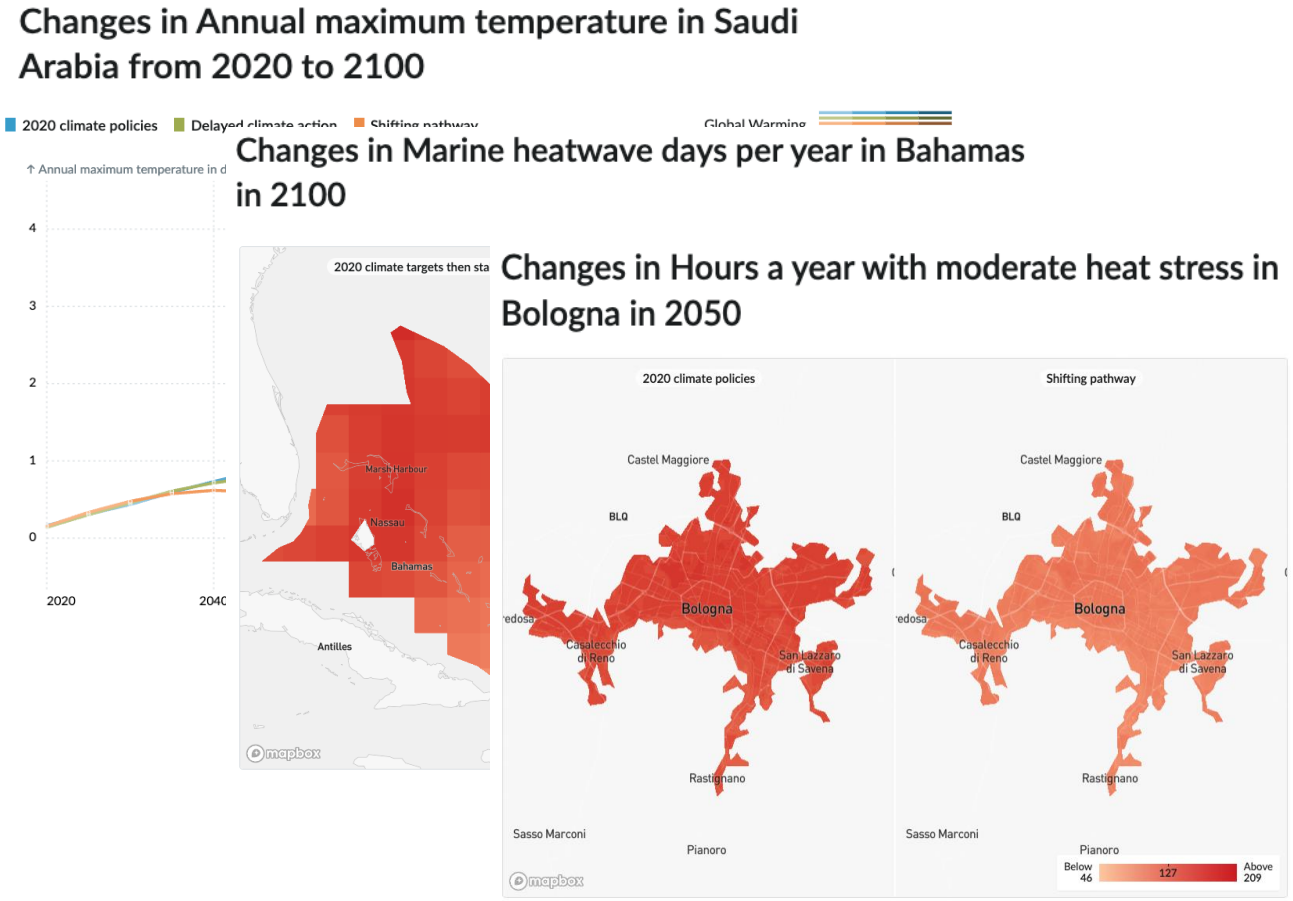
Climateurope2 festival – March 12

A public database for global-to-local climate impacts depending on mitigation outcomes

v1 since Jan. 30: https://climate-risk-dashboard.climateanalytics.org/

v2 to be launched in Sept. 2024

Impact projections across scales and sectors



1) Time series, 2) Maps and
3) Graphs showing fraction of risk avoidable via mitigation vs. unavoidable

Already available:

- Terrestrial Climate in countries
- Marine Climate in Exclusive Economic Zones
- Urban heat stress in 140 cities

Upcoming in 2024:

- World's terrestrial biodiversity
- World's glaciers (except Antarctica)
- Loss of sleep due to heat stress in 140 cities
- …

Graphs and data downloadable at https://climate-risk-dashboard.climateanalytics.org/

For the latest generations of scenarios

- Impact projections accessible for the scenarios from the IPCC AR6 WG3:
  - policy-relevant: aligned with implemented climate policies or NDCs from 2020, etc.
  - incl. for overshoot pathways: in which GMT exceeds 1.5°C, then peaks and declines
  - can be rapidly updated: due to their generation with lightweight emulators (for most sectors)

- Explainer for greenhouse gas emission scenarios

Scenario list

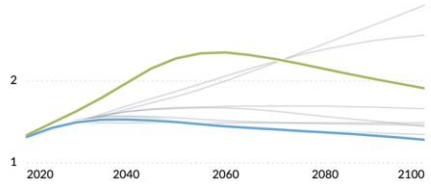
Compare and select up to three scenarios to display them in the scenario explorer.

Scenario	Peak GMT	2100 GMT	Cooling rate after peak	2050 emissions	2100 emissions
2020 climate policies	2.928 °C in 2100	2.928 °C	–	66.655 $GtCO_2eq/yr$	68.322 $GtCO_2eq/yr$
Delayed climate action	1.695 °C in 2080	1.663 °C	-0.016 °C / decade	17.282 $GtCO_2eq/yr$	-0.286 $GtCO_2eq/yr$
Shifting pathway	1.566 °C in 2040	1.295 °C	-0.045 °C / decade	10.199 $GtCO_2eq/yr$	-0.591 $GtCO_2eq/yr$
2020 climate targets	2.56 °C in 2100	2.56 °C	–	57.414 $GtCO_2eq/yr$	31.119 $GtCO_2eq/yr$
High negative emissions	1.673 °C in 2060	1.445 °C	-0.057 °C / decade	19.926 $GtCO_2eq/yr$	-6.051 $GtCO_2eq/yr$
High renewables	1.574 °C in 2040	1.462 °C	-0.019 °C / decade	11.337 $GtCO_2eq/yr$	6.589 $GtCO_2eq/yr$
Low demand	1.545 °C in 2040	1.348 °C	-0.033 °C / decade	9.26 $GtCO_2eq/yr$	1.434 $GtCO_2eq/yr$
SSP1-1.9	1.531 °C in 2040	1.283 °C	-0.041 °C / decade	9.257 $GtCO_2eq/yr$	-8.203 $GtCO_2eq/yr$
SSP5-3.4-OS	2.349 °C in 2060	1.911 °C	-0.11 °C / decade	62.089 $GtCO_2eq/yr$	-13.91 $GtCO_2eq/yr$
Stabilisation at 1.5°C	1.489 °C in 2030	1.489 °C	0 °C / decade	–	–

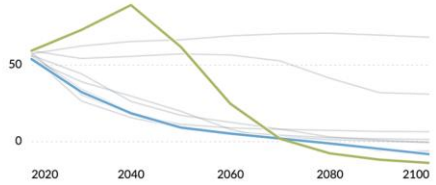
Scenario timelines

Select a scenario to see progress over time.

Global mean temperature in °C



Global greenhouse gas emissions in $GtCO_2eq/yr$



Scenario presets

Click on a research question and see the preselected scenarios that can answer it.

Pledges vs immediate action

What happens if governments implement their current climate pledges, versus if they strengthened them slightly, or if they acted in line with the Paris Agreement?

1.5°C compatible scenarios

What are the differences in climate impacts between various 1.5°C compatible pathways?

1.5°C vs 2°C compatible scenarios

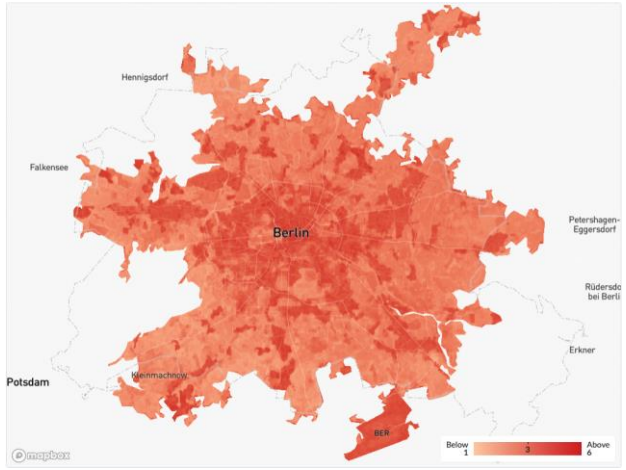
What are the differences in climate impacts between 1.5°C and 2°C compatible scenarios?

Services for urban adaptation practitioners

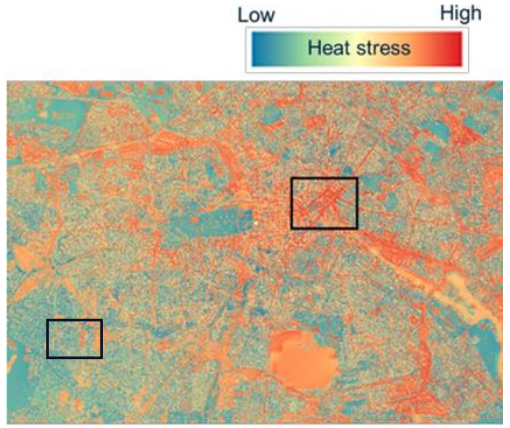
Very high resolution heat stress modelling

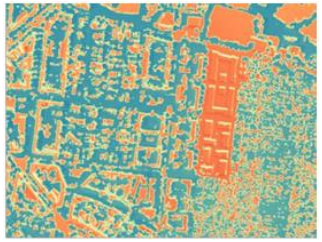
First-order hazard assessment at 100-meter resolution using the climate risk dashboard

Changes in Days a year with moderate heat stress in Berlin in 2050



Refinement with a simulation at 1-meter resolution for a very hot day

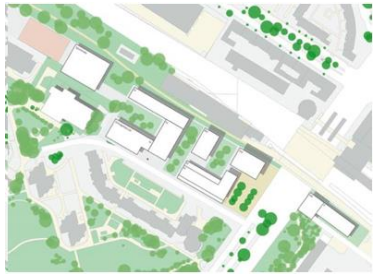


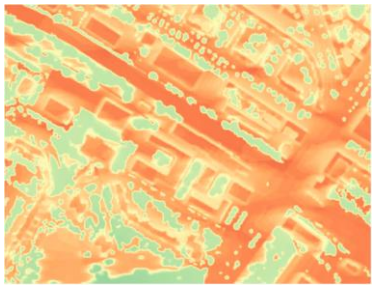


Climate impacts reduction via climate-smart urban planning

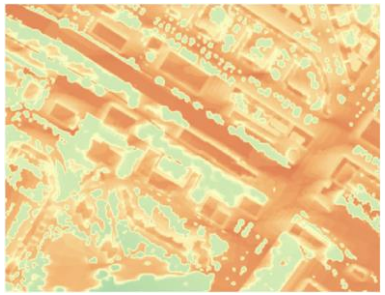
3 co-developed proposals for an ensemble of buildings of 40-45,000 m² (housing, school, sports and other public facilities) in Berlin

Proposal 1

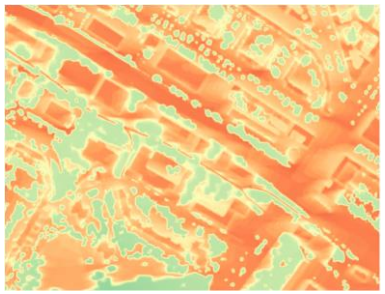




Proposal 2



Proposal 3



- Which climate development projects are most climate-resilient?
- What is the effectiveness of single or combined Nature-based solutions at reducing heat stress?

Questions for the World Café

- What are the most interesting/innovative/actionable aspects of this work for the broader community of adaptation practitioners?

- How should we feature it on a publicly accessible online demonstrator (linked to the climate risk dashboard)?

Contact

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European Funds

Climate proofing in the UE funded projects

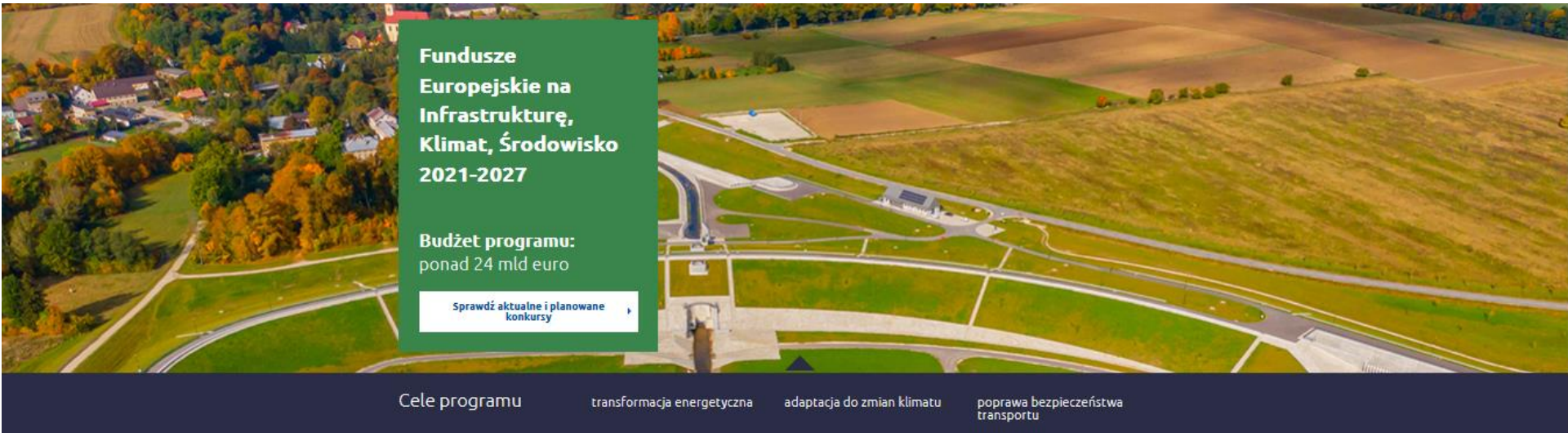
European Funds

Republic of Poland

Co-funded by the European Union

Climate proofing in the UE funded projects

- Accurate selection criteria and procedures
- Obligatory climate neutrality and climate adaptation analyses
- Environmental impact assessment procedure
- Climate proofing analises (self-assessment and verification)



Climate proofing - different methodologies

L.p.	Czynnik klimatyczny	Krótki
1.	Bardzo silny wiatr; trąby powietrzne; huragany	zrywanie dachów budynków, ... energetycznych, ... drzewa
2.	Bardzo duże, obfite opady deszczu; powódź; roztopy	... zalania terenu, ... urządzeń
3.	Bardzo duże ... śniegu; ...	... – dotyczy szczególnie nowych ... dachów), zaśnieżenie układu torowego ... oblodzenie nawierzchni peronów, zasypanie dróg ... energetycznych,
7.	Mgła; Inne ...	

Lp.	Zdarzenie	Ogólna ocena podatności – „V”	Ogólna ocena ryzyka – „R”	Współczynnik zmian klimatu – „ZK”	Ogólna ocena wpływu danego czynnika– „K”	Konieczność zaproponowania działań
1.	Niskie temperatury	3	1	0,9	0,9	Brak (K?3,8)
2.	Wysokie temperatury	1	1	1,2	1,2	Brak (K?3,8)
3.	Duże opady deszczu	1	1	1,1	1,1	Brak (K?3,8)
4.	Powódź	1	1	1,1	2,2	Brak (K?3,8)
5.	Duże opady śniegu	1	1	1,1	1,1	Brak (K?3,8)
6.	Silny wiatr	1	1	1,1	1,1	Brak (K?3,8)

$$WP_{zk} = W \times E \times Za \times ZK$$

gdzie:

WPzk – podatność na zmiany klimatu

W – wrażliwość na czynniki pogodowe i ich pochodne

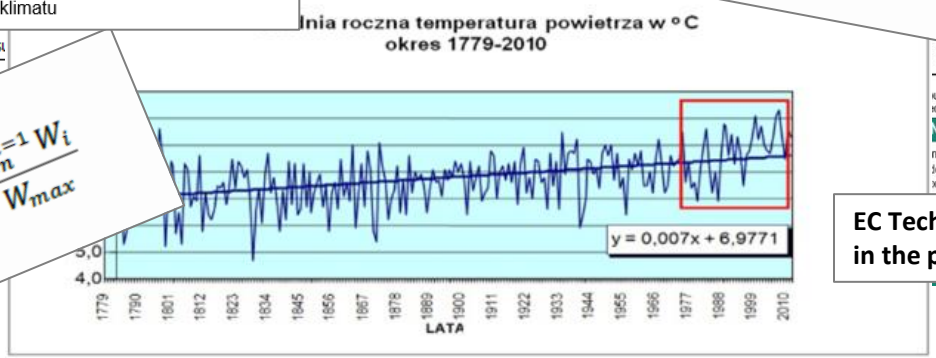
E – ekspozycja na czynniki pogodowe i ich pochodne

Za – zdolność adaptacyjna

ZK – wskaźnik zmian klimatu

$$W = \frac{2+1+1+3+1+2+3+1+1+1+1}{11 \times 4} = \frac{17}{44} \cong 0,39$$

$$W = \frac{\sum_{n}^{i=1} W_i}{W_{max}}$$



SENSITIVITY ANALYSIS

Indicative sensitivity table: *(example)*

Themes	Climate variables and hazards	Flood	Heat	...	Drought
	On-site assets, ...	High	Low	...	Low
	Inputs (water, ...)	Medium	Medium	...	Low
	Outputs (products, ...)	High	Low	...	Low
	Transport links	Medium	Low	...	Low
	Highest score 4 themes	High	Medium	...	Low

The output of the sensitivity analysis may be summarised in a table with the sensitivity ranking of the relevant climate variables and hazards for a given project type, irrespective of the location, including critical parameters, and divided in e.g. the four themes.

EXPOSURE ANALYSIS

Indicative exposure table: *(example)*

Climate variables and hazards	Flood	Heat	...	Drought
Current climate	Medium	Low	...	Low
Future climate	High	Medium	...	Low
Highest score, current+future	High	Medium	...	Low

The output of the exposure analysis may be summarised in a table with the exposure ranking of the relevant climate variables and hazards for the selected location, irrespective of the project type, and divided in current and future climate. For both the sensitivity and exposure analysis, the scoring system should be carefully defined and explained, and the given scores should be justified.

VULNERABILITY ANALYSIS

Indicative vulnerability table: *(example)*

Sensitivity (highest across the four themes)	Exposure (current + future climate): High	Medium	Low
High	Flood		
Medium		Heat	
Low			Drought

Legend: Vulnerability level: High, Medium, Low

The vulnerability analysis may be summarised in a table for the given specific project type at the selected location. It combines the sensitivity and the exposure analysis. The most relevant climate variables and hazards are those with a high or medium vulnerability level, which are then taken forward to the steps below. The vulnerability levels should be carefully defined and explained, and the given scores justified.

Phase 2 (subject to the outcome of phase 1)

LIKELIHOOD ANALYSIS

Indicative scale for assessing the likelihood of a climate hazard (example):

Term	Qualitative	Quantitative (*)
Rare	Highly unlikely to occur	5 %
Unlikely	Unlikely to occur	20 %
Moderate	As likely to occur as not	50 %
Likely	Likely to occur	80 %
Almost certain	Very likely to occur	95 %

The output of the likelihood analysis may be summarised in a qualitative or quantitative estimation of the likelihood for each of the essential climate ... and hazards. (*) Defining the scales requires careful analysis for ... e.g. that the likelihood and impacts of the essential ... antly during the lifespan of the infrastructure ... hange. Various scales are referred to in the

IMPACT ANALYSIS

Indicative scale for assessing the potential impact of a climate hazard (example)

Impacts: / *Risk areas:*	Insignificant	Minor	Moderate	Major	Catastrophic
Asset damage, engineering, operational					
Safety and heath					
Environment, cutural heritage					
Social					
Financial					
Reputation					
Any other relevant risk area(s)					
Overall for the above-listed risk areas					

The impact analysis provides an expert assessment of the potential impact for each of the essential climate variables and hazards.

RISK ASSESSMENT

Overall impact of the essential climate variables and hazards (example)

	Insignificant	Minor	Moderate	Major	Catastrophic
		Drought			
		Heat	Flood		
Likely					
Almost certain					

Legend: Risk level: Low, Medium, High, Extreme

output of the risk analysis may be summarised in a table combining likelihood and impact of the essential climate variables and hazards. Detailed explanations ... required to qualify and substantiate the assessment conclusions. The risk levels should be explained and justified.

NTIFYING ADAPTATION OPTIONS

n identification process:
dentify options responding to the risks (use e.g. ... xpert workshops, meetings, evaluations, ...)

APPRAISING ADAPTATION OPTIONS

The appraisal of adaptation options should give due regard to the specific circumstances and availability of data. In some cases a quick expert judgement may suffice whereas other cases may warrant a

ADAPTATION PLANNING

Integrate relevant climate resilience measures into the technical project design and management options. Develop implementation plan, finance plan, ... plan for monitoring and response plan for regular ... climate ... on. The ... adaptation ... climate

EC Technical guidance on the climate proofing of infrastructure in the period 2021-2027

Adaptation to climate change good practices

- Change of approach.
- Access to actual climate data.
- Database on local climate hazards and the impacts.
- Database on adaptation measures efficiency and costs.
- Increased awareness and data accessibility.
- Nature based solutions.

Adaptation to climate change - challenges

- EC Technical guidance on the climate proofing.
- Change of approach.
- Climate adaptation in the project's life cicle.
- Interdisciplinary Climate Adaptation Team.
- Citizens and stakeholders participation.
- Nature based solutions.
- Adaptation to climate change in national legislation.
- Do Not Significant Harm Principle.