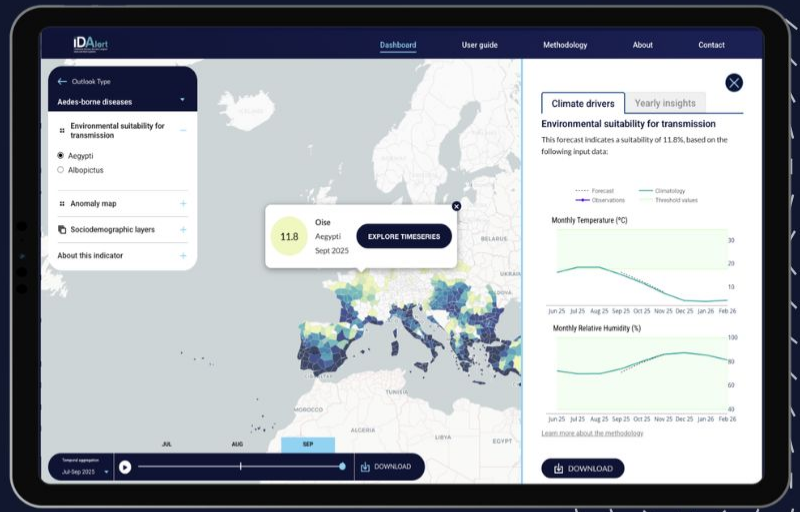
EpiOutlook

# EpiOutlook Launch: A Co-Production Journey




## Online

15 June, 2026

12:00 - 13:30 CEST

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

IDAlert
Infectious Disease decision-support tools and Alert systems

Funded by the European Union

IDAlert has received funding from the European Union's Horizon Europe programme under Grant Agreement 101057554.

# AGENDA

**12:00** Welcome and opening remarks

**12:05** EpiOutlook: A Co-Production Journey

The development team will present the completed platform, highlighting its key features and the methodology underpinning its creation.

**12:45** Round table

Key stakeholder representatives from global health policy will examine the near-term outlook for climate-sensitive infectious diseases in Europe, as well as the future potential of the platform and its relevance to their daily work.

**13:15** Q&A

Open time for audience questions to the development team and panellists.


Use the Q&A chat box during the event to submit your questions to the speakers and panellists. They will answer them during the allocated Q&A time.

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# Round table

## Moderator

**Jan Semenza**
Lancet Countdown & IDAlert

## Panellists

**Esther Kukielka**
ECDC

**Paolo Tizzani**
WOAH

**Aleksandra Kazmierczak**
EEA

**Rita Araujo**
European Commission

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# EpiOutlook: A Co-Production Journey

## BSC - CNS Development Team

**Rachel Lowe**

**Diana Urquiza**

**Emma Roberts**

**Emily Ball**

**Rebeca Nunes**

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We co-design climate, air quality and health resilience services, while facilitating knowledge exchange and technology transfer of state-of-the-art research at local, national, and international levels.

**Groups and teams involved:** Global Health Resilience, Climate Services, Knowledge Integration, and Computational Earth Sciences

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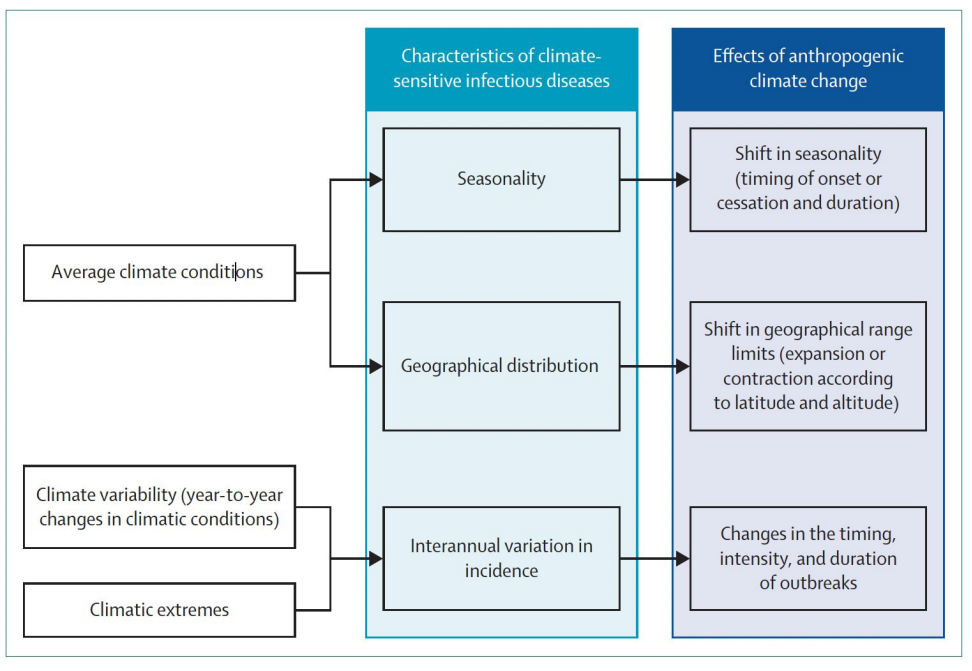
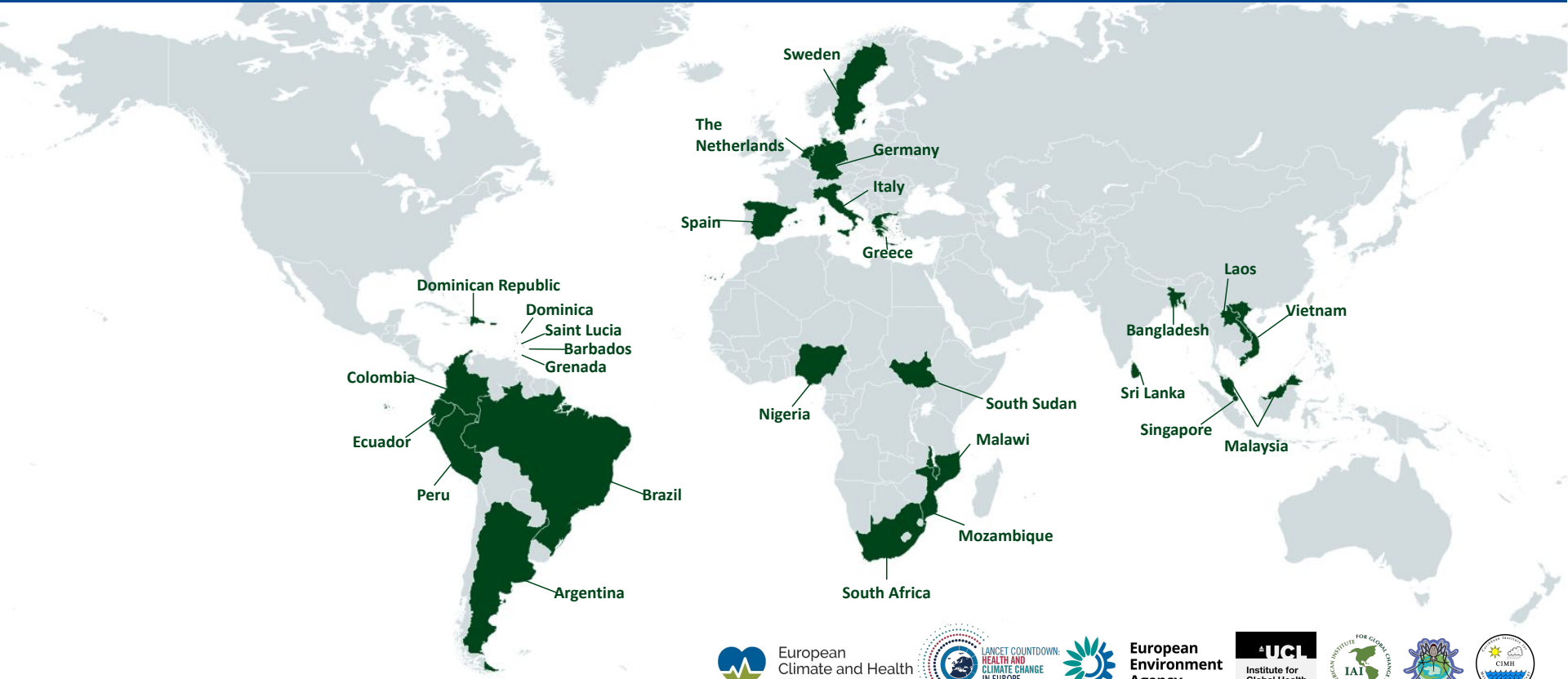
# Global Health Resilience

# Climate-sensitivity of infectious diseases

Tilly Alcayna *et al*., *Lancet Planet Health* 2025



# Global Health Resilience Partnerships




European Climate and Health Observatory

LANCET COUNTDOWN: HEALTH AND CLIMATE CHANGE IN EUROPE

European Environment Agency

UCL Institute for Global Health

IAI

CIMH

HARMONIZE

IDExtremes

iDAlert Infectious Disease decision-support tools and Alert systems

E4W

Caribbean Public Health Agency CARPHA

EERIE

CATALYSE

esa

# Global Health Resilience (GHR)

## Harmonizing multi-scale spatiotemporal data

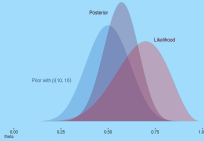
- Climate data
- Socio-economic data
- Surveillance data

HARMONIZE

clim4health

data4health

## Predicting the probability of climate-sensitive disease outbreaks



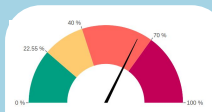
Disease risk model

IDExtremes

GHRexplore

GHRmodel

GHRpredict



Decision-making platforms

Co-creating early warning systems for climate-sensitive infectious diseases

E4 WARNING

iDAlert

Infectious Disease decision-support tools and Alert systems

ENDCast

Attribution

Attributing human health impacts to human-caused climate change

TACTIC

Scenario building

Integrating climate observations, predictions and scenarios into climate and health intelligence solutions

Preparedness and response

Guide adaptation

Evaluate interventions


Loss and damage

# Methodological advances in modelling the impacts of climate on infectious diseases

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## Compound and cascading effects of climatic extremes on dengue outbreak risk in the Caribbean: an impact-based modelling framework with long-lag and short-lag interactions

Chloe Fletcher, Giovenale Moirano, Tilly Alcayna, Leslie Rollock, Cédric J Van Meerbeeck, Roché Mahon, Adrian Trotman, Laura-Lee Boodram, Tia Browne, Sabu Best, Daniela Lührsen, Avriel R Diaz, Willy Dunbar, Catherine A Lippi, Sadie J Ryan, Felipe J Colón-González, Anna M Stewart-Ibarra, Rachel Lowe

## A climatic suitability indicator to support *Leishmania infantum* surveillance in Europe: a modelling study

Bruno M. Carvalho,[a,*] Carla Maia,[b] Orin Courtenay,[c] Alba Llabrés-Brustenga,[a] Martín Lotto Batista,[a] Giovenale Moirano,[a] Kim R. van Daalen,[a,d,e] Jan C. Semenza,[f,g] and Rachel Lowe[a,h,i,**]

## Short-term effect of temperature and precipitation on the incidence of West Nile Neuroinvasive Disease in Europe: a multi-country case-crossover analysis

Giovenale Moirano,[a,b,*] Chloe Fletcher,[a,c] Jan C. Semenza,[d,e] and Rachel Lowe[a,f,g,**]

## Modelling the impact of climate and the environment on the spatiotemporal dynamics of Lyme borreliosis in Germany

Martín Lotto Batista,[a,b,*] Bruno Carvalho,[a] Rory Gibb,[c] Balakrishnan Solaraju-Murali,[a] Stefan Flasche,[d,e] Stefanie Castell,[b] Stéphane Ghozzi,[b,h] and Rachel Lowe[a,d,f,g,**]

## Identifying the climate sensitivity of infectious diseases: a conceptual framework

Tilly Alcayna, V Bhargavi Rao, Rachel Lowe

## Adult *Aedes albopictus* in winter: implications for mosquito surveillance in southern Europe

## Climate variation and serotype competition drive dengue outbreak dynamics in Singapore

Emilie Finch, Chia-chen Chang, Adam Kucharski, Shuzhen Sim, Lee-Ching Ng & Rachel Lowe


## Strengthening resilience to emerging vector-borne diseases in Europe: lessons learnt from countries facing endemic transmission

Gina E. C. Charnley,[a,b,*] Tilly Alcayna,[a,c,d] Alex Almuedo-Riera,[e,f] Christiana Antoniou,[g] Athanase Badolo,[h] Frederic Bartumeus,[i,j] Laura-Lee Boodram,[k] Rubén Bueno-Marí,[l,m] Claudia Codeço,[n] Flavio Codeço Coelho,[o] Federico Costa,[p] Horace Cox,[k] Nabil Haddad,[q] Nurulhusna Ab Hamid,[r] Pattamaporn Kittayapong,[s] Gülay Korkmazoğlu,[t] Antonios Michaelakis,[u] Rafael Maciel-de-Freitas,[v,w] Tomas Montalvo,[x,y] Jose Muñoz,[z] Silvia Sauleda Oliveras,[z] John R. B. Palmer,[aa] Carlos Jesús Barboza Pizard,[ab] Guilherme S. Ribeiro,[ac,ad] and Rachel Lowe[a,c,j,**]

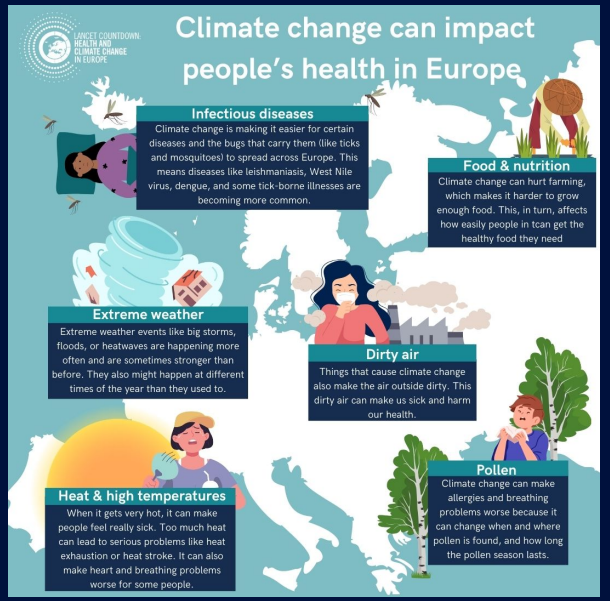
## Towards a leptospirosis early warning system in northeastern Argentina

Martín Lotto Batista[1,2,†], Eleanor M. Rees[3,4,†], Andrea Gómez[5,6], Soledad López[5,6], Stefanie Castell[1], Adam J. Kucharski[3], Stéphane Ghozzi[1], Gabriela V. Müller[5,6] and Rachel Lowe[2,3,4,7]

## Integrating anticipatory action in disease outbreak preparedness and response in the humanitarian sector

Tilly Alcayna [1,2,3,4] Franziska Kellerhaus,[5] Leo Tremblay,[6] Chloe Fletcher,[7,8] Rachel Goodermote [9] Mauricio Santos-Vega,[1,10] Juan Chaves-Gonzalez,[11] Meghan Bailey,[1] V. Bhargavi Rao,[4,12] Rachel Lowe [2,3,7,13]

# Translating our findings for a young audience

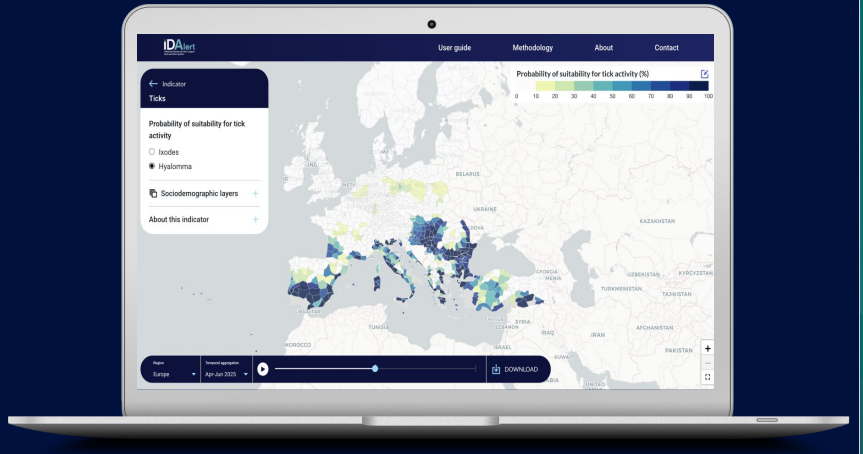


Rachel Lowe *et al.*, *Frontiers Young Minds* 2025

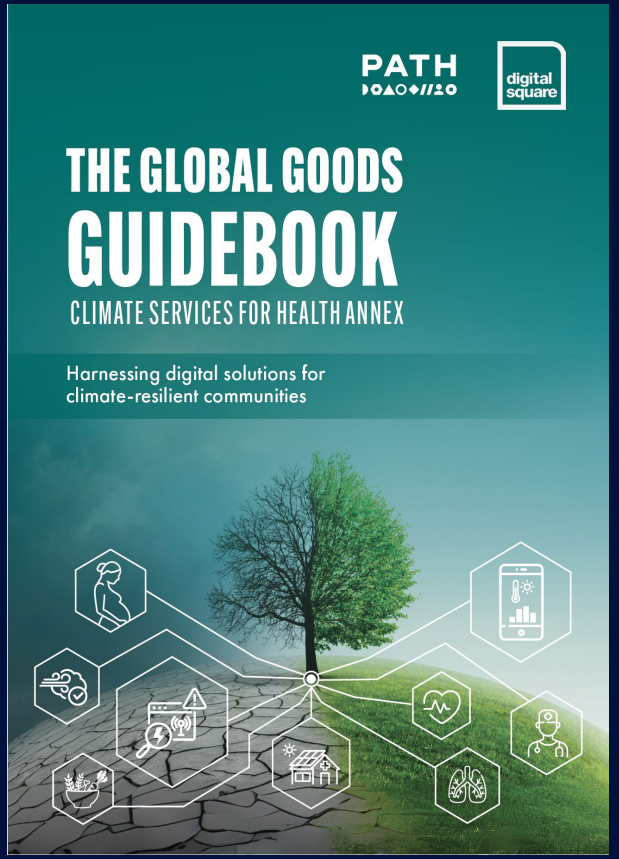
LANCET COUNTDOWN HEALTH AND CLIMATE CHANGE IN EUROPE

IDAlert

# Digital Public Goods

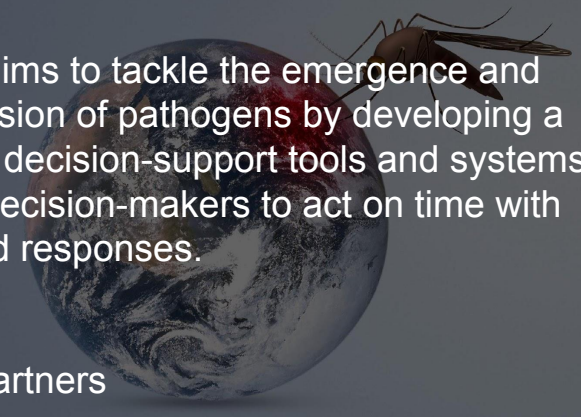




iDAlert
Infectious Disease decision-support tools and Alert systems

# Our Vision

IDAlert aims to tackle the emergence and transmission of pathogens by developing a range of decision-support tools and systems to enable decision-makers to act on time with improved responses.



**19** partners

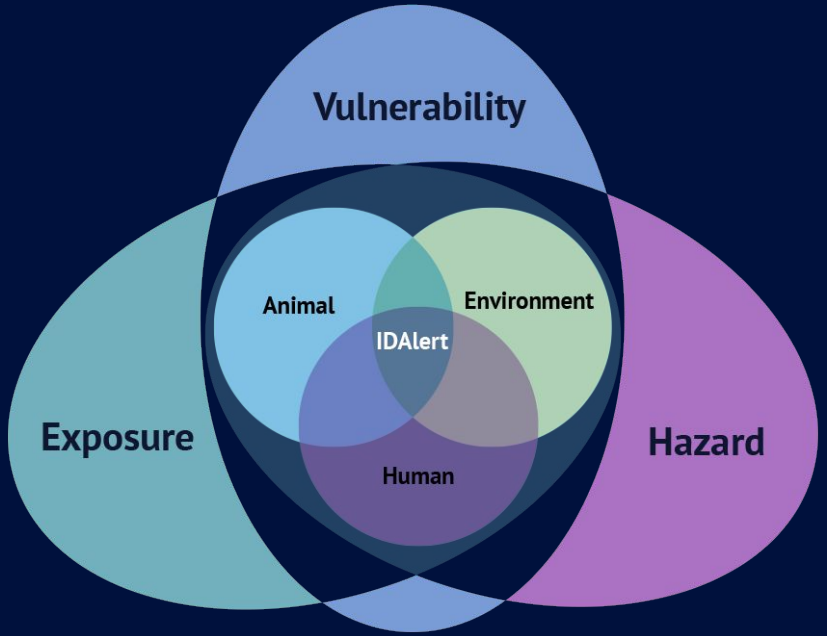
**5** year project, funded under Horizon Europe programme

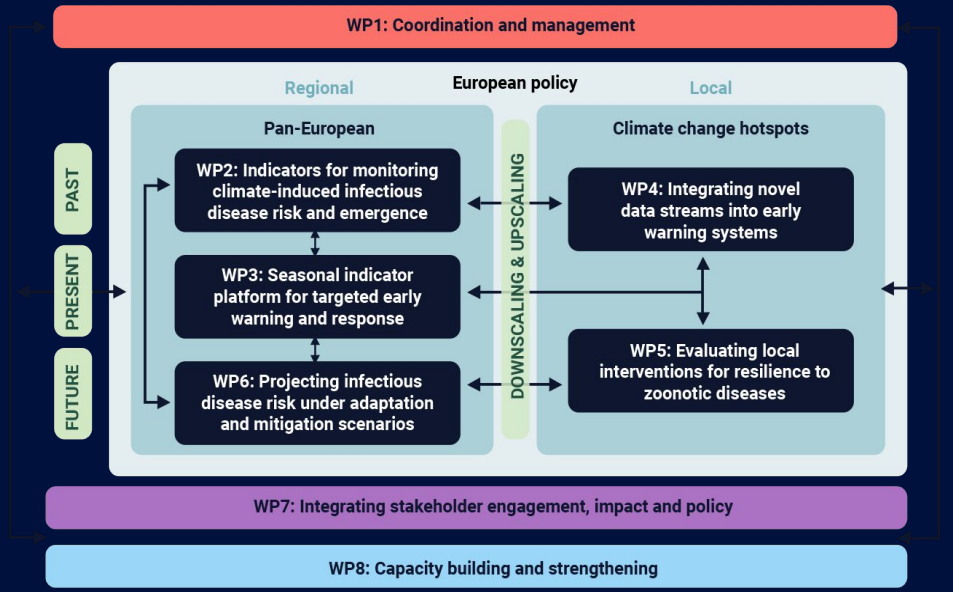
# Our Approach

Climate change is one of several drivers of recurrent outbreaks and geographical range expansion of infectious diseases in Europe.

We tackle multidimensional research challenges by adopting a framework of co-production of policy-relevant indicators and decision support tools that track past, present, and future climate- induced disease risks across hazard, exposure, and vulnerability domains at the animal, human, and environmental interface.

# Focus: Climate Change & One Health




Rocklöv, Joacim, et al. "Decision-support tools to build climate resilience against emerging infectious diseases in Europe and beyond." *The Lancet Regional Health–Europe* 32 (2023).

# 6 Case studies

The validity of the tools and methods developed will be demonstrated in climate-emergence hotspots, with different ecological settings and climate-induced threats


## Bangladesh

- Dengue is the most common mosquito-borne, viral disease in the world. The virus is spread to humans through the bite of infected *Aedes aegipti* mosquitos.
- Forty percent of the world's population lives in areas with a risk of dengue.
- Climate change increases incidence, severity, and frequency of dengue.
- Dengue is endemic in Bangladesh and it is a cause of morbidity and mortality.

**Users**

International Centre for Diarrhoeal Disease Research, Bangladesh


## Germany

- Arboviruses like Chikungunya, West Nile Virus, and Dengue can cause serious health complications and are spread to humans by the bites of infected *Aedes albopictus* mosquitos.
- Trade and travel have helped *Aedes albopictus* to expand across Germany.
- Warmer temperatures are increasing the presence of *Aedes albopictus* in the Upper Rhine Valley.
- The Upper Rhine Valley is at risk of future autochthonous transmission of arboviruses.

**Users**

Rhein-Neckar-Kreis Public Health Agency, Germany


## Greece

- West Nile virus (WNV) is spread to humans through the bite of infected *Aedes albopictus* or *Culex pipiens* mosquitos.
- Since the beginning of 2022 EU/EEA countries have reported more than 960 human cases of WNV infection.
- Changes in temperature, precipitation and humidity alter the presence and abundance of *Culex pipiens*.
- Greece experienced a high number of WNV human infections since 2010.

**Users**

Benaki Phytopathological Institute, Greece


## Netherlands

- Usutu virus (USUV) and West Nile virus (WNV) may harm the central nervous system. Disease is spread to humans by the bite of infected mosquitos, who fed on infected bird.
- Climate change alters the conditions for pathogens and vectors of zoonotic diseases.
- USUV and WNV are moving to the north because of increasingly warming temperatures.
- The Netherlands experienced two major outbreaks of avian diseases in the past twenty years.

**Users**

Municipal health service in Rotterdam, Netherlands


## Spain

- Dengue, Zika, Chikungunya, and West Nile Viruses are transmitted to humans by the bite of infected *Aedes albopictus* mosquitos.
- *Aedes albopictus* has rapidly expanded throughout Europe, becoming a public health concern in the Mediterranean Basin.
- Without limiting global warming below 2 °C, the risk zone of mosquitos infestation expands considerably.
- During the last ten years, the presence of *Aedes albopictus* in Catalonia has increased.

**Users**

Mosquito Control Service and Public Health Agency in Girona and Barcelona, Spain


## Sweden

- Tick-borne encephalitis (TBE) is a viral infectious disease involving the central nervous system. Virus is passed to animals and humans by tick bites.
- The life cycle and prevalence of ticks are influenced by the temperature.
- Warming temperatures associated with climate change increase the range of suitable tick habitat.
- In recent decades, the incidence of tick-borne deseases in Sweden has increased.

**Users**

National Veterinary Institute, Sweden

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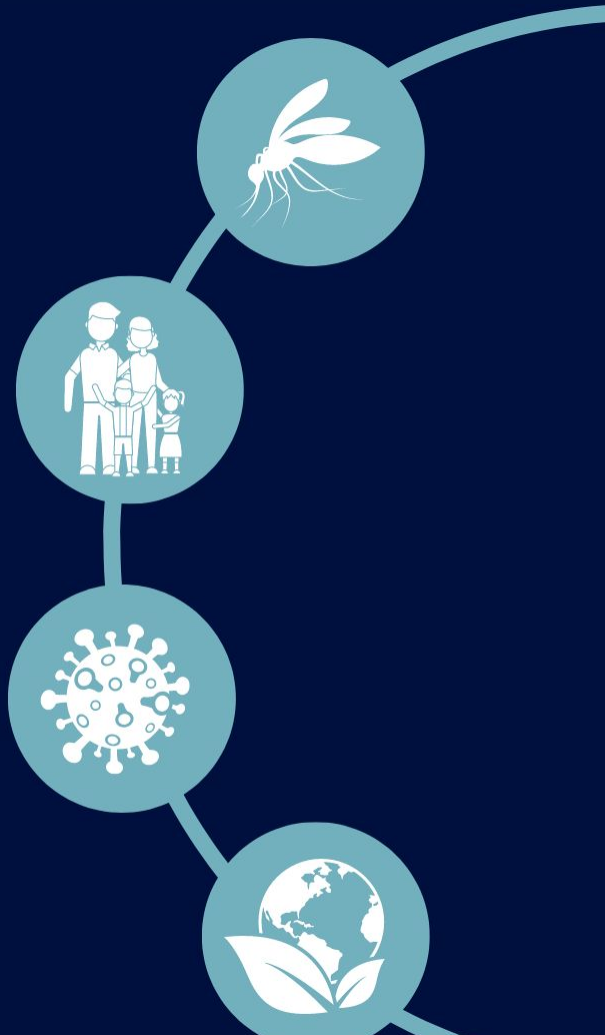
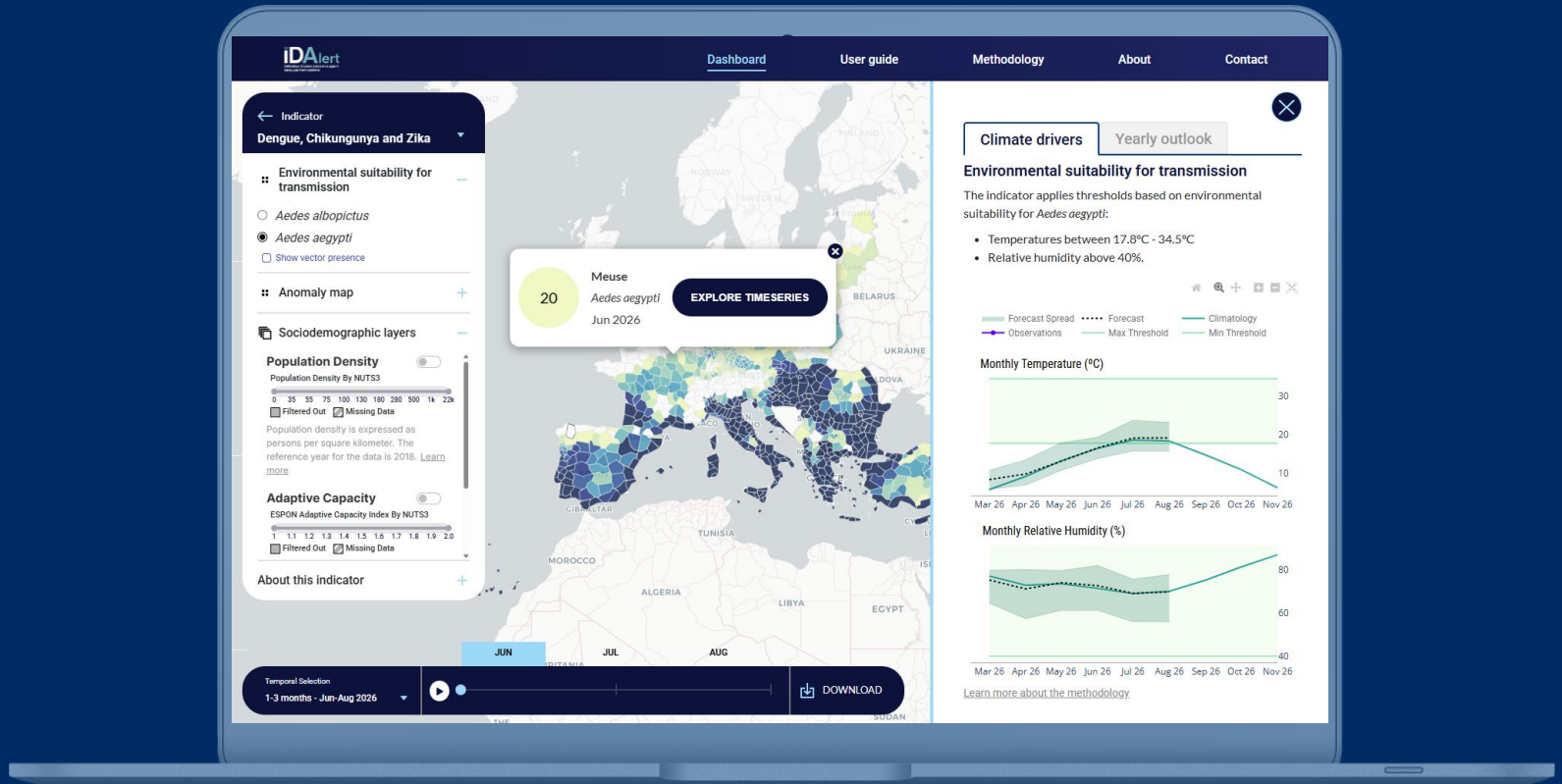
# EpiOutlook:
## A seasonal forecasting platform for climate-sensitive infectious disease risk



Funded by
the European Union

# The EpiOutlook platform



# EpiOutlook

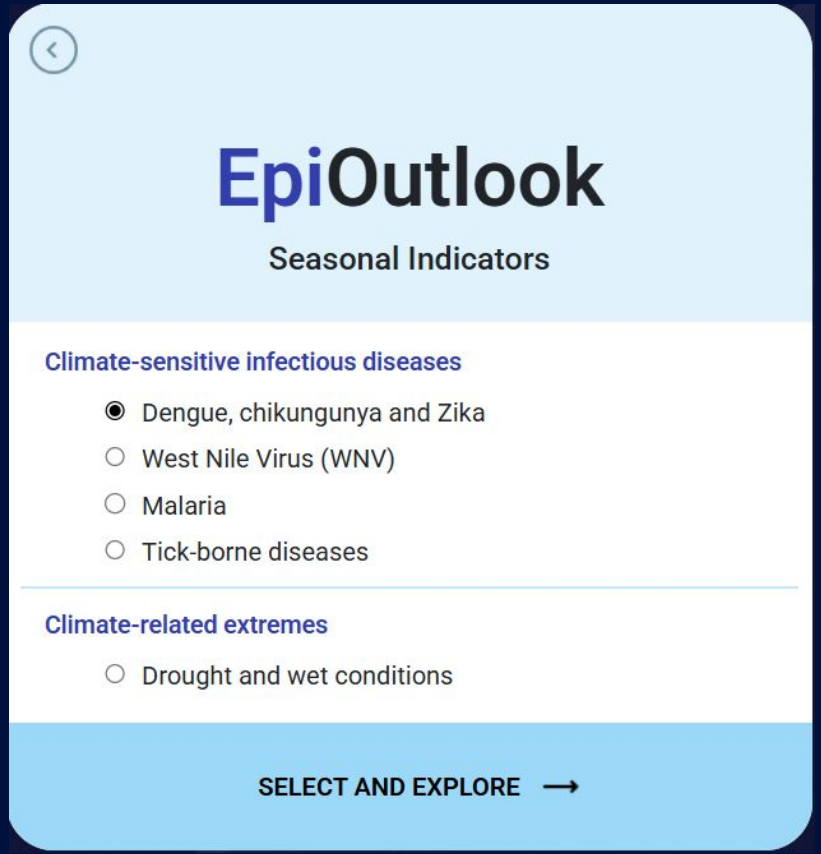
## EpiOutlook is a digital platform for forecasting and monitoring climate-related health risks in Europe.

It combines climate predictions and epidemiological risk indicators to support timely, cost-effective **public health decisions**.

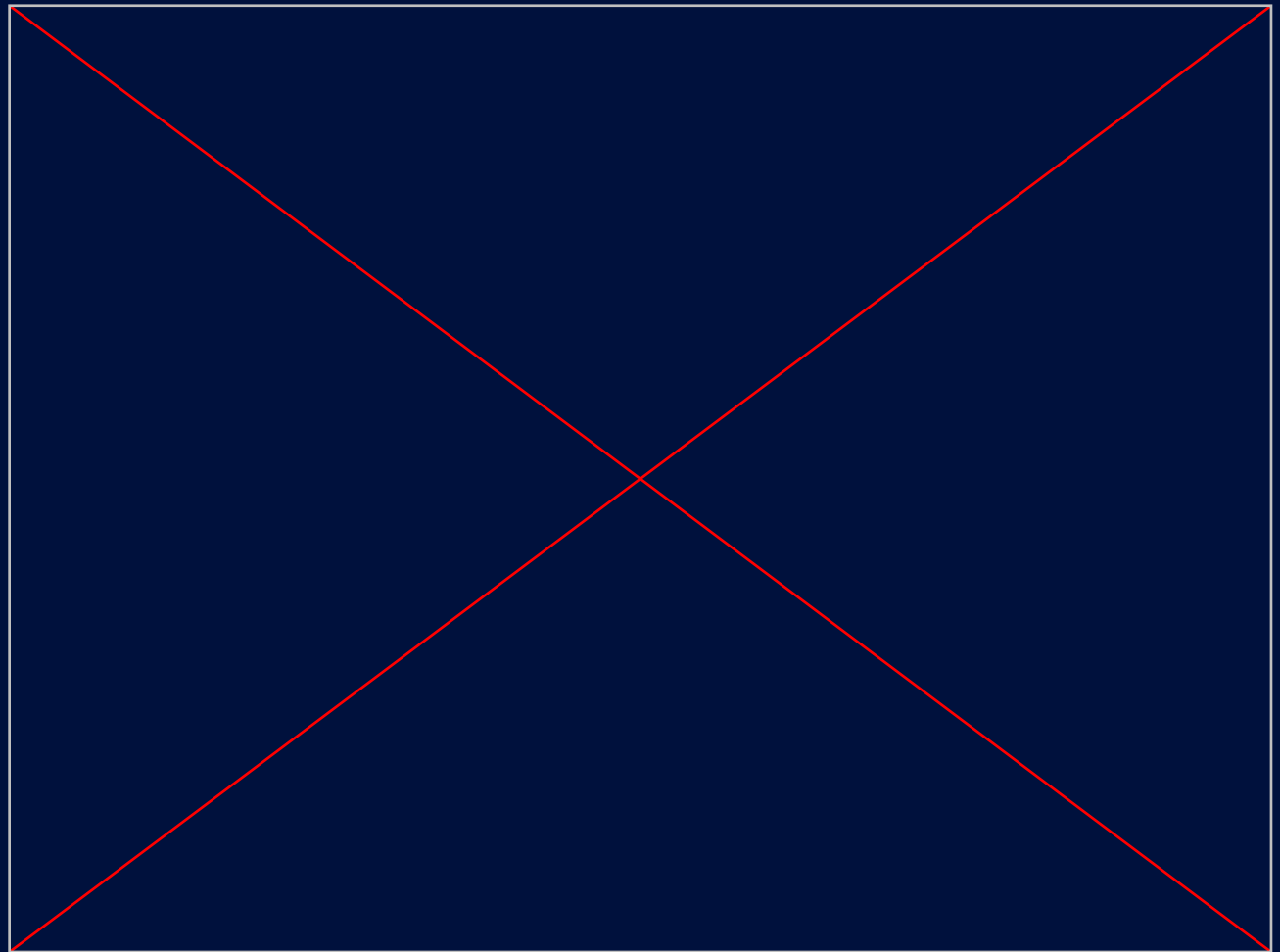
The platform is designed for scientists, medical professionals, humanitarian agencies, and policymakers.

It estimates changing climatic suitability for different pathogens and disease vectors.

These indicators are particularly relevant for supporting decisions that need to be made several months in advance.



# Demo



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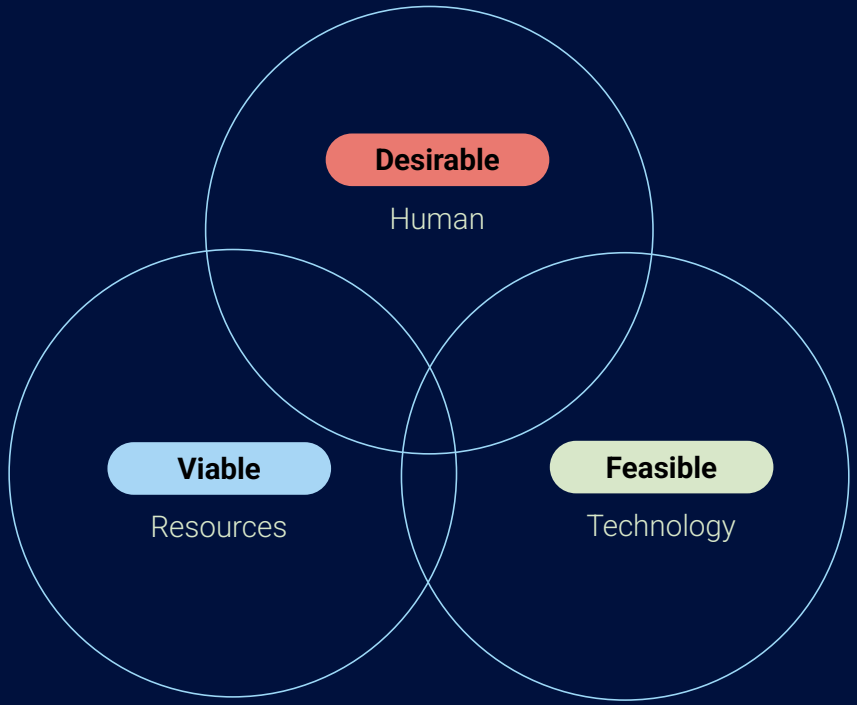
# Human-centered design co-production process

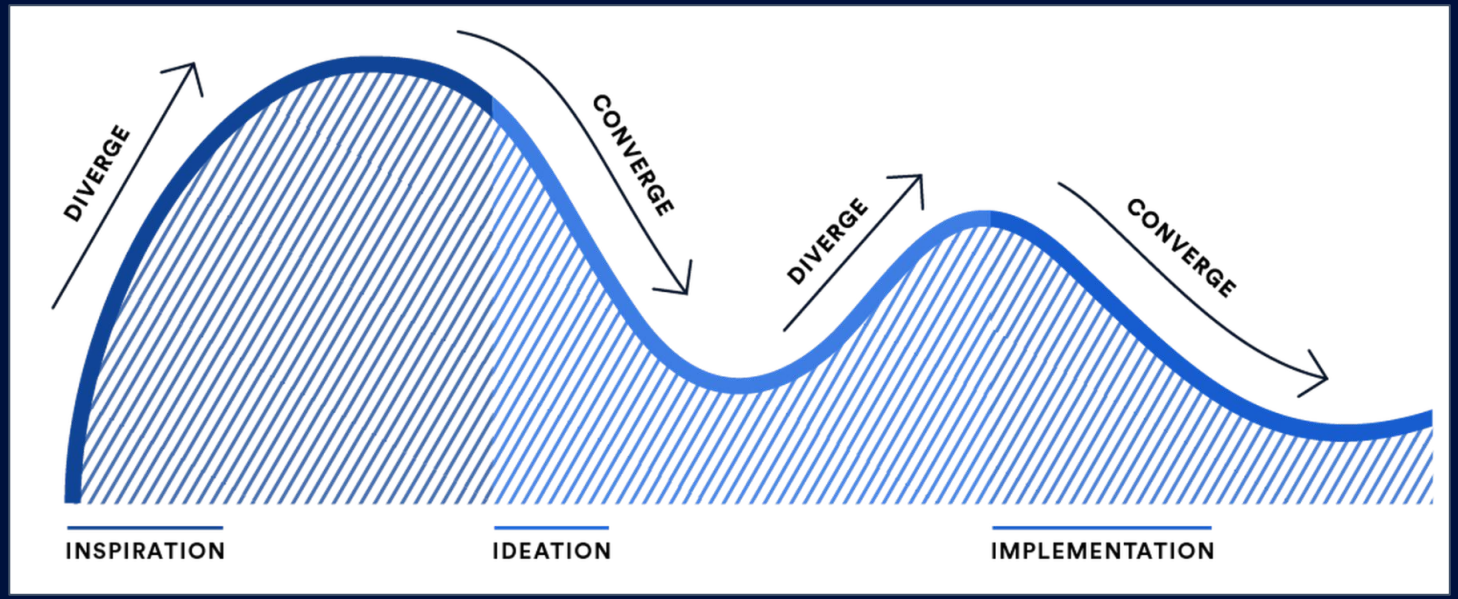
# User centered approach

The development of the EpiOutlook platform has followed a collaborative, **design-driven approach** from its inception.

Using design thinking methodologies, the project has actively involved both local and regional stakeholders to ensure that the platform addresses real-world needs and challenges.

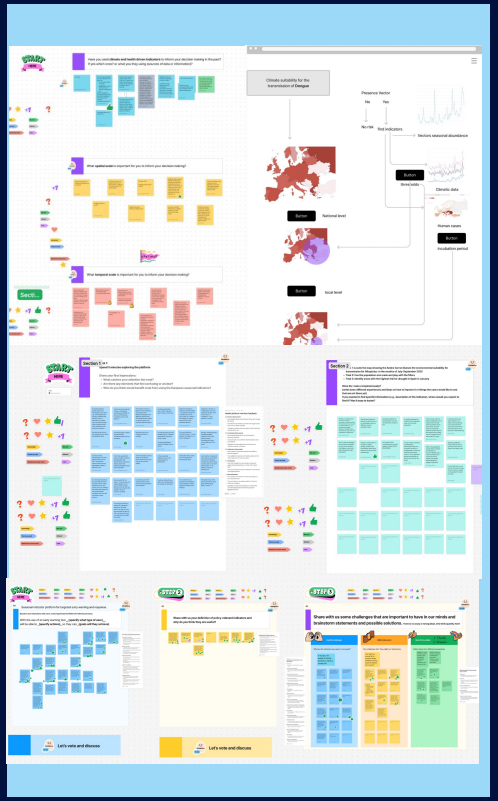


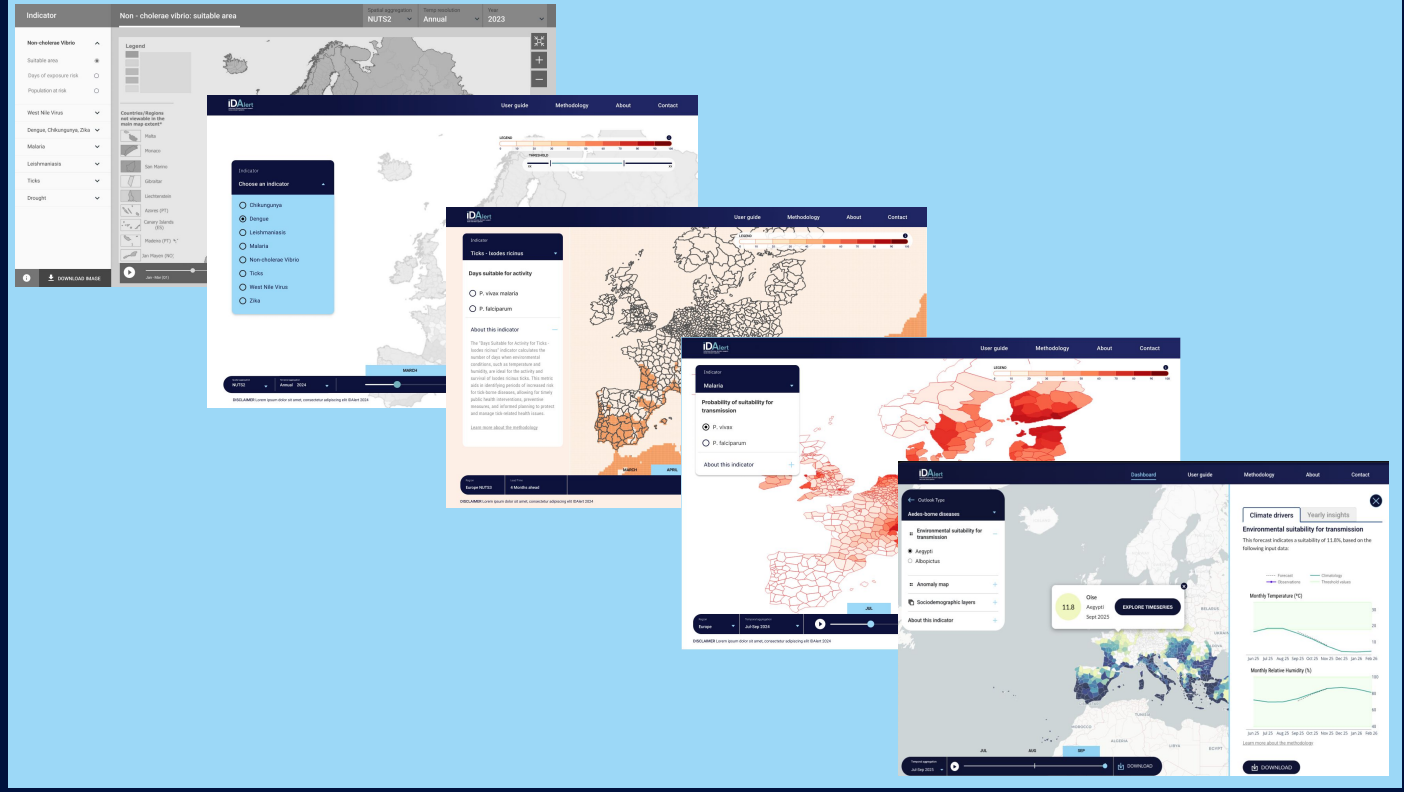
# Co-production process




**Design thinking frameworks that relies on qualitative and quantitative data** that helps us quickly identify **trends and patterns**. It starts with a nuanced understanding of what motivates a set of people and why.

# Co-production process





# Co-Creation and Collaboration

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Different iterations of stakeholder consultation events, from idea brainstorming to testing:


# User personas

## María

Persona 2

"For indicators where you have a lot of variables inside, either you know really well what it is or it could be complicated to understand"

### Organised · Busy · Expert

Age: 54

María is an experienced public health leader with expertise in urban health and social determinants of health. She has dedicated her career to addressing health inequalities in Barcelona, focusing on protecting vulnerable populations from environmental and climate-related risks such as heatwaves, air pollution, and vector-borne diseases.

### Goals · Interest

- Protect Barcelona's residents from the health impacts of climate change, particularly those most vulnerable to environmental risks.
- Improve local disease surveillance systems to anticipate outbreaks of vector-borne diseases like dengue or chikungunya.
- Advocate for equitable access to resources that enhance community resilience to climate-related health threats.
- Collaborate with regional and national stakeholders to align local public health initiatives with broader strategies.

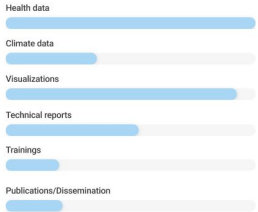
### Challenges

- Limited resources for implementing large-scale interventions or upgrading infrastructure to mitigate disease risks.
- Addressing socio-economic disparities that exacerbate vulnerabilities to climate-sensitive diseases in certain neighbourhoods.
- Communicating complex scientific forecasts in an accessible way to local decision-makers and communities.

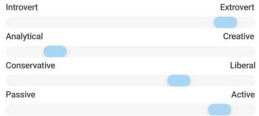
### Needs from EpiOutlook

- Sub-seasonal early warnings for emerging disease risks to guide timely interventions during critical periods.
- Localized seasonal forecasts tailored to Barcelona's urban environment to support proactive planning measures (e.g., vector control).
- Being able to easily download the time series and maps to integrate to the administrative summaries that align with municipal planning needs, ensuring actionable insights for local policymakers.
- Up to date data, inequality lens and user friendliness are key

### Motivations




### Personality




- Pragmatic and action-oriented, with a focus on implementing practical solutions.
- Empathetic, prioritising the well-being of vulnerable communities.
- Adaptable, capable of working within resource constraints while achieving meaningful outcomes.

## Luka

Persona 1

"I'm a the only medical entomologist at ECDC and I don't have the capacity to provide options for response for vectors"

### Organised · Busy · Expert

Age: 58

Luka is a seasoned epidemiologist with decades of experience in public health and climate change. He plays a key role in shaping cross-border health policies and ensuring Europe's preparedness for emerging infectious diseases. Luka is deeply invested in understanding how climate dynamics influence disease patterns and in using science to inform policy decisions at the EU level.

### Goals · Interest

- Strengthen Europe's capacity to respond to climate-sensitive diseases through data-driven policymaking.
- Foster collaboration among EU member states to address cross-border health threats effectively.
- Advocate for the integration of health considerations into broader climate adaptation strategies.
- Stay informed about cutting-edge tools and research that can enhance disease forecasting and prevention.

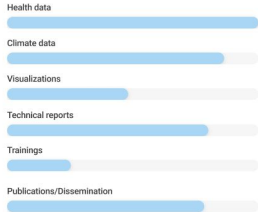
### Challenges

- Navigating the complexities of coordinating public health responses across diverse political and administrative systems in Europe.
- Difficulty in translating complex scientific data into actionable policies that resonate with policymakers.
- Navigating cross-border health threats while ensuring equitable resource allocation across diverse regions.
- Balancing long-term climate resilience goals with immediate public health needs

### Needs from EpiOutlook

- Early warnings of changing climatic suitability for diseases to guide EU-wide preparedness efforts.
- Seasonal forecasts and long-term projections summarised at administrative levels relevant for policymaking.
- A user-friendly platform that facilitates cross-disciplinary collaboration and supports evidence-based decision-making.

### Motivations




### Personality


- Analytical and methodical, with a strong preference for evidence-based approaches.
- Strategic and forward-thinking, always considering long-term impacts.
- Collaborative, working across disciplines to address complex public health challenges.

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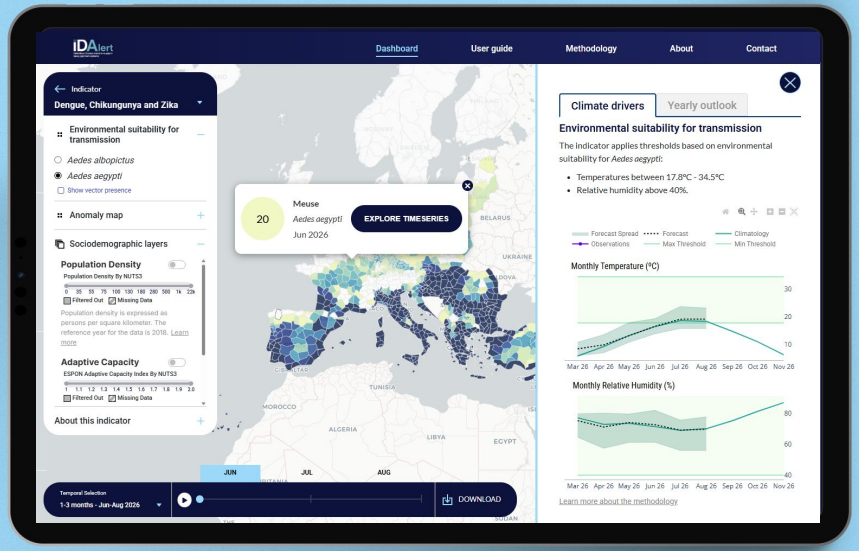
# Overview of platform and indicators

# Main functionalities



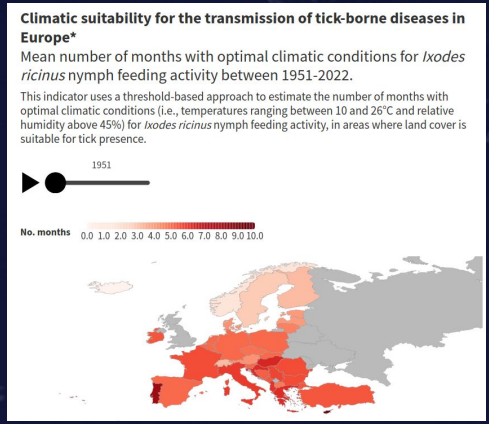

- Seasonal forecasts of climatic suitability
- Anomaly maps
- Sociodemographic layers
- Vector presence layer
- Climate drivers and yearly outlooks
- Downloadable images and data

# Development of policy-relevant indicators

- Lancet Countdown in Europe: annual indicators for climate-sensitive infectious diseases
  - Used to compare changing length of transmission season over time (historical) as well as projected into the future (up to 2100)
- Why adapt these?
  - Trust of policy-makers in these annual indicators
  - Adaptation from annual reports to seasonal forecasts for decision-making
  - Additional relevant data layers

LANCET COUNTDOWN: HEALTH AND CLIMATE CHANGE IN EUROPE

EUROPEAN CLIMATE AND HEALTH OBSERVATORY

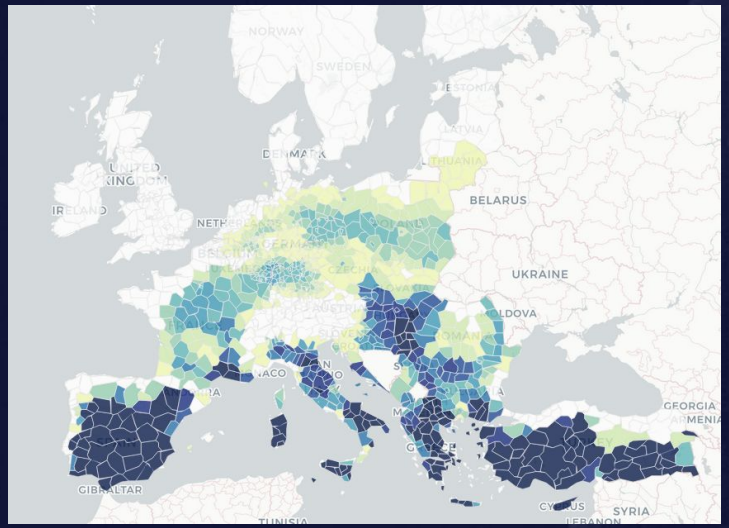


# Background: indicator development

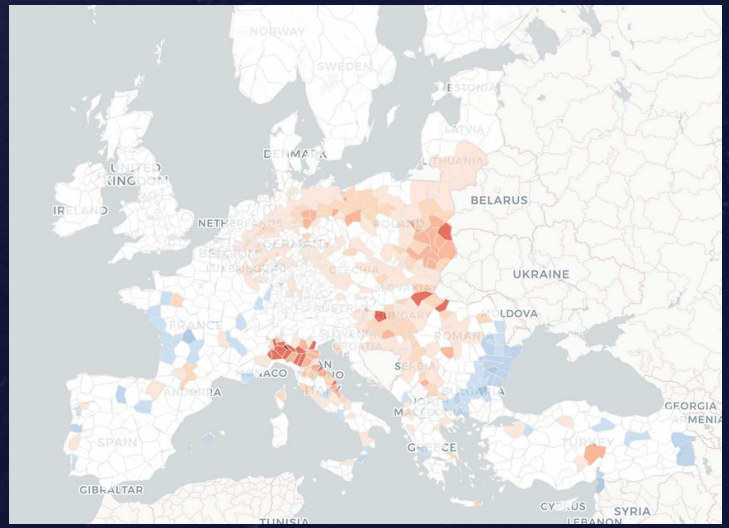
- Linking climate-sensitive infectious disease and extreme weather indicators to seasonal forecasts (lead times of 1-6 months)
- Each NUTS3 area of Europe receives a probabilistic score for climatic suitability for a given month

**Example indicator**
*A vector survives in the following conditions:*
Temperature between 10-25ºC
Relative humidity above 40%

**Climatic suitability map**




**Anomaly map**



# Overview of platform content

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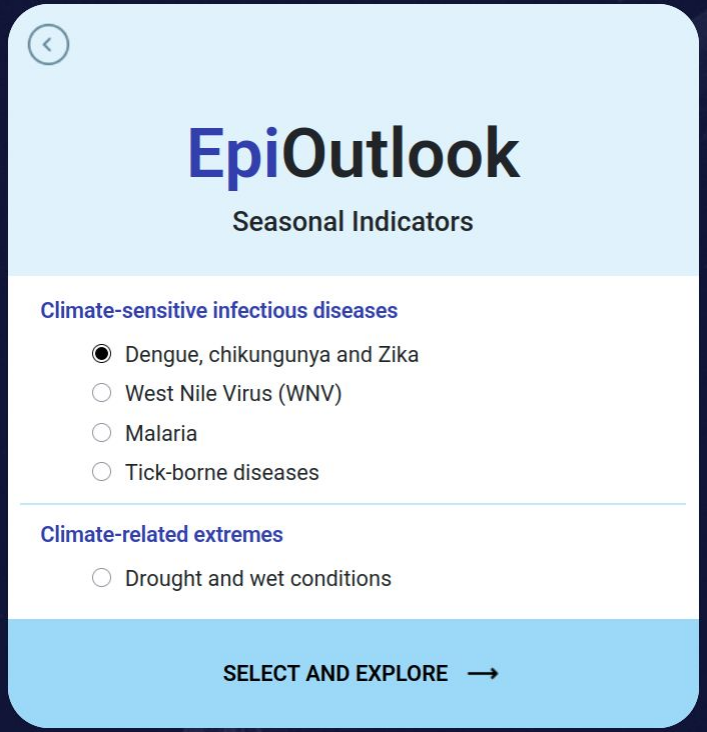
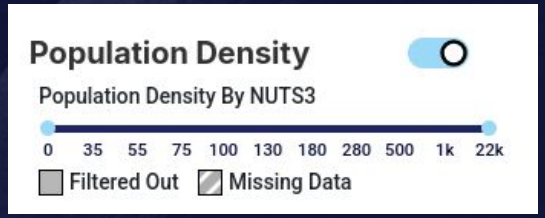
## Climate-sensitive infectious disease and extreme weather indicators




## Sociodemographic layers




**Unit:** persons per square km
**Source:** EUROSTAT 2024
**Scale:** NUTS3


**Unit:** Index score
**Source:** ESPON 2022
**Scale:** NUTS3

## Vector presence layers


**Classes:** established, introduced
**Source:** VectorNet
**Scale:** NUTS3

# Overview of indicators

| Indicator | Climatic thresholds | Data sources |
|---|---|---|
| **Dengue, Chikungunya and Zika** | Temperature, relative humidity | ERA5-Land monthly means and ECMWF SEAS-5.1 forecast data |
| **West Nile Virus** | Temperature, relative humidity | |
| **Malaria** | Temperature, relative humidity, precipitation | |
| **Tick-borne diseases** | Temperature, relative humidity | |
| **Drought and wet conditions** | SPEI 3 | |

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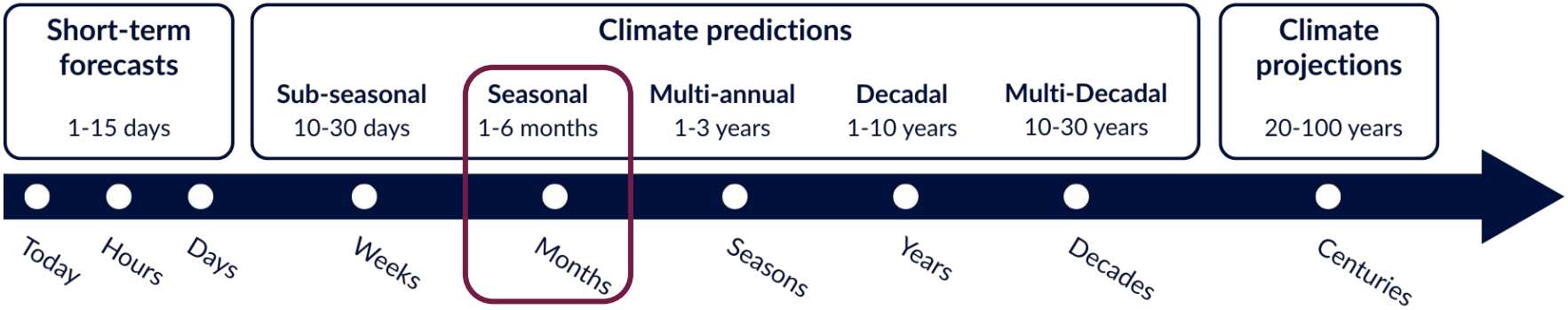
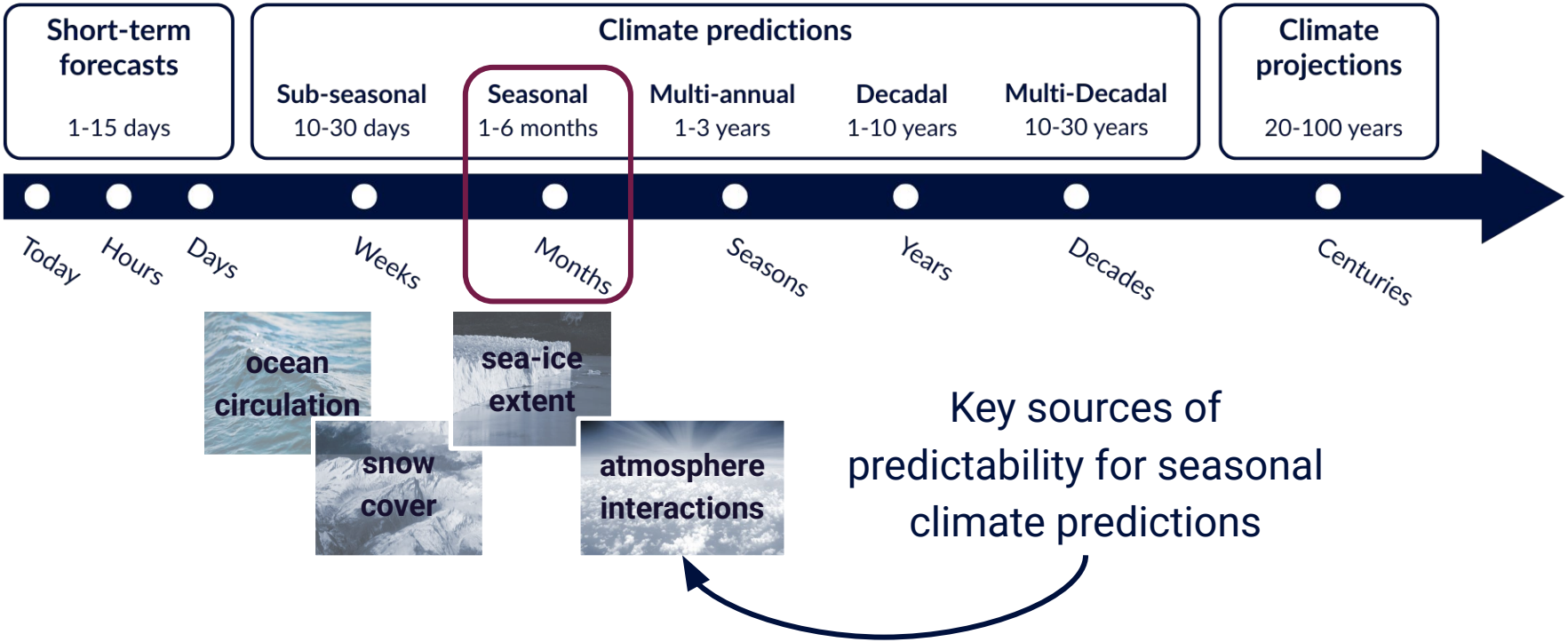
# Seasonal climate predictions

# What are seasonal climate predictions?



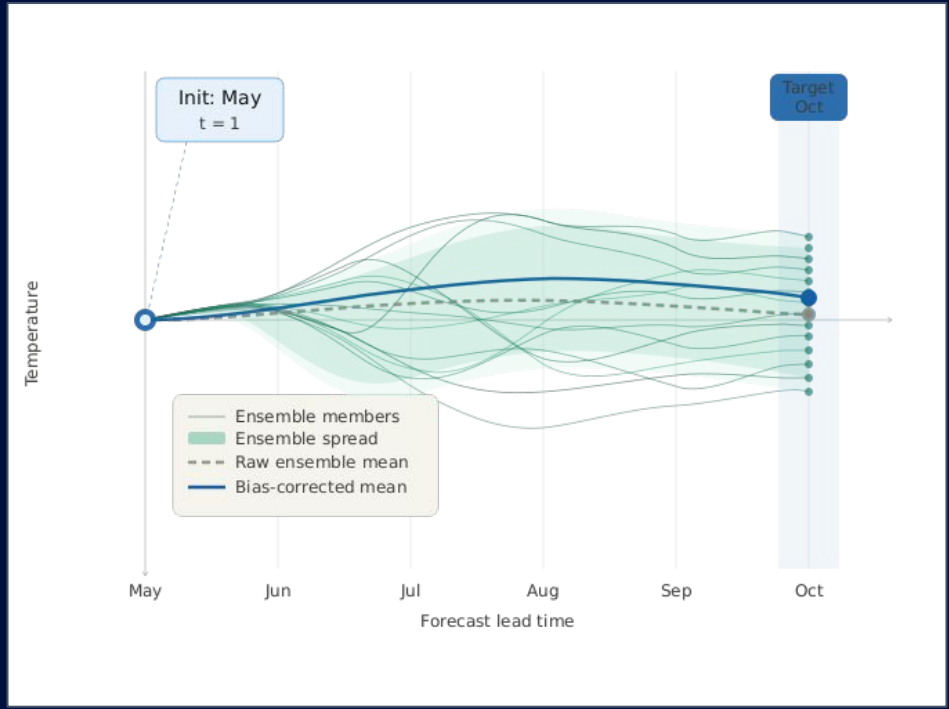

Seasonal forecasts are produced using an Earth system model to represent interactions between the atmosphere, ocean, land and other Earth-system components

# How are seasonal climate predictions made?



# Processing raw seasonal predictions

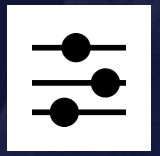
- Seasonal climate predictions are made with multiple *ensemble members*
- The raw forecast can be *biased*
- We calibrate (or *bias adjust*) the predictions to reduce biases and improve model reliability
  - to do this, we use past forecasts and observations



# EpiOutlook threshold-based indicator predictions

Raw forecasts of monthly variables

Spatial aggregation to NUTS3 level



Bias adjustment of climate variables


Calculation of indicators using thresholds


Probability of suitability for each region

# Software development

# Software Development

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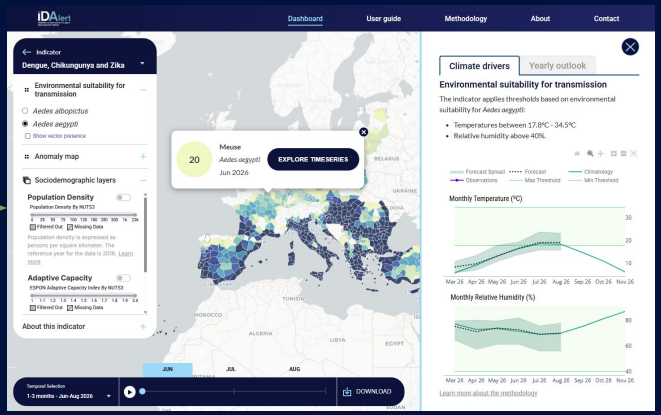
?



# Software Development Life Cycle

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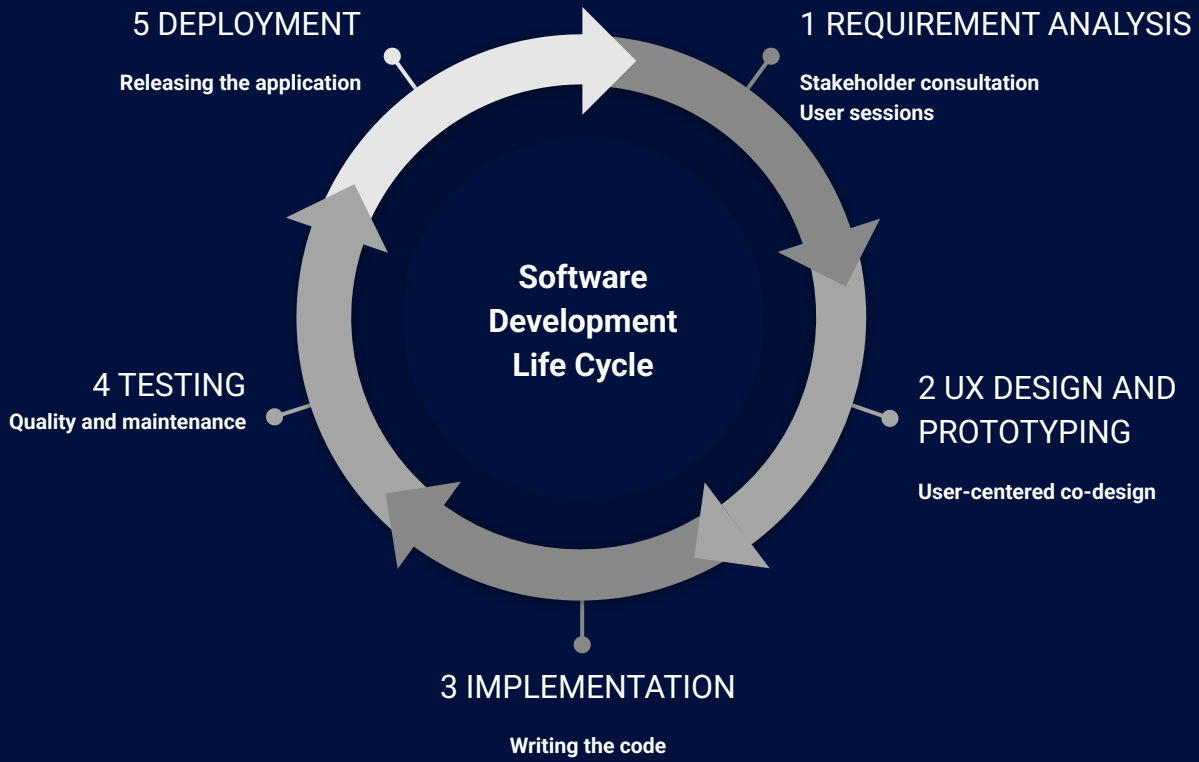

# Software Development Life Cycle

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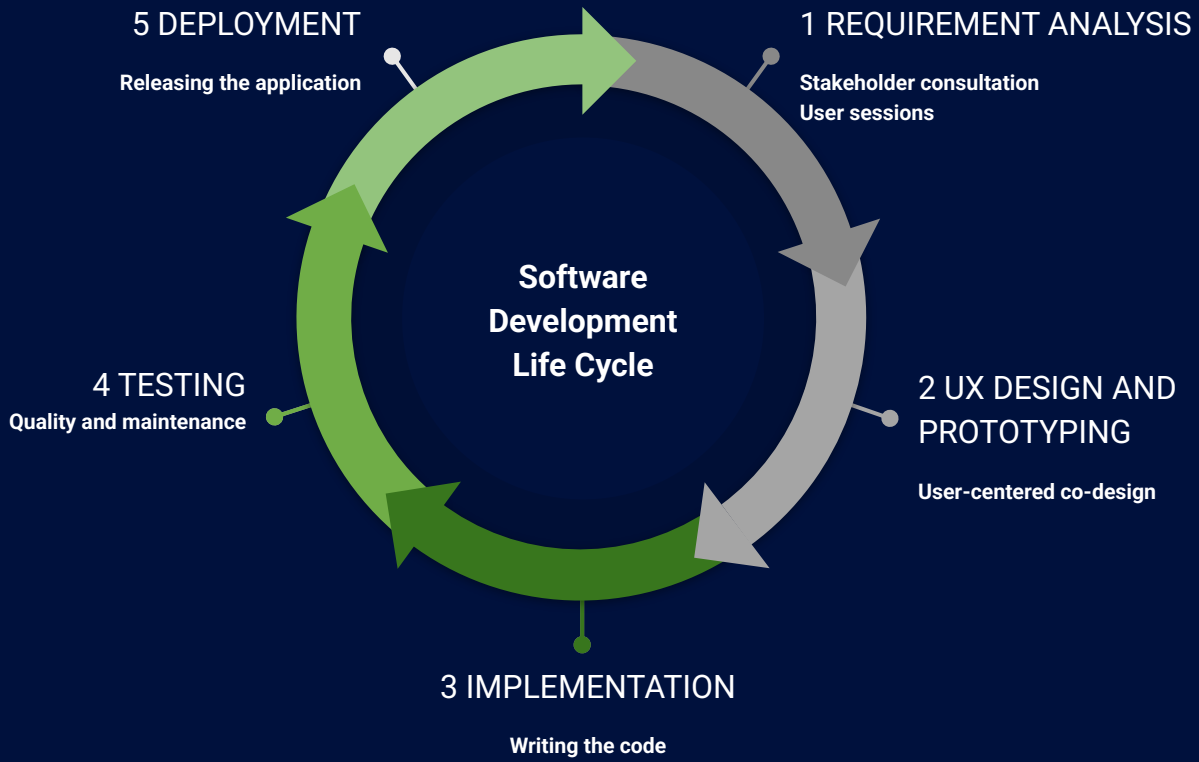

# Software Development Life Cycle

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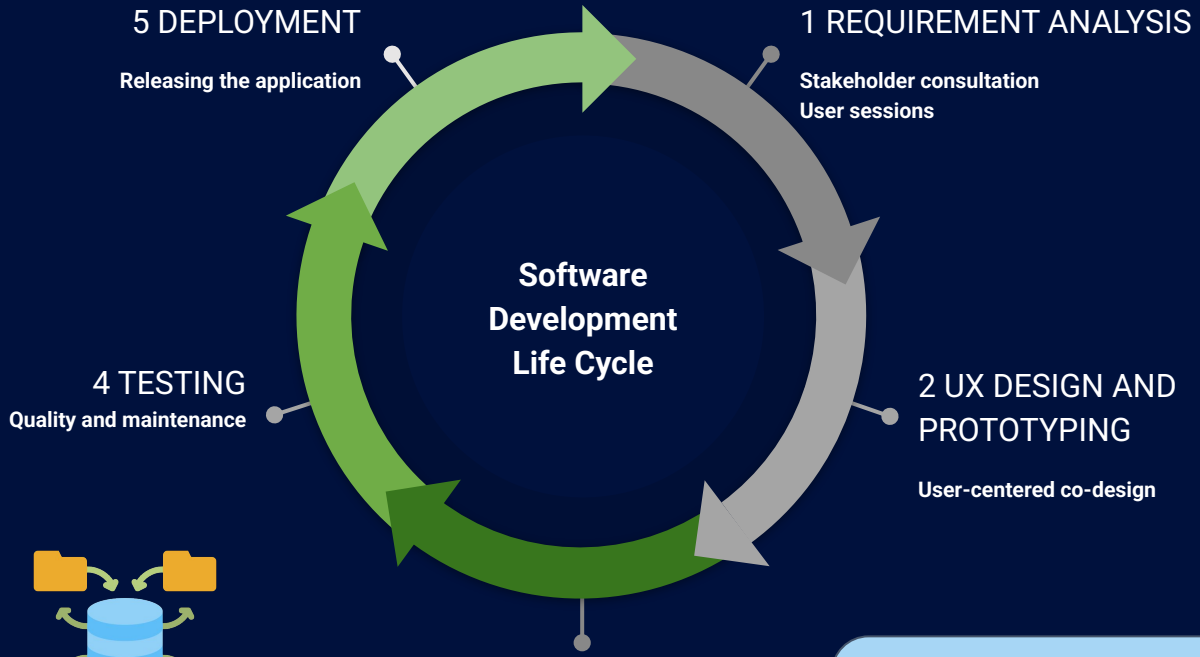


Open Source



Data Integration

plotly | Dash Leaflet

GeoPandas python™

# Software Development Life Cycle

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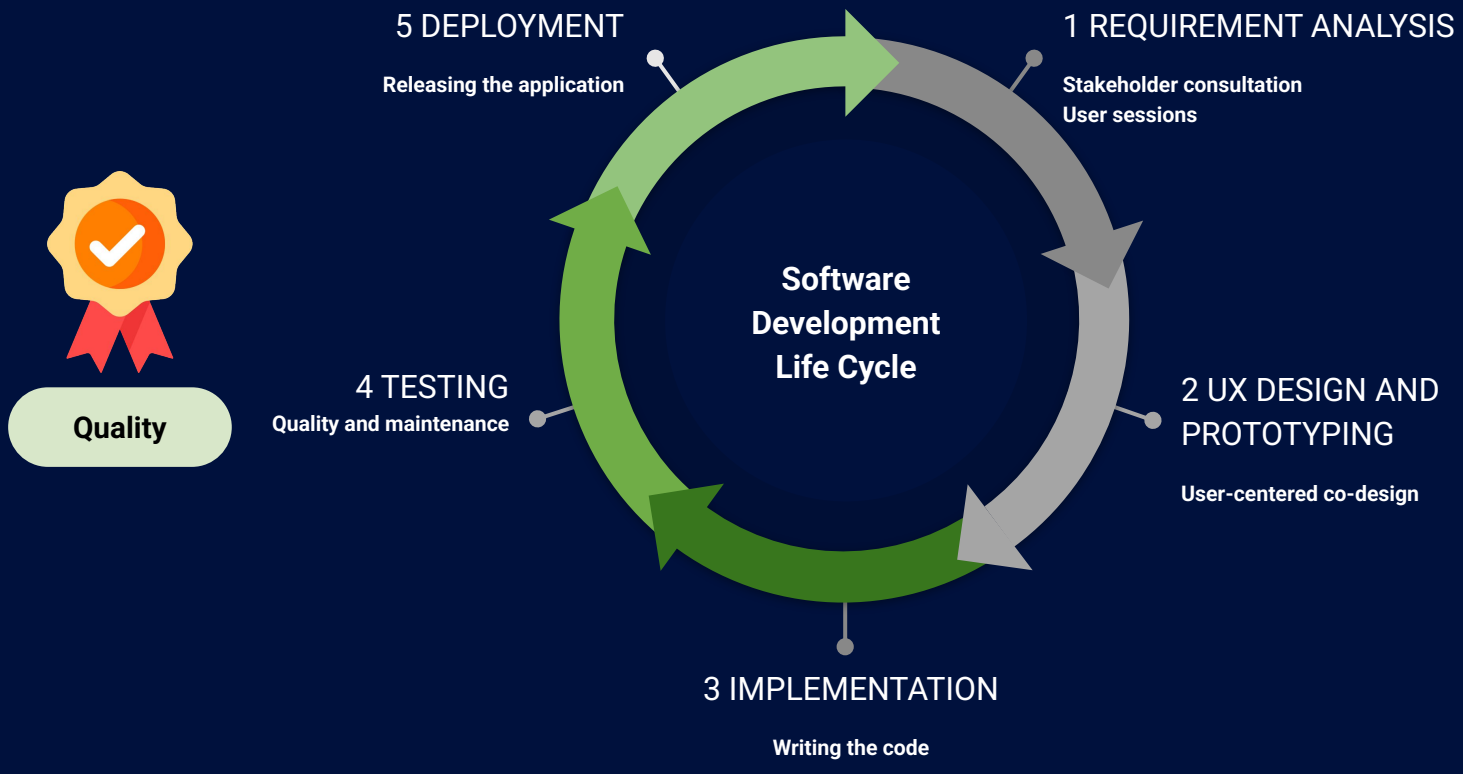

# Software Development Life Cycle

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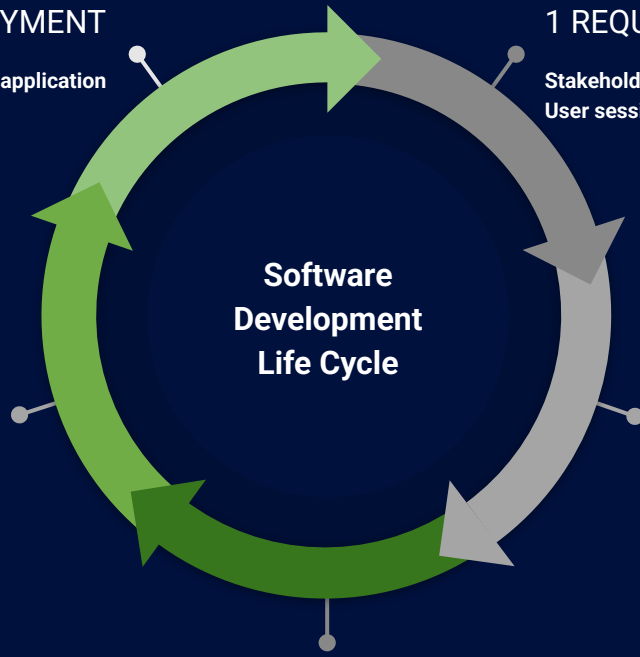
**Infrastructure**

**Dataflow**




5 DEPLOYMENT

**Releasing the application**

1 REQUIREMENT ANALYSIS

**Stakeholder consultation**
**User sessions**

2 UX DESIGN AND PROTOTYPING

**User-centered co-design**

3 IMPLEMENTATION

**Writing the code**

4 TESTING

**Quality and maintenance**

# How the data flows to you?

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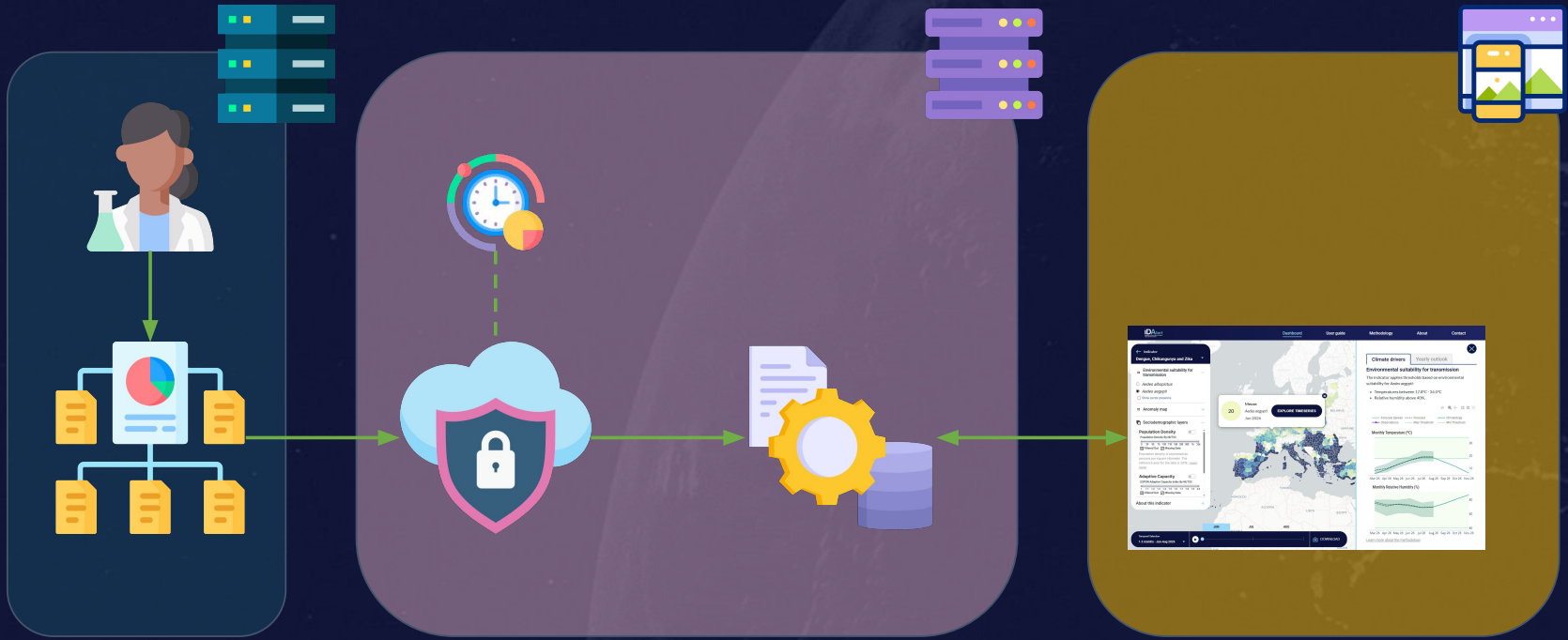
Supercomputer

Platform Server

User



# How the data flows to you?

Barcelona Supercomputing Center
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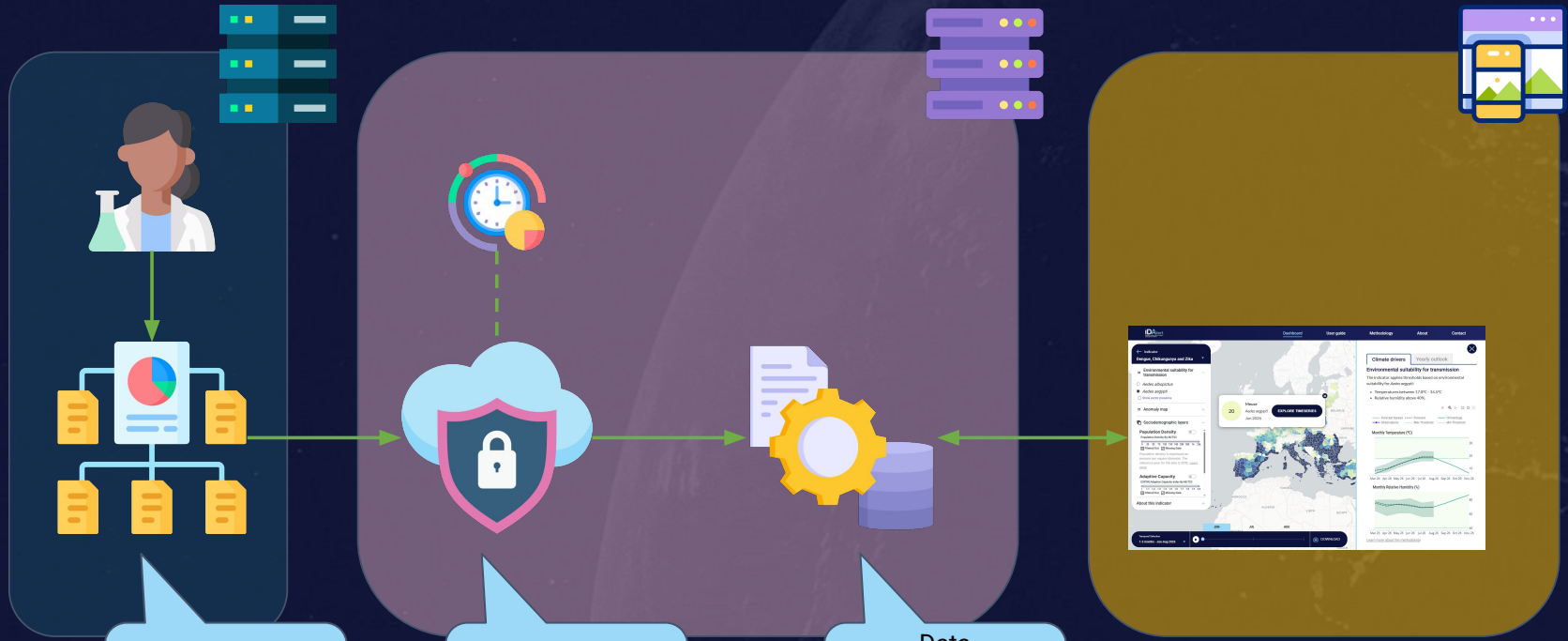
Barcelona Supercomputing Center
Centro Nacional de Supercomputación

**Supercomputer**

**Platform Server**

**User**



Data analysis results

Monthly data transmission

Data transformation for better performance

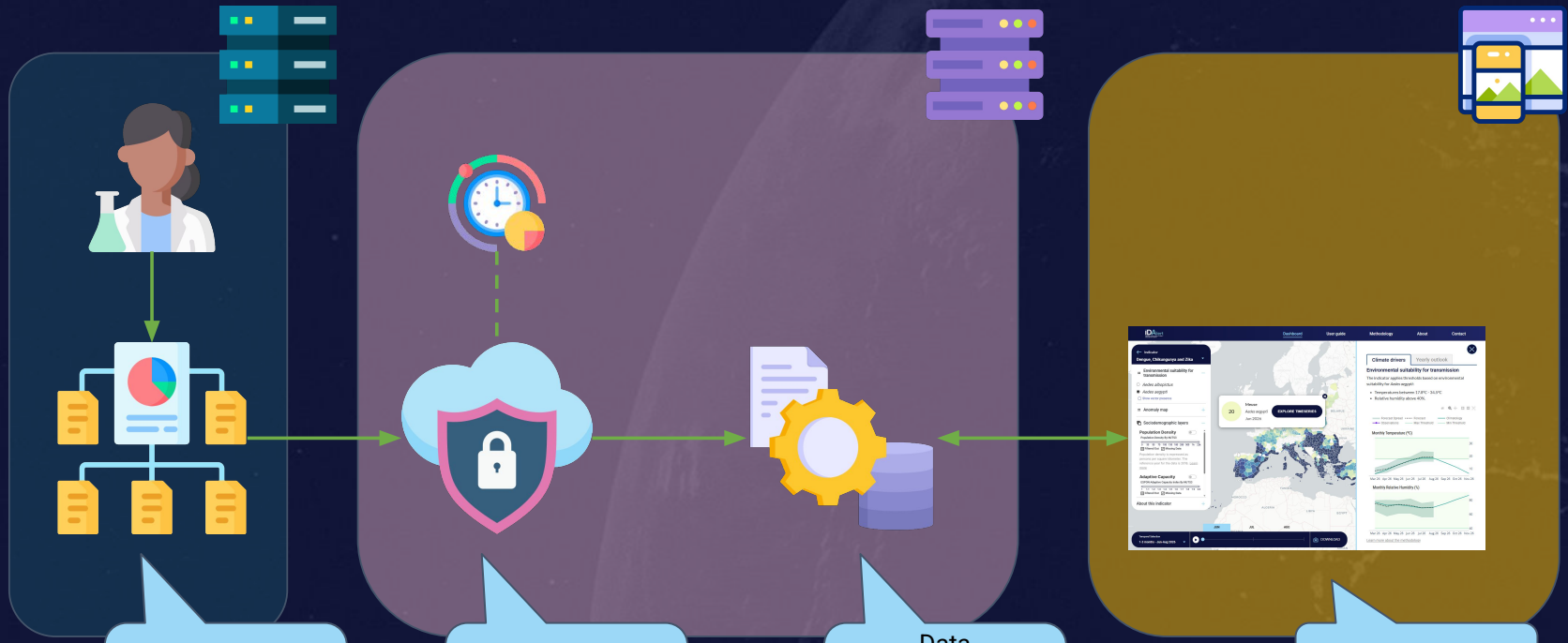
# How the data flows to you?

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

**Supercomputer**

**Platform Server**

**User**



Data analysis results

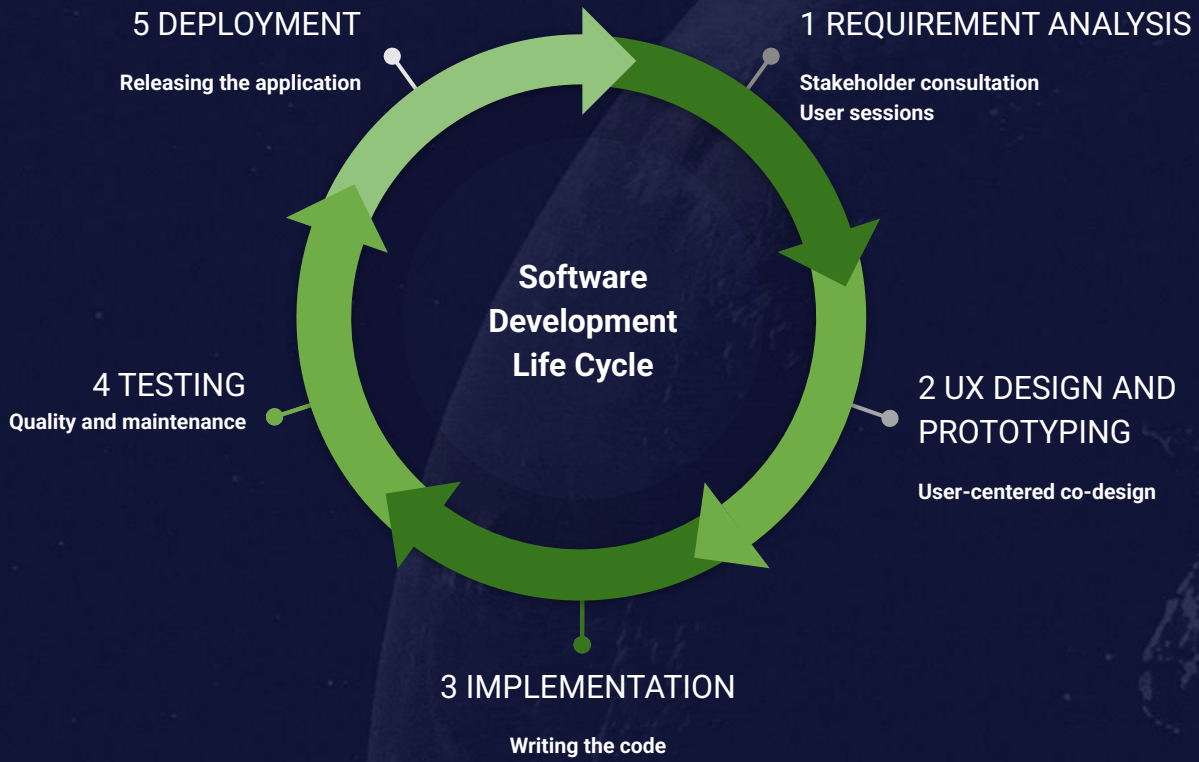
Monthly data transmission

Data transformation for better performance

Data visualization

# Software Development





# Future directions

# Future directions

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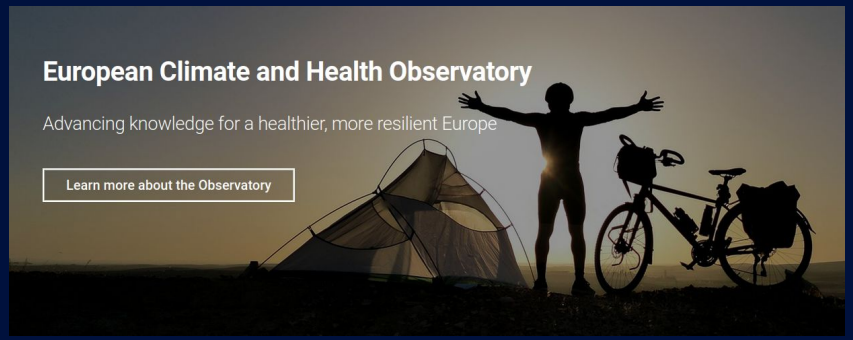
## Technical

- Expand to multi-model approach for indicators
- Expand geographically, deploy case studies, include subseasonal forecasts
- Include additional data sources (e.g., anonymised human case data)

## Policy and practice

- Integrate into the European Climate and Health Observatory
- Develop AI LLM to improve policy-maker and practitioner engagement



# Round table

## Moderator

**Jan Semenza**
Lancet Countdown & IDAlert

## Panellists

**Esther Kukielka**
ECDC

**Paolo Tizzani**
WOAH

**Aleksandra Kazmierczak**
EEA

**Rita Araujo**
European Commission

iDAlert Infectious Disease decision-support tools and Alert systems
Funded by the European Union

# Q&A

ines.martin@bsc.es

IDAlert
Infectious Disease decision-support tools and Alert systems

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## More information

**www.idalertproject.eu**

## Follow

**@IDAlertproject**

**IDAlert**

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101057554.

climate-health cluster

IDAlert is one of the 6 research and innovation projects that form the Climate-Health Cluster, funded by the European Commission Horizon Europe programme and the European Health and Digital Executive Agency (HaDEA).

All cluster projects address climate change-induced health risks and help increase preparedness and adaptation.

**www.climate-health.eu**