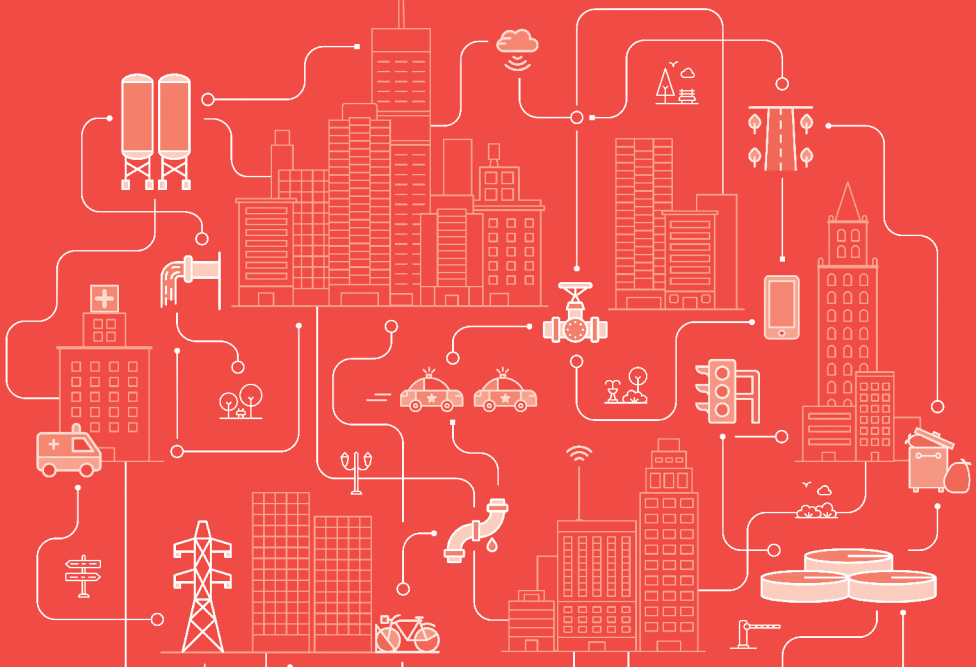
RESCCUE

RESILIENT CITIES FACING CLIMATE CHANGE

IMPACTS ASSESSMENT AND CASCADING EFFECTS
RESCCUE GUIDELINES #3

HOW TO...

estimate direct, indirect and subsequent cascading impacts from climate driven hazards



WHAT IS YOUR CONCERN?

What hazards could impact your services?

Heatwave | Flooding | Drought | CSOs

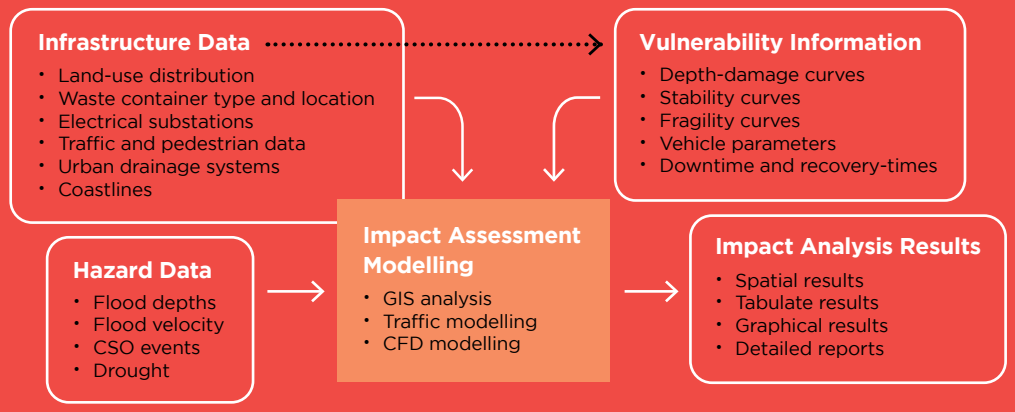
What can they impact?

- People safety
- Electrical power supply
- People bathing
- Damage to properties, goods and infrastructures
- Traffic
- Water supply

How can these impacts be assessed?

- Integrated flood and traffic models
- Water resource modelling
- Integrated flood and electrical power distribution models
- Drought and water supply models
- Integrated flood and waste models
- Integrated urban drainage and receiving water quality models

The results from impact assessment can be presented in form of risk and impact heatmaps and/or impact/disruption indicators with different levels ranging from low to high. Quantifying impacts is fundamental for understanding urban resilience with respect to climate driven events, identifying where the weaknesses lie within the chain of services and infrastructure in the city and how to improve the resilience through the incorporation of adaptation measures.



WHAT BENEFITS WOULD YOU ACHIEVE?

Detailed impact assessment scenarios

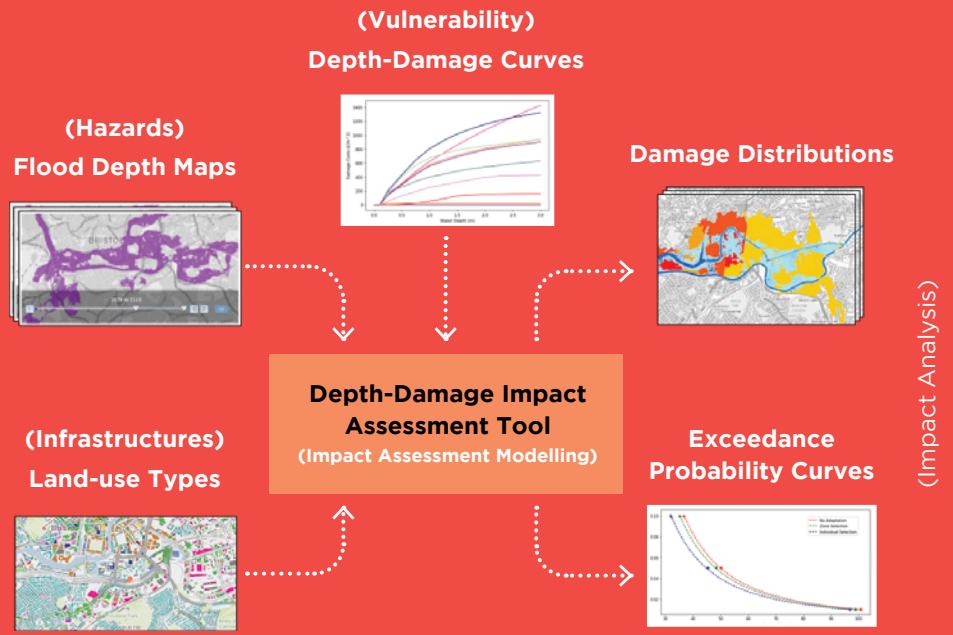
Urban scale and regional scale scenarios for assessing impacts upon urban services and infrastructures and services as a result of climate driven hazards.

Adapted to your local needs

Generic impact assessment models designed to utilise data and information at varying levels of detail that allow for a wide range of cities and local authorities to carry out their analyses.

With high quality

Impact assessment models provide the means to analyse the potential risks and impacts that climate driven hazards may have in your regions. Models developed within both commercial and open source software and designed to work with a variety of data sources and differing scales depending upon city's needs and resources.



Example of information used to assess potential impacts of flooding on properties

RESCCUE SOLVES YOUR PROBLEMS THIS IS HOW!

What are your concerns?

What scale are your impact assessments?

- ○ Citywide
- ○ Localised regions

How do climate driven hazards impact services within your city?

- ○ It impacts a single urban service
- ○ The impacts result in cascade effects onto other urban services and infrastructures

When does the hazard event occur?

- ○ It is a current problem
- ○ It is a potential future problem

How long are services disrupted?

- ○ Short recovery time
- ○ Recovery takes several days
- ○ Longer-term implications

What are the interdependencies between services?

- ○ Donor and Receiver relationships
- ○ Redundancies in place

High-quality, understandable, useful, usable, valid and reliable information is fundamental for a quality outcome.

What can you use?

Background information

- ○ Physical data for the model setup (from drainage, electrical, water resources network, etc.)
- ○ Hazard Maps (Current and Future Climate Change Scenarios)
- ○ Infrastructure fragility or property vulnerability information (asset category, damage curves, etc.)
- ○ Local expert opinions
- ○ Historical data for reference and calibration

Models

- ○ Commercial or/and Open Source modelling tools
- ○ Integrated model (loosely coupled models)

Outputs from hazard models are utilised with service/infrastructure data within impact assessment models/tools to simulate and quantify the potential impacts and disruptions to infrastructures and services that result from a given hazard.

Cascading Effects

The functionality of various critical services within the respective cities may be dependent upon the functionality of other critical infrastructures and services within the city whereby the failure within one sector may result in the failure in another.

Impact assessment maps and indicators

The derived impact assessment maps and indicators provides valuable insight into the potential losses and disruption hazards may cause and the cities resilience against such hazards. Interrogation of such data provides means to investigate what changes can be made to your city to reduce the impacts through Cost-Benefit Analyses.

What should you do?

Select climate driven hazards
Identify the main hazard and consequent cascade hazards of interest.

Select key/critical service sectors for impact assessment
Obtain data/information about critical services and infrastructures within your city.

Define hazard-vulnerability relationships
Define how infrastructures and services respond to the selected hazard and how the responses vary with respect to magnitude of the hazard.

Model selection
Select or build models for the analysis of impacts to services within your city or region.

Validate impact assessments
Validate the obtained results against historical references such as insurance claim data and the data provided by risk owner and local stakeholders.

What can you use to know that?

1 in 200 Year Baseline fluvial and tidal combined event

1 in 20 Year BAU fluvial and tidal combined event

Aggregated damage estimate (£):

39,000,000

1,000,000

Maximum water depth (m):

2.0+

0.0

Comparative example of spatial distribution of direct damages (without property value capping) as a result of Fluvial flood event for a 1 in 200 Year Event Baseline Vs 1 in 20 Year Event BAU scenario to highlight potential consequences climate change and sea-level rise may have on a region.

STRATEGIC URBAN SERVICES MODELLING: IMPACT ASSESSMENT AND CASCADING EFFECTS

Use these guidelines to:

Assess the impacts and cascading effects in critical services and infrastructures in cities from climate driven hazards

Urban floods, combined sewer overflows, sea level rise and droughts are among the major climate-related hazards that threaten our cities. These hazards can pose significant threats to the infrastructures and services. The failure of services due to climate driven hazards may trigger further impacts and disruptions to other services, known as cascading effects.

Within RESCCUE, the potential impacts on critical infrastructures and services as a result of climate driven hazards were selected to be assessed in the cities of Barcelona, Bristol and Lisbon for both current and future climate scenarios. Modelling and analysing results of such scenarios improved the understanding of the effect these may have on the respective cities, where the experience of operators may not be enough to foresee the potential response of the interdependent services outside of normal operating conditions.

5 steps to your solution:

- **What is your concern?**
- **What benefits should you achieve?**
- **What do you need to know?**
- **What can you use?**
- **What should you do?**

RESCCUE Project

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This project has received funding from European Comission by means of Horizon 2020, the EU Framework Programme for Research and Innovation, under Grant Agreement no. 700174

Strategic urban services modelling experts:

Several RESCCUE partners worked together under the guidance of the University of Exeter to assess impacts to services and infrastructures from multiple climate related hazards for Barcelona, Lisbon and Bristol:

- **University of Exeter**
- **Aquatec-SUEZ Advanced Solutions**
- **FIC (Climate Research Foundation)**
- **Cetaqua (Water Technology Centre)**
- **IREC (Institut de Recerca En Energía de Catalunya)**
- **LNEC (Laboratório Nacional de Engenharia Civil)**
- **EDP Distrubuiçao (Energias de Portugal)**
- **Ajuntament de Barcelona**
- **Câmara Municipal de Lisboa**
- **Bristol City Council**
- **Wessex Water**

The University of Exeter was responsible for the coordination of the methodologies and impact assessments carried out in the three respective cities.

The Centre for Water Systems (CWS) at the University of Exeter provided their expertise and guidance in the fields of flood risk analysis and impact assessment, along with the development of methodologies and tools to integrate flood, traffic and risk analyses for the Barcelona and Bristol research sites.

CWS has an extensive reputation in projects around the world that relate to climate change adaptation and impact assessments within the field of flood risk management. Other areas of expertise in CWS include expertise includes data mining and analytics, smart systems, decision support, hydraulics, hydrology, numerical modelling, optimisation, socio-technical and systems thinking.

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RESCCUE HELPS YOU MAKE YOUR CITY RESILIENT TO CLIMATE CHANGE

The RESCCUE project

RESCCUE (RESilience to cope with Climate Change in Urban arEas—a multisectorial approach focusing on water) is Europe's first large-scale innovation and urban resilience project, aimed to **improve the capability of cities to anticipate, prepare for, respond to, and recover from significant climate-change related threats with minimum damage**.

A multisectorial approach, a key advantage of RESCCUE

The RESCCUE perspective is a holistic one, which focuses rather on the interconnections than on separate city units of the urban infrastructure networks. To interconnect the several sectorial models, the project takes advantage of the **proposed tools and methodologies**.

3 cities, 3 different challenges

The models and tools developed within RESCCUE to analyse urban resilience based on a multisectorial approach have been validated in three different cities, carefully selected by their representativeness of the European diversity in terms of climate type and city characteristics: **Barcelona, Lisbon and Bristol.**

The RESCCUE partners can be your strategic team to help you make your city resilient to climate change:

AQUATEC · SUEZ · CETAQUA WATER TECHNOLOGY CENTRE · UN-HABITAT FOR A BETTER URBAN FUTURE · Ajuntament de Barcelona

BRISTOL CITY COUNCIL · LISBOA · PROTECÇÃO CIVIL LISBOA · fic fundación para la investigación del clima · UNIVERSITY OF EXETER · LNEC LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL · endesa · cemex latam a YTL company

IREC · UrbanDNA innovate incubate accelerate · ÁGUAS do TEJO ATLÂNTICO Grupo Águas de Portugal · EIVP ÉCOLE D'INGÉNIEURS DE LA VILLE DE PARIS · edp distribuição · HIDRA Hidráulica e Ambiente