D1.3 CLARITY CSIS v1

WP1 – CO-CREATION

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Figure 1: CLARITY Disclaimer

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CLARITY Project Overview

Urban areas and traffic infrastructure linking such areas are highly vulnerable to climate change. Smart use of existing climate intelligence can increase urban resilience and generate added value for businesses and society at large. Based on the results of FP7 climate change, future internet and crisis preparedness projects (SUDPLAN, ENVIROFI, CRISMA) with an average TRL of 4-5 and following an agile and user-centred design process, end-users, purveyors and providers of climate intelligence will co-create an integrated Climate Services Information System (CSIS) to integrate resilience into urban infrastructure.

As a result, CLARITY will provide an operational eco-system of cloud-based climate services to calculate and present the expected effects of CC-induced and -amplified hazards at the level of risk, vulnerability and impact functions. CLARITY will offer what-If decision support functions to investigate the effects of adaptation measures and risk reduction options in the specific project context and allow the comparison of alternative strategies. Four demonstration cases will showcase CLARITY climate services in different climatic, regional, infrastructure and hazard contexts in Italy, Sweden, Austria and Spain; focusing on the planning and implementation of urban infrastructure development projects.

CLARITY will provide the practical means to include the effects of CC hazards and possible adaptation and risk management strategies into planning and implementation of such projects, focusing on increasing CC resilience. Decision makers involved in these projects will be empowered to perform climate proof and adaptive planning of adaptation and risk reduction options.

Abbreviations and Glossary

A complete glossary of all CLARITY terms and abbreviations can be found in the public document “CLARITY Glossary” available at https://cat.clarity-h2020.eu/glossary/main.

Table 1: CLARITY abbreviations.

Abbreviation/ Acronym	DEFINITION
CA	Consortium Agreement
CKAN	Comprehensive Kerbal Archive Network
CLARITY	Integrated Climate Adaptation Service Tools for Improving Resilience Measure
CS	Climate Service
CSIS	CLARITY Climate Services Information System
DC	Demonstration Case
DoA	Description of the Actions (Annex 1 to the Grant Agreement)
EC	European Commission
EU-GL	Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient (Document)
GeoJSON	geographical JavaScript Object Notation
GeoTIFF	Geographic Tagged Image File Format
GML	Geography Markup Language
JSON	JavaScript Object Notation
OGC	Open Geospatial Consortium
RDBMS	Relational Database Management System
WFS	Web Feature Service
WMS	Web Map Service
WMTS	Web Map Tile Service
WP	Work Package
TOC	Table of Content
WP	Work Package

Executive Summary

The objective of WP1 is to involve practitioners, suppliers, purveyors and technology providers, scientists and potential end users (customers) in the climate service co-creation and deliver the CLARITY CSIS software and workflows in support of the climate-resilience planning.

Task T1.3 Climate Services Co-creation is responsible for integrating the WP3 (datasets and models) and WP4 (software) outputs and implement the CLARITY CSIS for use in WP2 demonstrators and in line with the user stories (requirements) from task T1.2 Climate Service Requirements.

As such, the present report briefly describes the first prototype version of the CSIS (i.e., deliverable D1.3 CLARITY CSIS v1, marked as OTHER in the DoA) prepared for the Naples demonstrator case and focused on providing features that enable the end-user to perform a basic screening study at this stage.

1 Introduction

The introduction chapter defines the purpose and intended audience of deliverable "D1.3 CLARITY CSIS v1" and briefly explains its structure.

1.1 Purpose of this document

Deliverable "D1.3 CLARITY CSIS v1" represents the first implementation prototype of the CLARITY CSIS. As such, being software, the deliverable is considered as "OTHER" in the DoA. Nevertheless, the present document provides a high-level description of the main features implemented so far with respect to the:

- CLARITY User Stories and Test Cases compiled as part of task T1.2 "Climate Service Requirements" - stored in the online catalogue[1] established by the project- which were derived from the input collected from the four Demonstration Cases, the EU-GL guideline, partners' ideas and workshops outcomes related to the envisioned and were presented in deliverables D1.1 "Initial workshops and the CLARITY development environment" and its follow-up document "D1.2 Database of initial CLARITY CSIS user stories and test cases".
- Mock-ups derived from the above deliverables (i.e., D1.1 and D1.2), which describe in a visual manner the conceptualization of CLARITY CSIS used by partners (and more particularly the involved developers) as the common ground for understanding what needs to be implemented how (the mock-ups focus mainly in the frontend but also in the underlying implications in terms of features and data structures/contents required by the system).
- The datasets collected in WP2 (deliverable D2.2 Catalogue of data sources and sample datasets) for the Naples demonstrator (DC1) – used as basis for developing the mock-up and feeding the CSIS prototype – and
- The CLARITY data package specification, which acts as "glue" enabling the interrelation of the various pieces of information (and its related data models) that are necessary at each step of the CLARITY (EU-GL) methodology (implemented by means of the CSIS).

Further detailed information concerning implementation status of each of the specific components can be found in WP4 deliverable "D4.3 Technology support report v1".

1.2 Intended audience

The target readers of this document are mainly the stakeholders of the four CLARITY Demonstration Cases in WP2 "Demonstration & Validation" that represent the Climate Service Customer perspective and the purveyors and climate data providers that represent the Climate Service Supplier perspective in the overall co-creation process; as well as CLARITY technical partners in charge of the Climate Service integration and development in WP1 "Co-Creation" and WP4 "Technology Support".

1.3 Document structure

The structure of the document and the relationships between the different chapters is as follows:

Chapter 1 (this chapter) introduces the document and explains the overall purpose of this document and its relation to other work packages and deliverables.

Chapter 2 gives presents the CSIS specification in terms of visual mock-ups in relation to the User Stories from where they were conceived.

[1] http://cat.clarity-h2020.eu

Chapter 3 presents the reference modelling workflow used to process the data required by the DCs, it also lists the datasets prepared for the Naples demonstrator (DC1) and introduced the CLARITY data package specification.

Chapter 4 presents the list of components currently being implemented and deployed that make part of the first CSIS prototype.

Chapter 5 provides the conclusions and a summary on foreseen implementation activities towards the second version of the prototype.

Chapter 6 lists the references and bibliography used in this document.

Chapter 7 provides two annexes providing full details on the CLARITY data package specification as well as a working example of the data package being prepared for Naples demonstrator.

2 CSIS specifications

CSIS prototype is developed based on the user requirements that were initially developed in the form of the User Stories and later refined in a co-creation process and in the form of the mock-ups. At a current implementation status, only the screening process has been fully specified in terms of the mock-ups and partially implemented in a demonstrator. A commented list of the CSIS mock-ups, as they were in January 2019 is shown hereafter.

First mock-up page (Figure 2) shows the overview of the projects that have been previously defined in the CSIS. Currently, this is already implemented as a proof of concept. “Clone project” function is not working yet and only the expert users can add new projects.

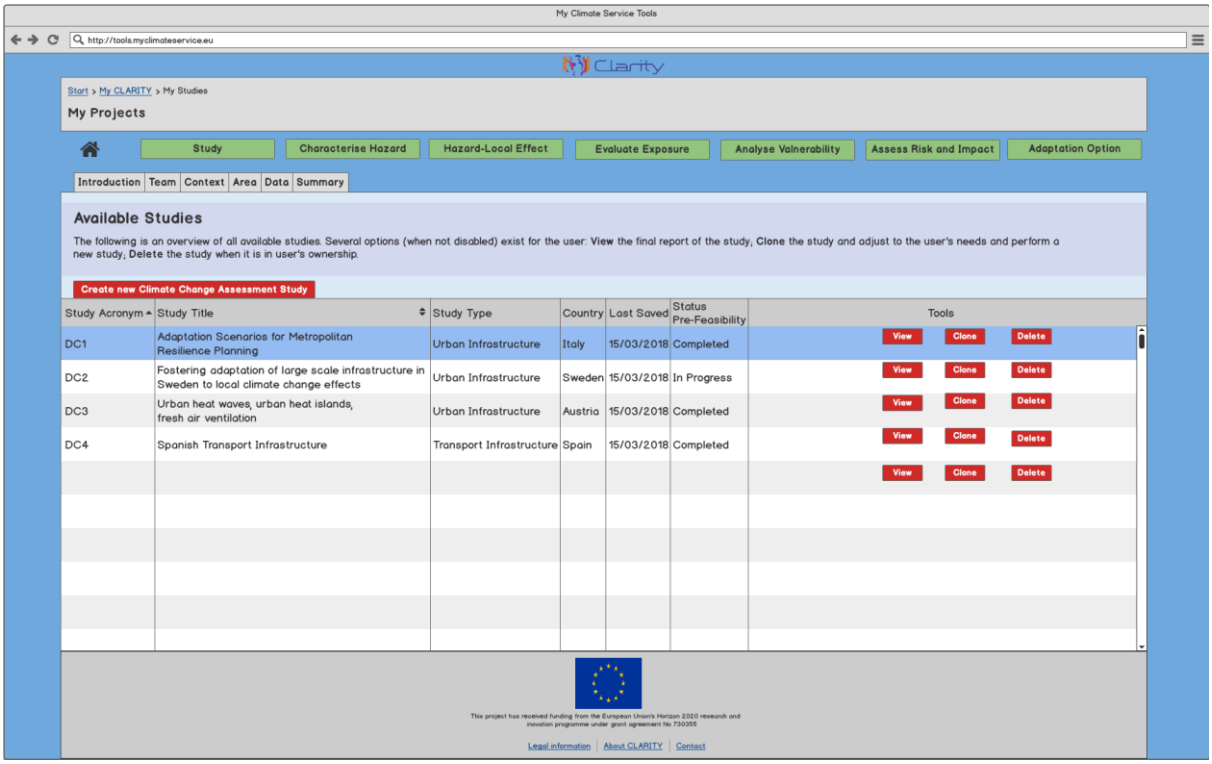

Figure 2: CSIS studies homepage

Several options (when not disabled) exist for the user: *View* the final report of the study(any user); *Clone* the study and adjust to the user's needs and perform a new study (any user); *Delete* the study (study owner). Permissions to view or clone a study may become more restricted in the future.

Figure 3: Study -Introduction

"Introduction" tab (Figure 3) is as an introduction of the EU Non-paper Guidelines for Project Managers. The EU-GLs are structured to provide a toolkit to incorporate climate resilience into a conventional project cycle.

Team tab (Figure 4) shows who participates in preparing the study. Team members can have different roles.

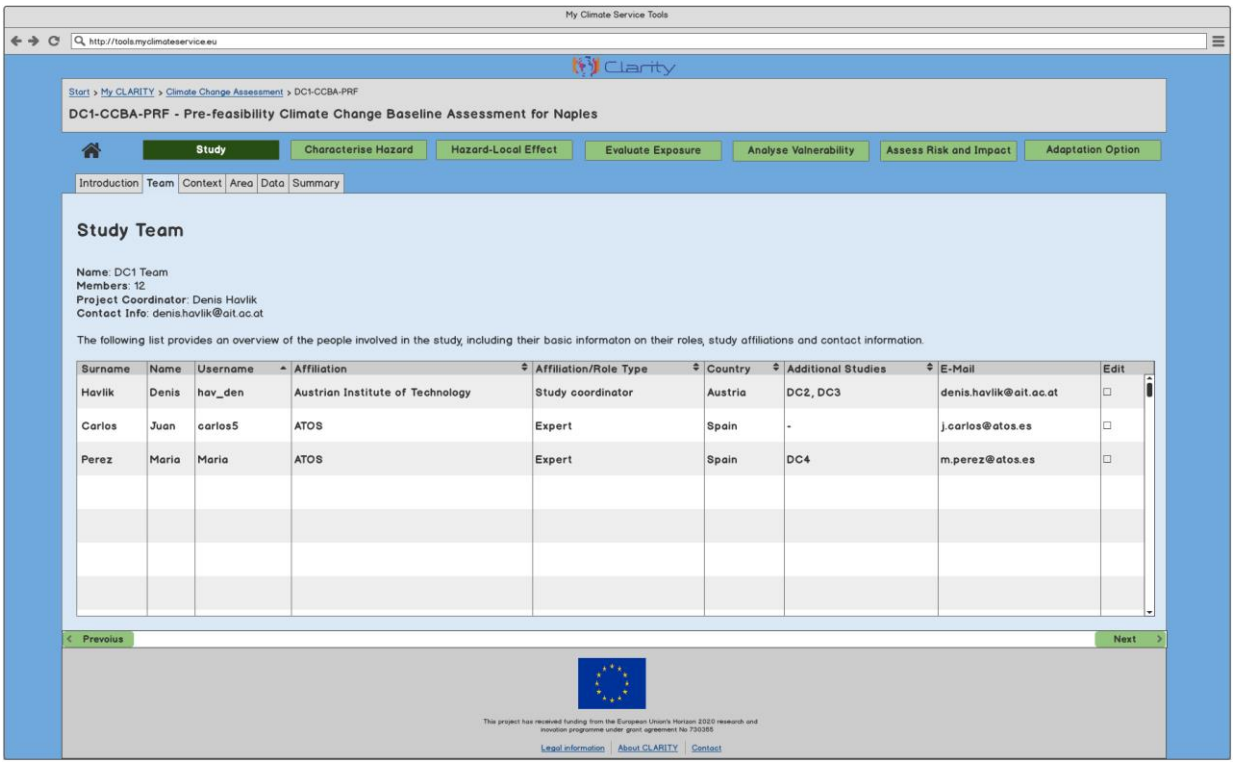

Figure 4: Study - Team

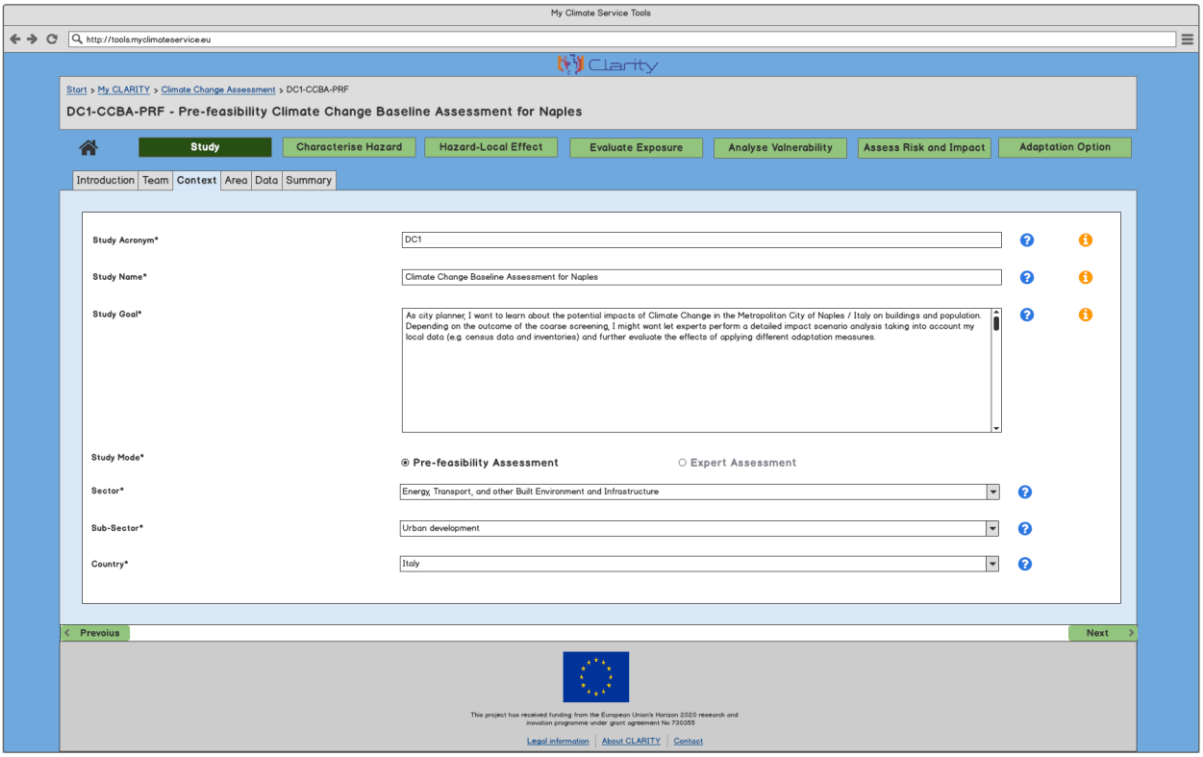

Figure 5: Study -Context

Context and area steps (Figure 5, Figure 6) are used to provide some contextual information about the project. “Area” step has a second sub-step (not shown) where the exact polygon of the study area is indicated. This is important for the next step: choosing a data package.

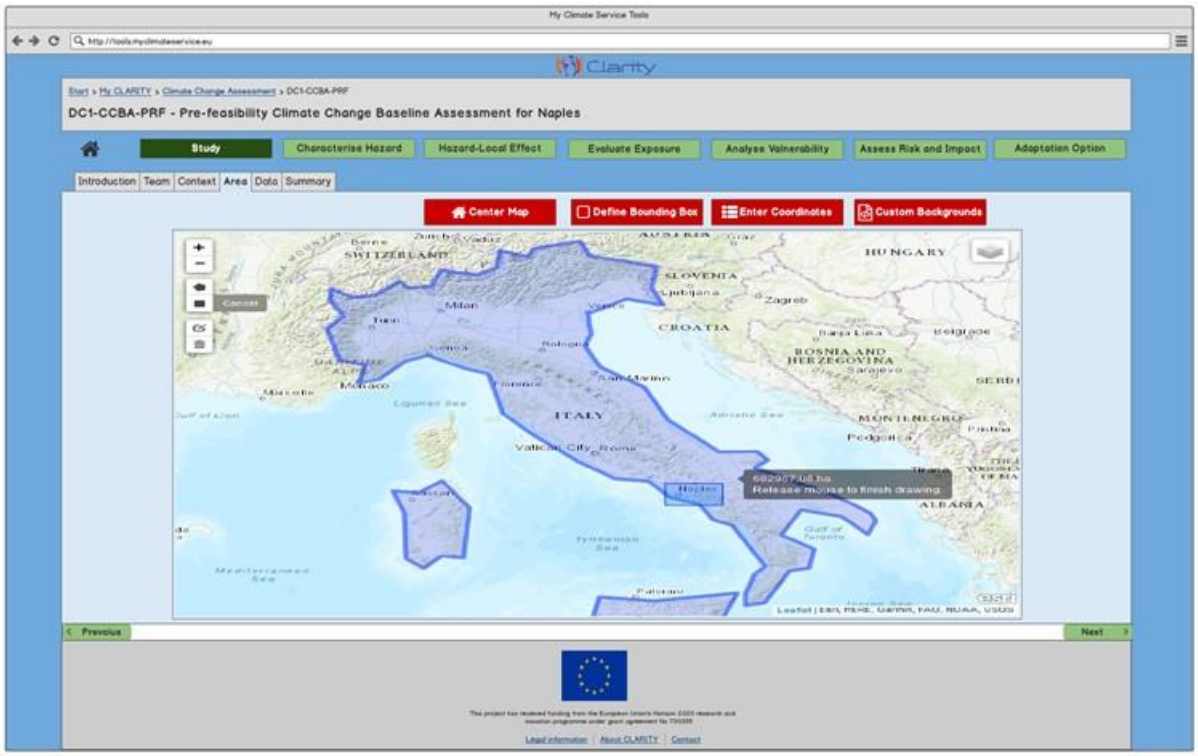

Figure 6: Study – Area

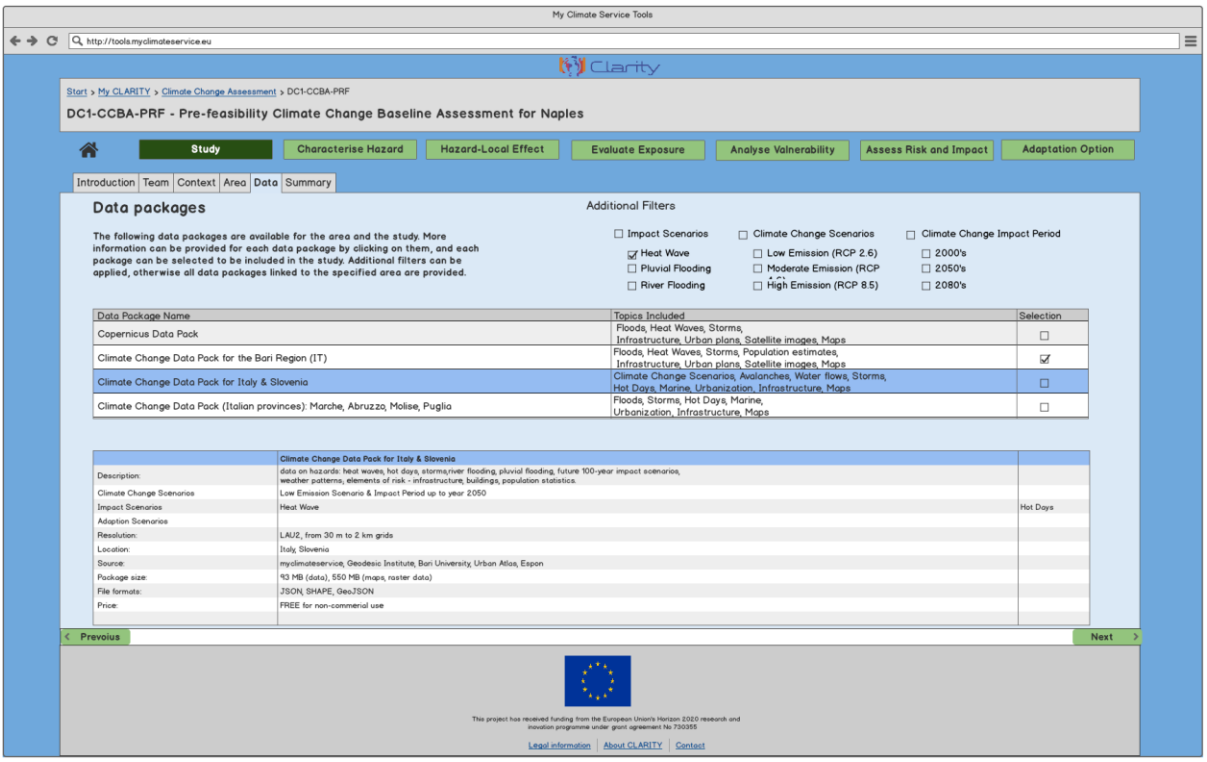

Figure 7: Study - Data

In the “Data” step (Figure 7), user can choose one of the data package that are available for the area and the study. Data packages can cover different areas and they can offer different hazards, elements at risk, validation options, etc. Final tab in the “Study” step is “Summary” (Figure 8). It presents a preview of the first chapter in the future screening report and summarizes the information entered in this step: team, context, area, data package chosen

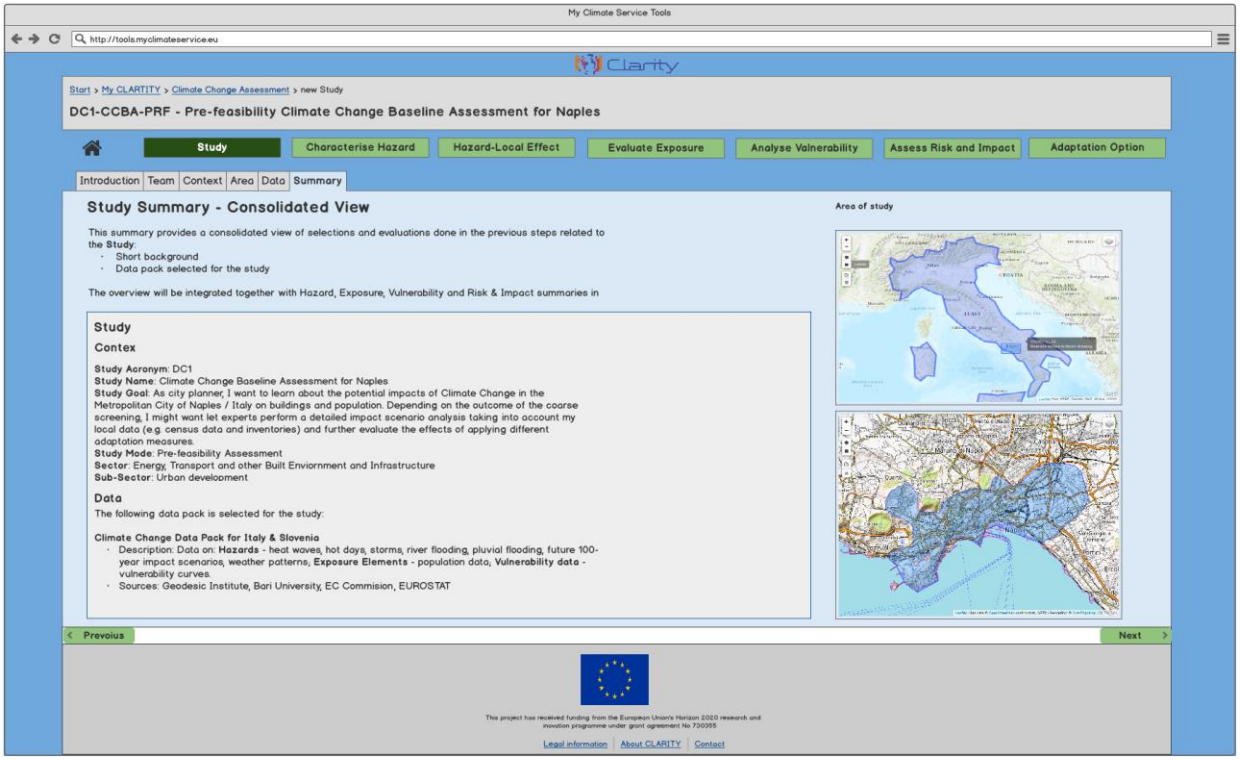

Figure 8: Study - Summary

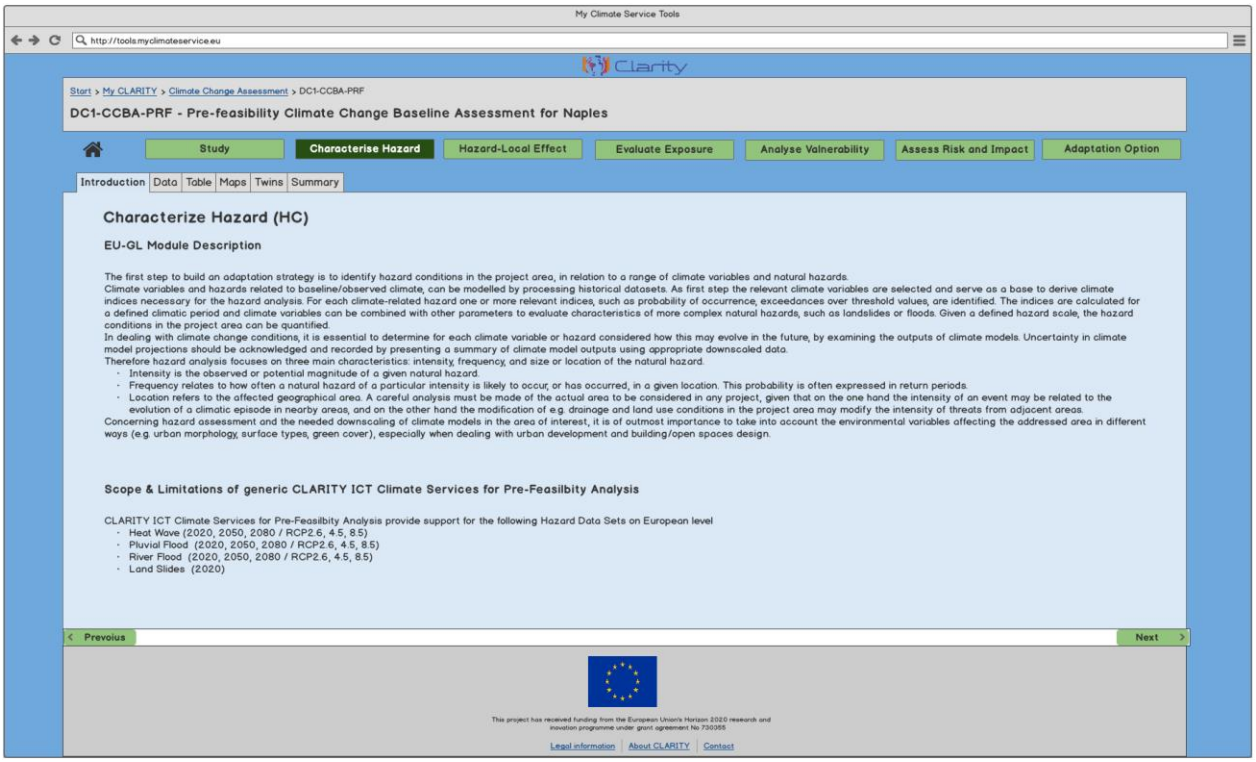

Figure 9: Characterise Hazard - Introduction

"Characterize hazard" step also starts with the "introduction" (Figure 9) and ends with the "Summary" (Figure 15). The same is true for all following steps and assures that: (1) users don't have to read long methodology documents before starting to use the tool, and (2) immediately understand how the report is built and what is included in it.

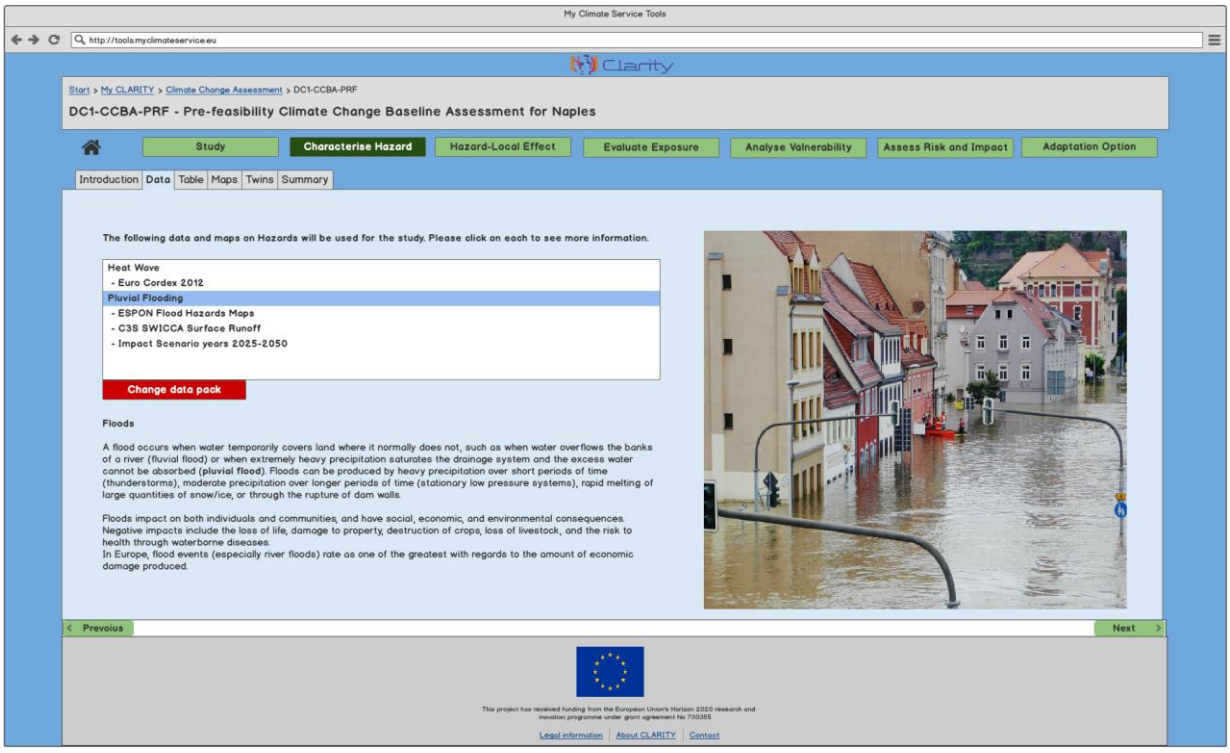

Figure 10: Characterise Hazard - Data 1

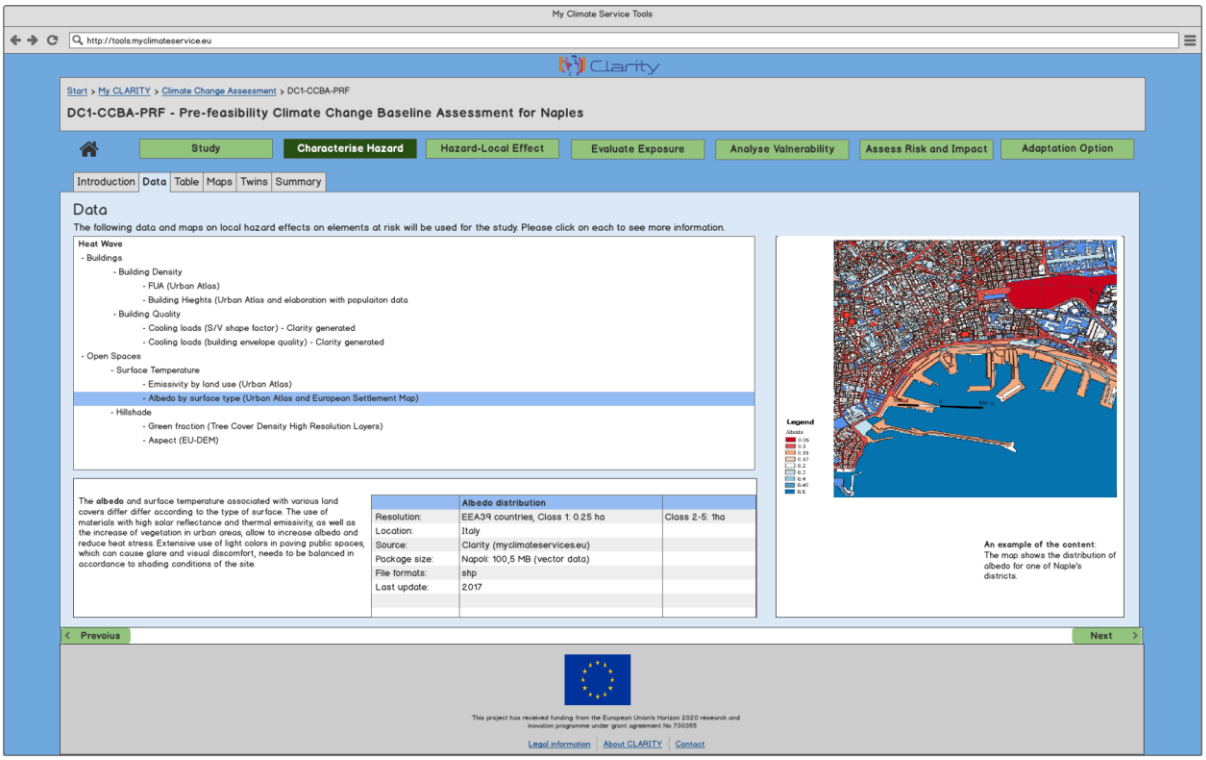

Figure 11: Characterise Hazard- Data 2

Next tab in this step is “Data” (Figure 10, Figure 11). Here, the users can see which hazard-related indices are used in the data package, what they represent, how accurate the data is etc. “Table” tab (Figure 18) shows the first study result: relative importance of different hazards in the study area. “Scenarios” are the future climate scenarios and depend on the data package used.

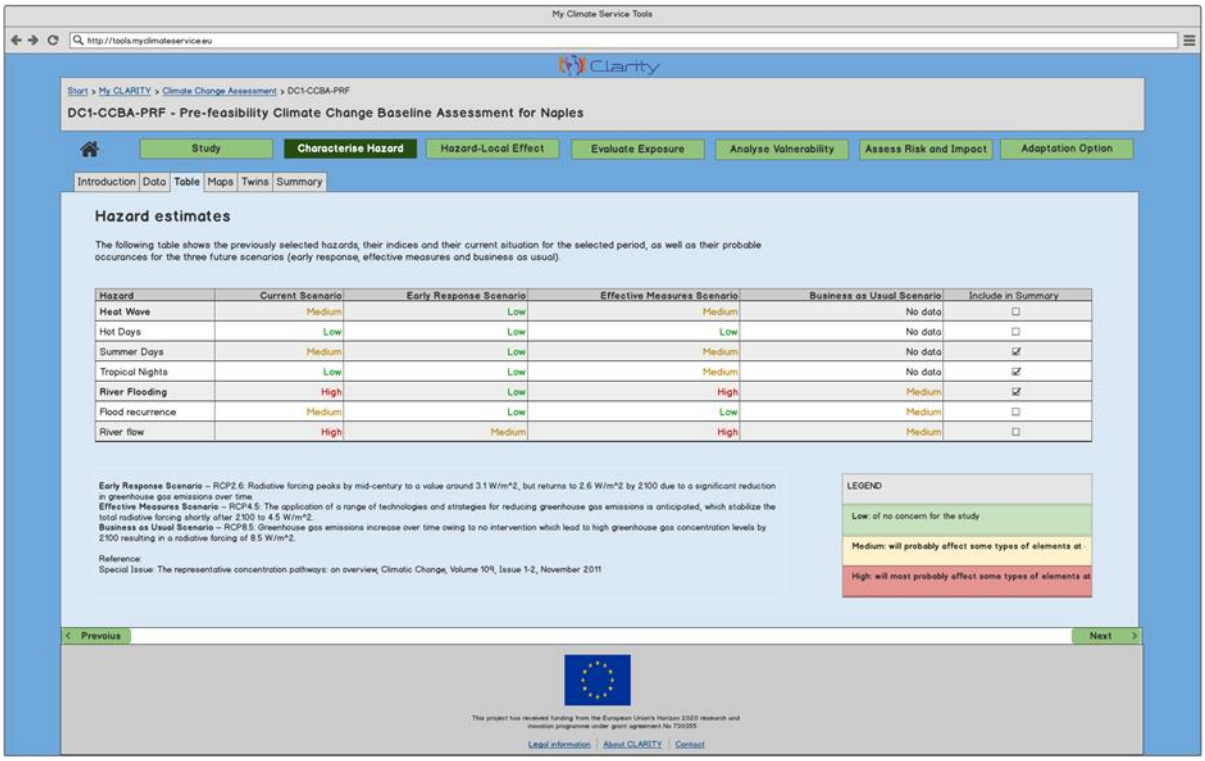

Figure 12: Characterise Hazard – Table

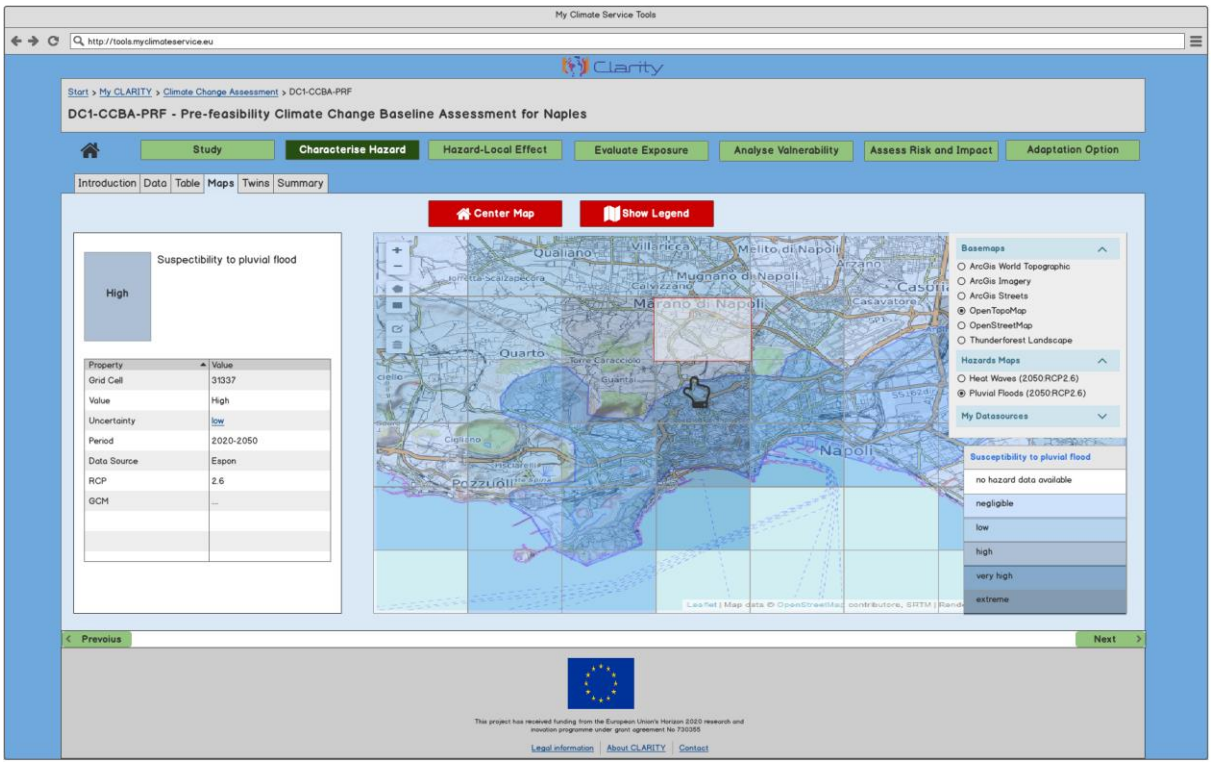

Figure 13: Characterise Hazard – Maps

"Maps" tab (Figure 13) allows the users to explore map views of different hazard indices. In many cases, no variation of the hazard will be seen in the study area due to coarse resolution of the hazard maps, but the users can zoom out and include the map snapshots in the report as they see fit. (This principle applies to all other map views.). Finally, the "Twins" tab (Figure 14) allows the user to discover and concrete examples of various hazard events and include them in the report.

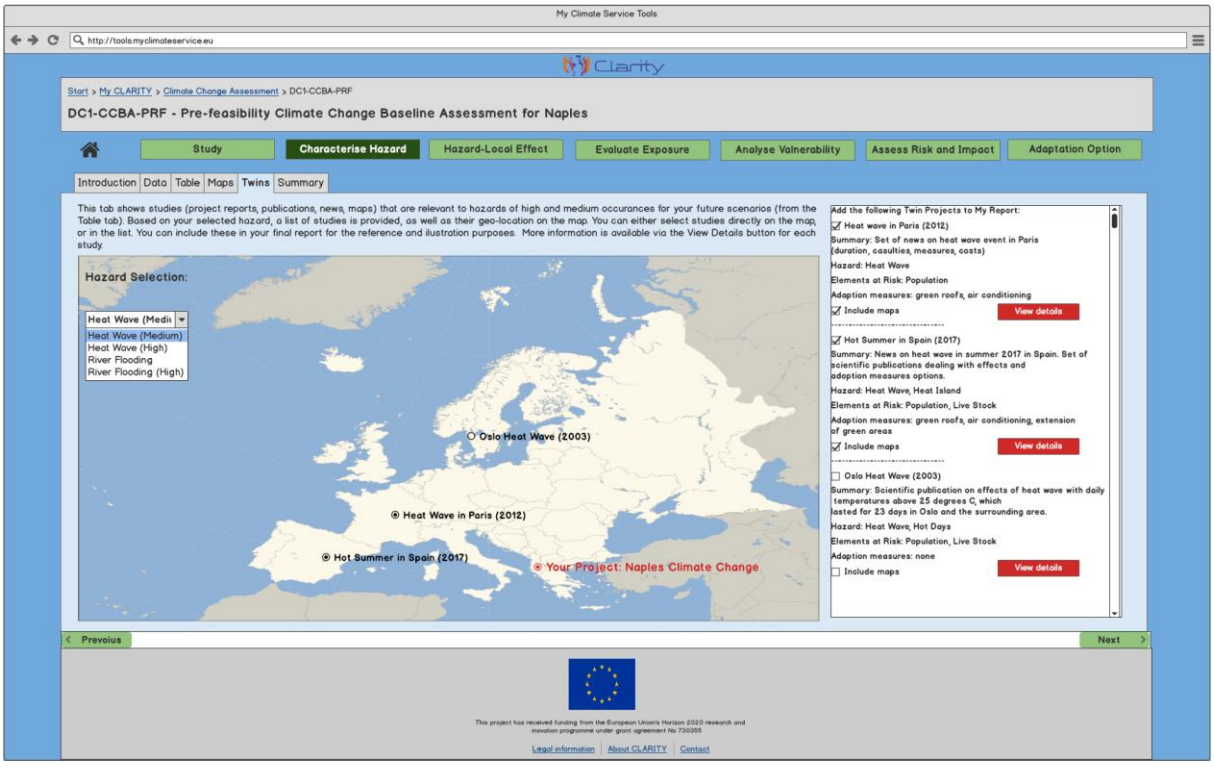

Figure 14: Characterise Hazard – Twins

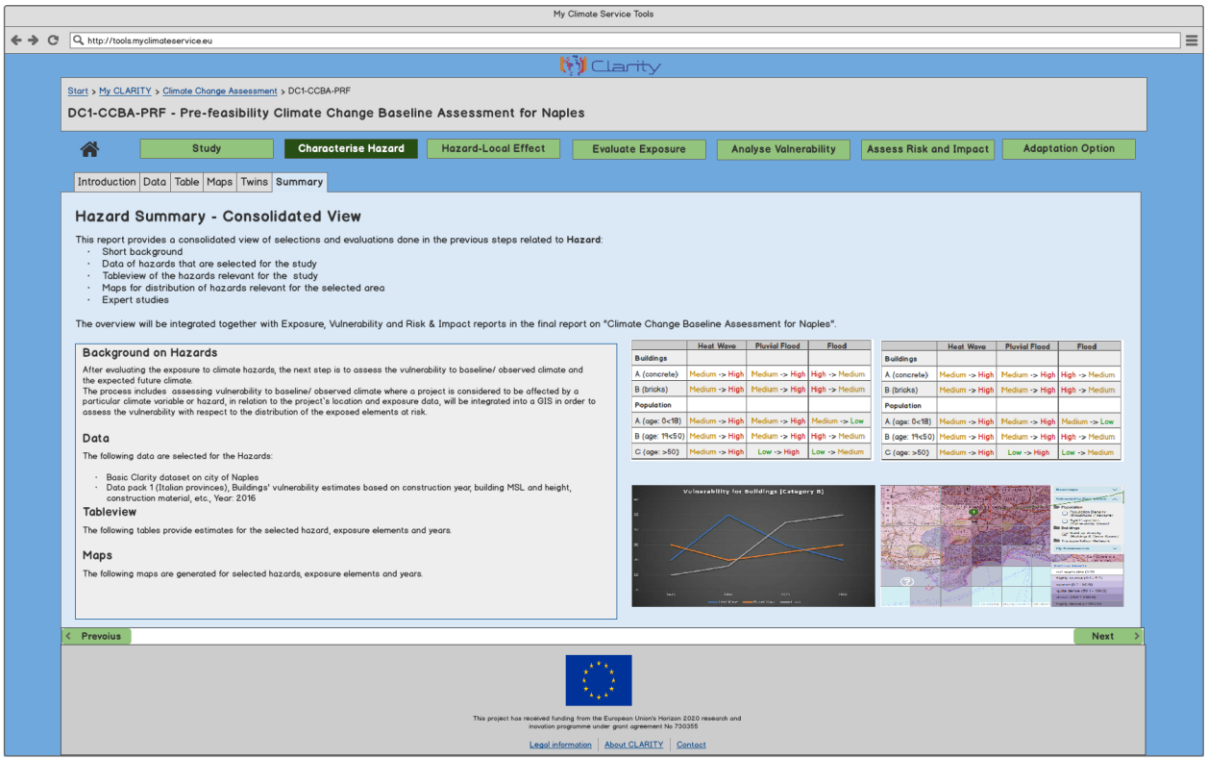

Figure 15: Characterise Hazard – Summary

Following the preview of the "hazards" chapter of the future study (Figure 15), user can continue to "local effects" tab. Here, a result of simple microclimate simulation in an urban area is shown – effectively a higher resolution hazard map (see D3.2 "Science support report" for details). This step doesn't exist in EU-GL, but we had to introduce it for the practical reasons (higher spatial resolution and future extreme weather events for impact calculation).

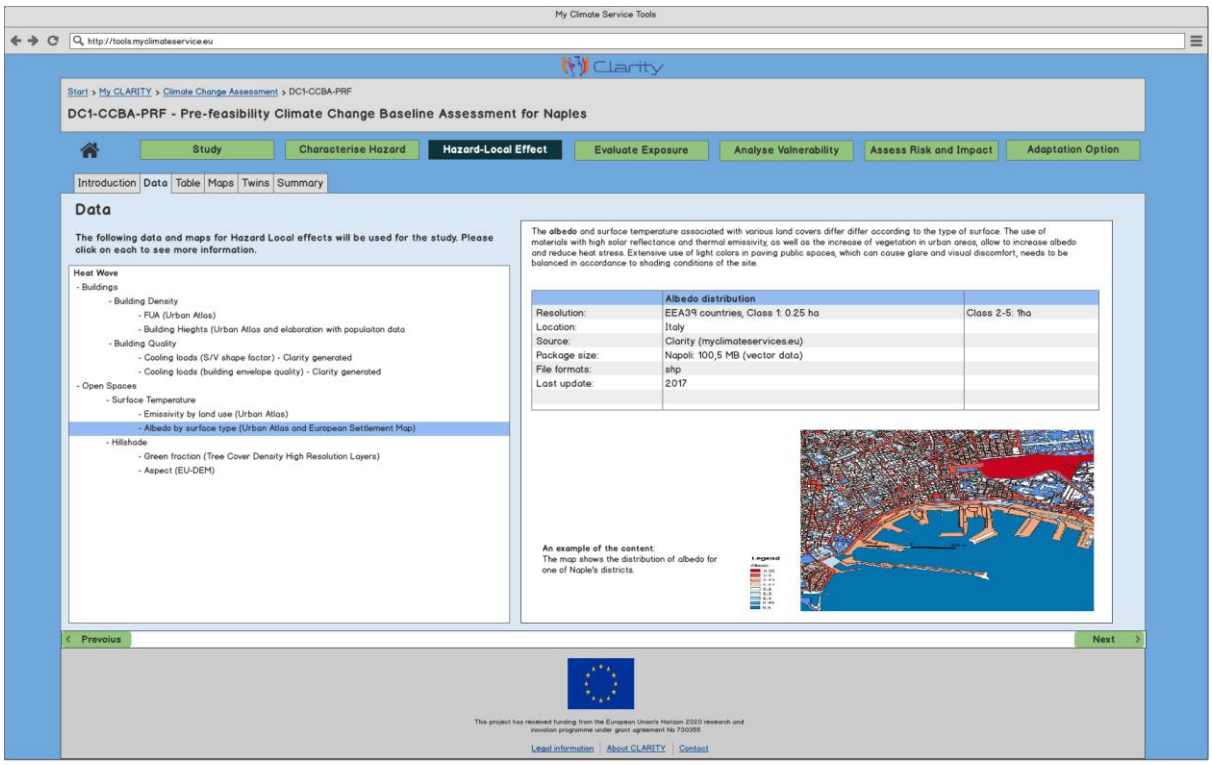

Figure 16: Hazard-Local Effect - Data 1

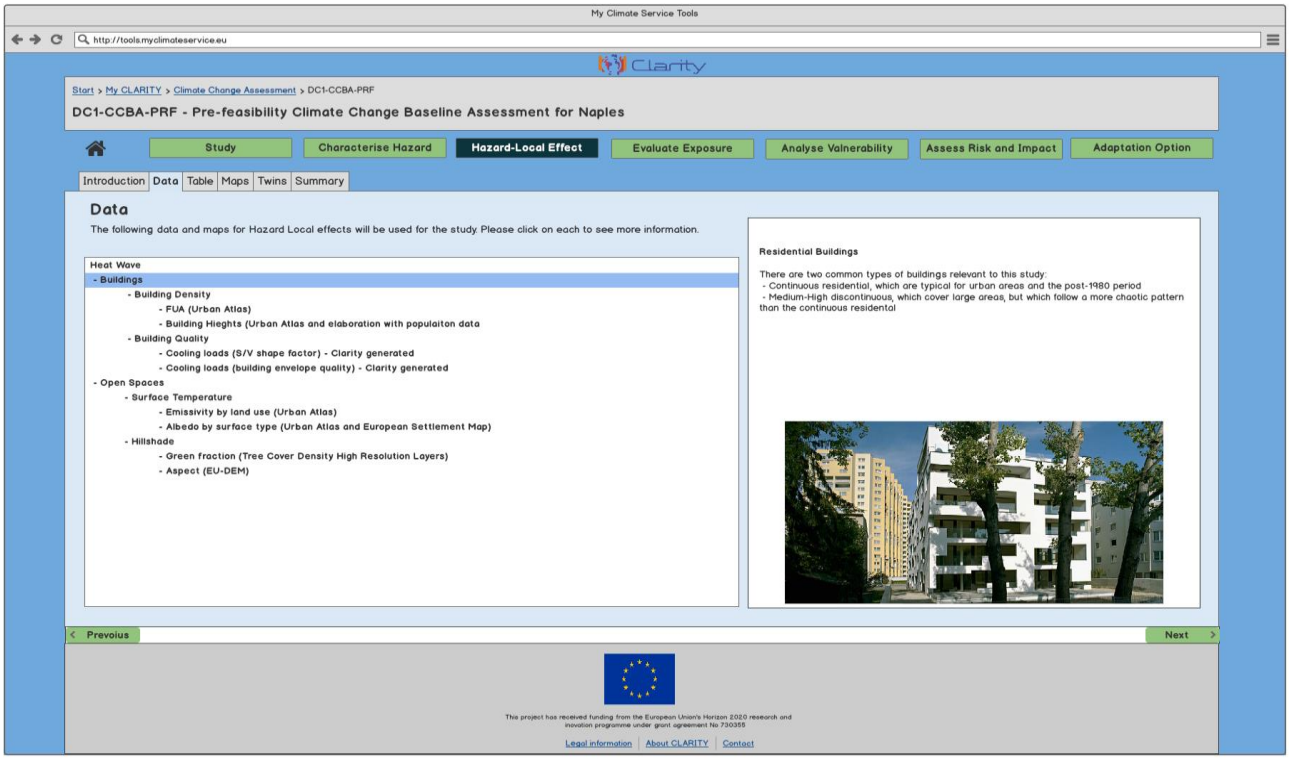

Figure 17: Hazard-Local Effect - Data 2

Figure 18 shows the previously selected hazards, their indices and their current situation for the selected period, as well as their probable occurrences for the three future scenarios (early response, effective measures and business as usual).

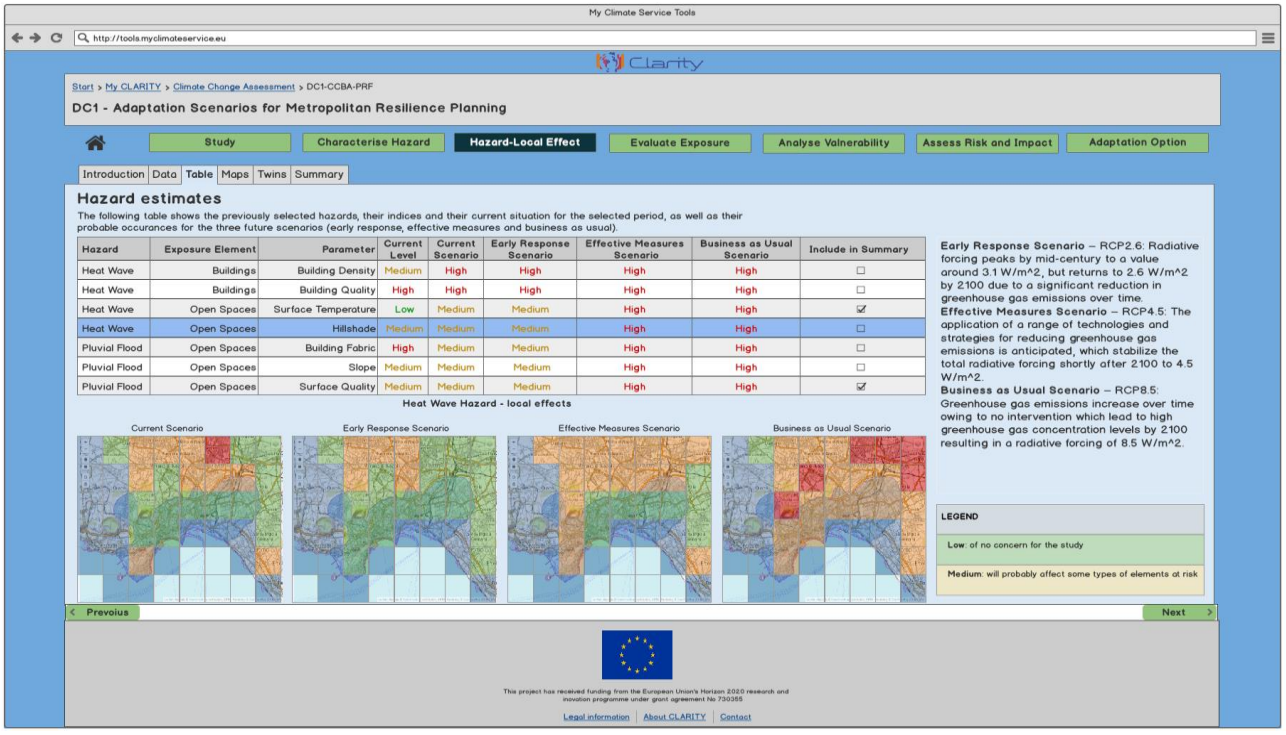

Figure 18: Hazard-Local Effect - Table

During the discussions on Vienna WP1/WP4 meeting in January 2019, it became clear that this approach has to be changed. “Hazard-Local Effect” is not a complete hazard information downscaled to 250x250m^2 but represents specific “future hazard events”, e.g. “6 consecutive days > 30°C max Temperature heat wave”.

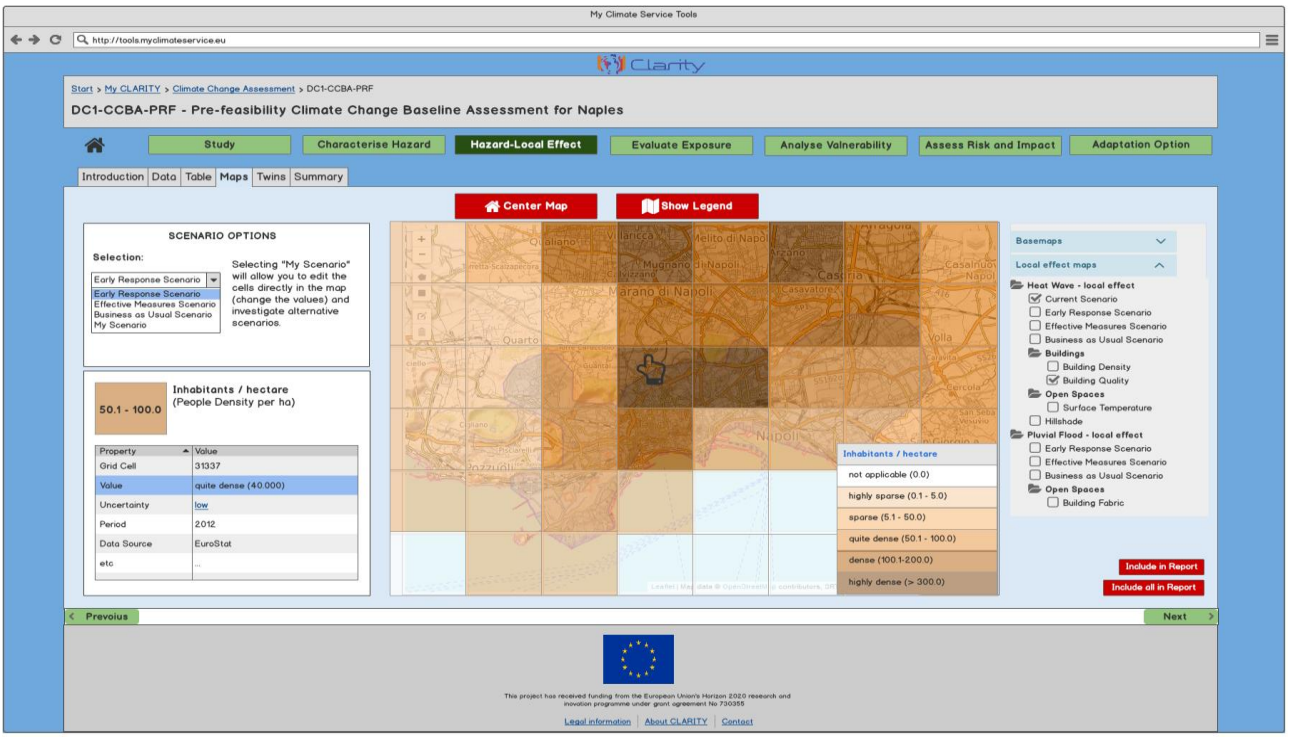

Figure 19: Hazard-Local Effect – Maps

Hazard local effect maps (Figure 19) may be of more interest for the user due to their higher resolution and corresponding with future extreme weather episodes. Again, it is up to them to decide which map views will be included in the report.

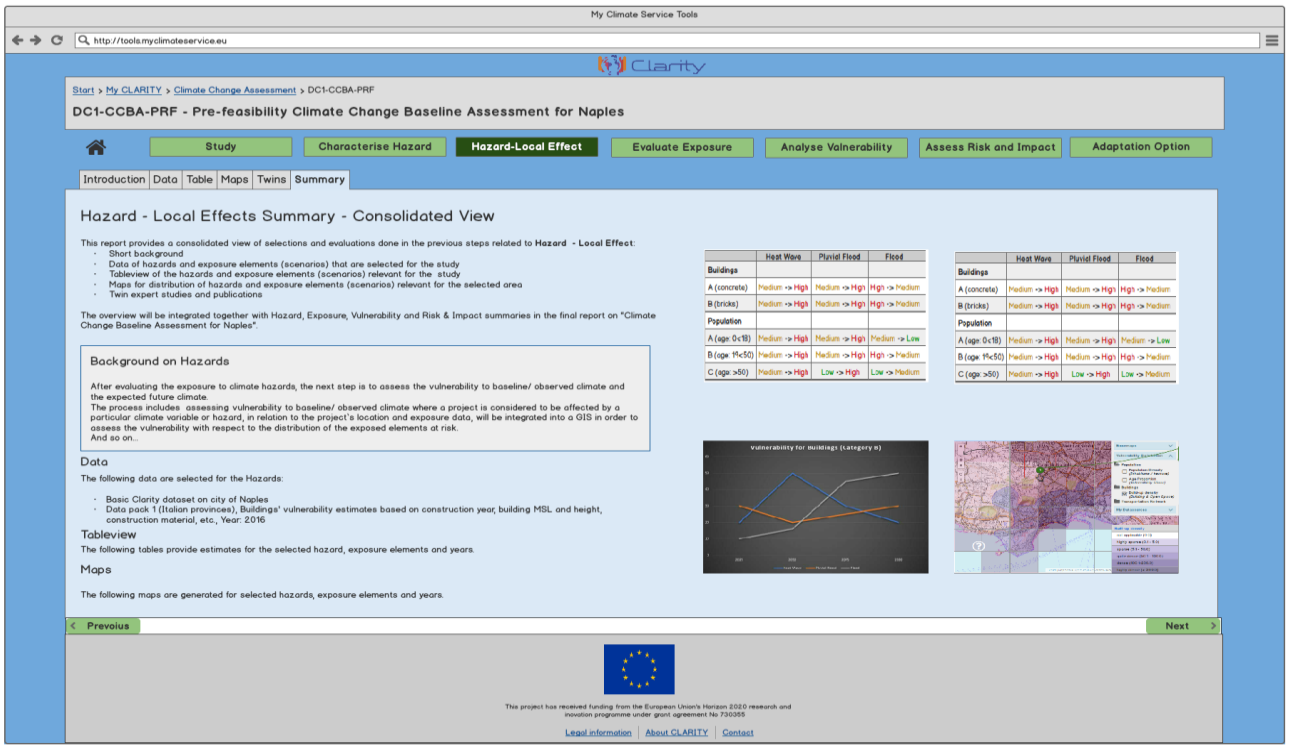

Figure 20: Hazard-Local Effect - Summary

“Twin” tab will be disabled, either here or in this or in the “Characterize Hazard” step.

“Summary” tab (Figure 20) provides a preview of the third chapter of the screening report.

Figure 21: Evaluate Exposure - Introduction

Once the hazard characterization in the project area has been assessed, the next step is to evaluate exposure to climate hazards of the elements at risk considered (e.g. population, buildings, infrastructures, etc.), at the project location(s). The exposure is the quantitative distribution, in space and time, of elements exposed (people, buildings, infrastructures, etc.) grouped on the base of their behaviour under effect of the hazard into categories (called "vulnerability classes"), defined on the base of specific characteristics (i.e., age for people, structure- al-typological characteristics for buildings, etc.), able to influence the damageability of the elements ex- posed against hazards.

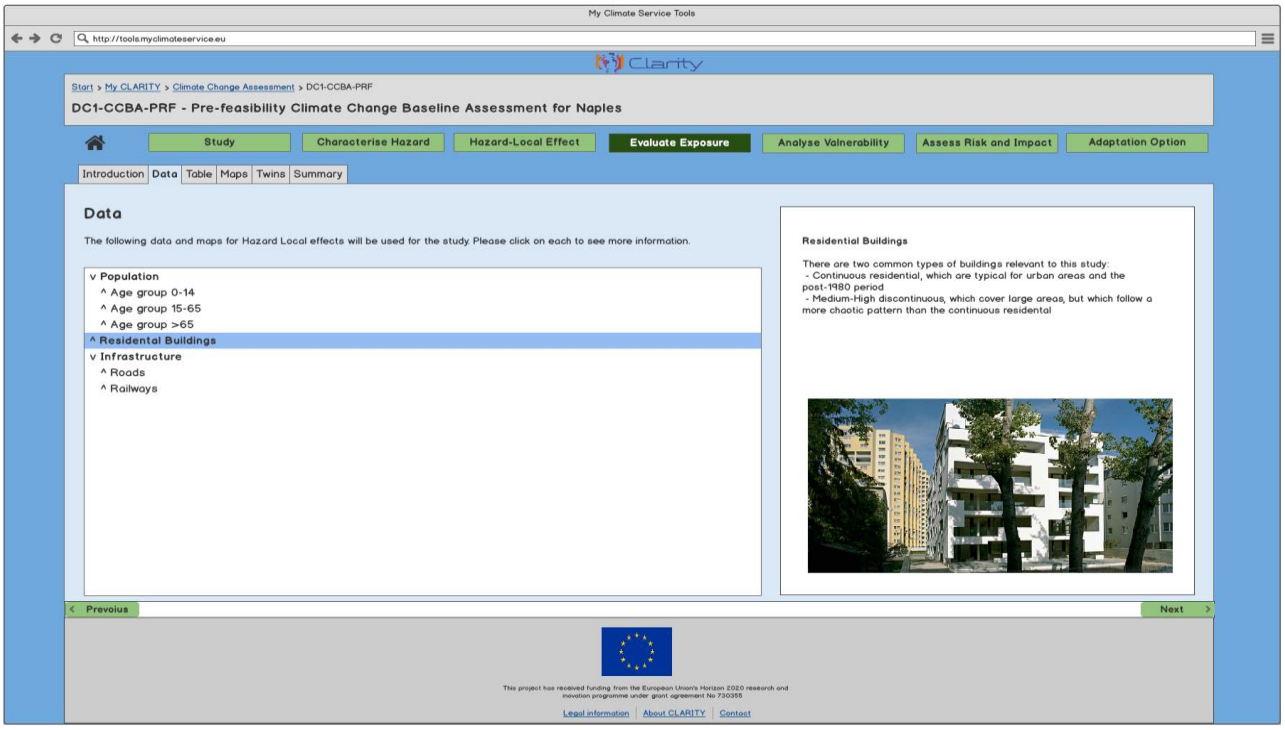

Figure 22: Evaluate Exposure- Data 1

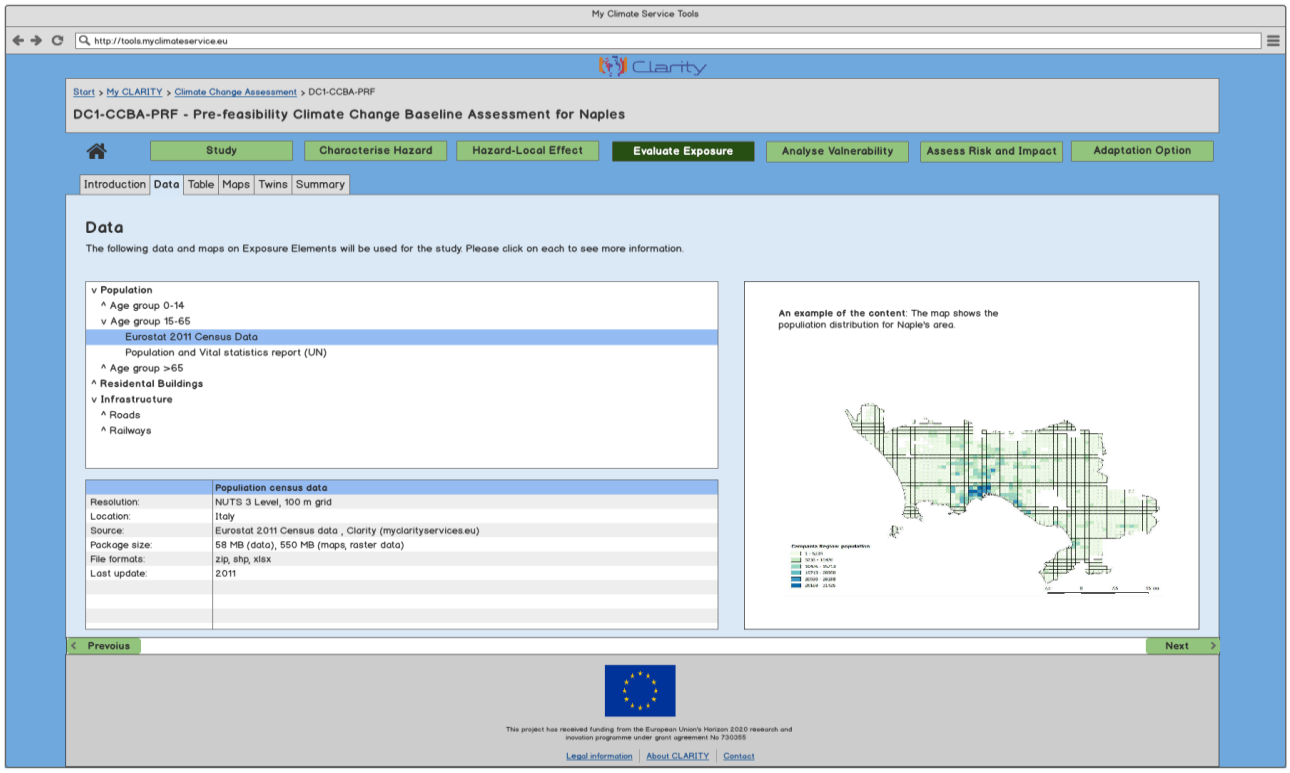

Figure 23: Evaluate Exposure- Data 2

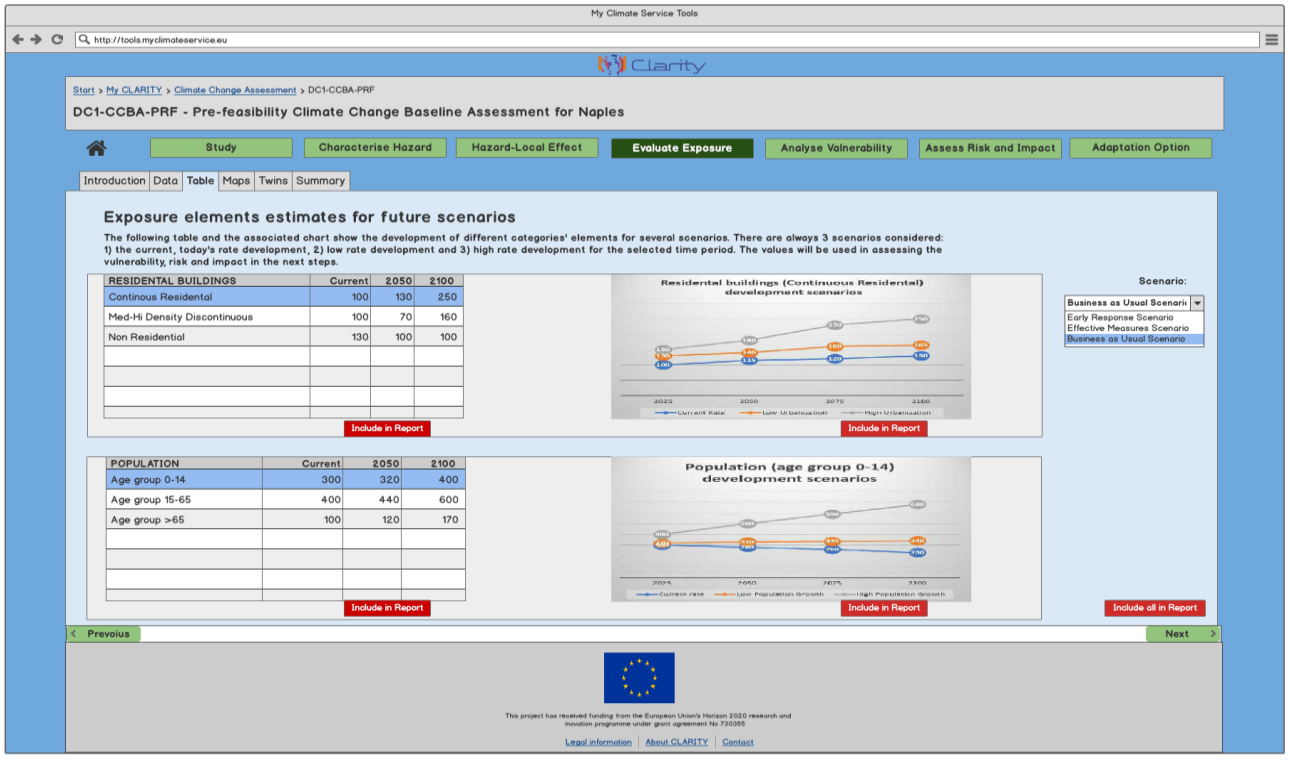

Figure 24: Evaluate Exposure - Table

Figure 24 illustrates how a summary view could look like for the elements at risk. This view should also be seen as an alternative to the hazard table views that are shown in Figure 12 and Figure 18. Figure 25 illustrates the map view at the exposed elements at risk. It works in the same way as the previously shown map views for the hazard and local effects – users can explore the map views and include those they consider important in the report.

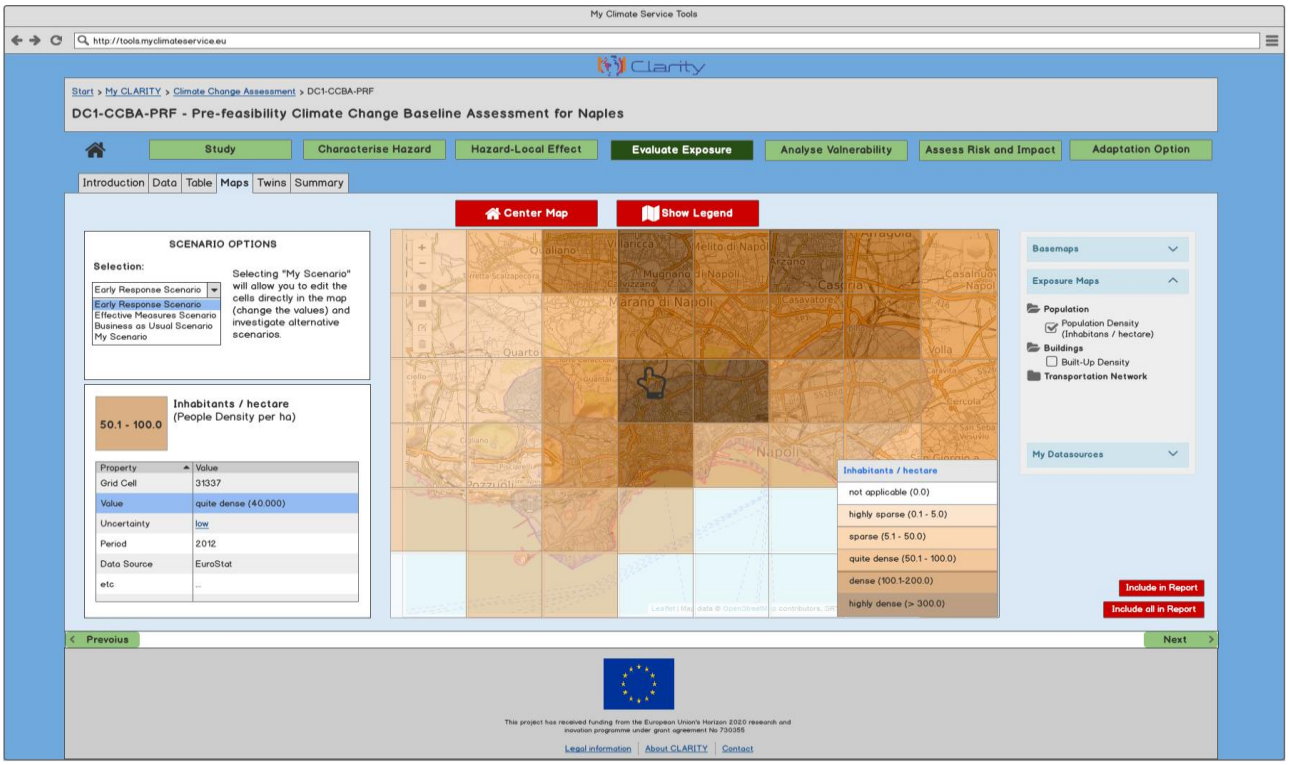

Figure 25: Evaluate Exposure – Maps

Figure 26 illustrates how existing studies (project reports, publications, news, maps) can be related to elements at risk. User can either select studies directly on the map, or in the list. They can include these in the screening report for the reference and illustration purposes.

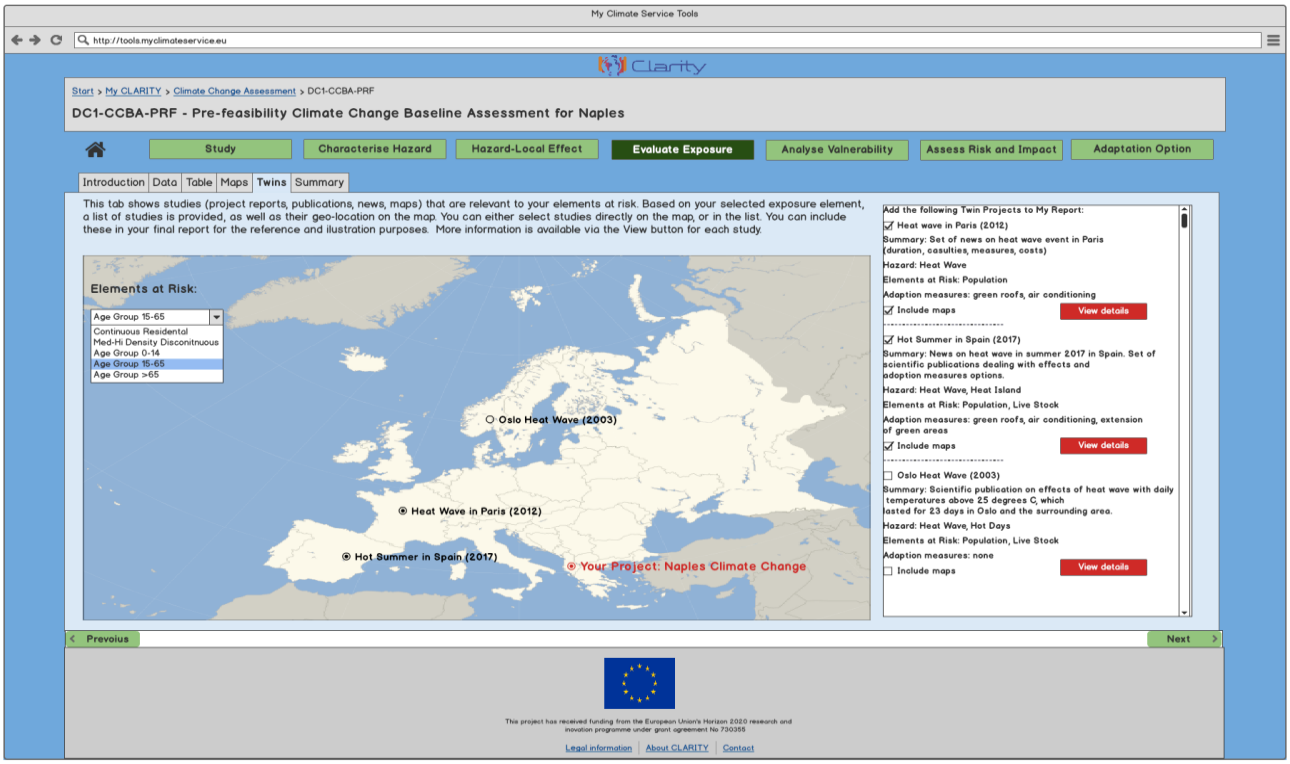

Figure 26: Evaluate Exposure- Twins

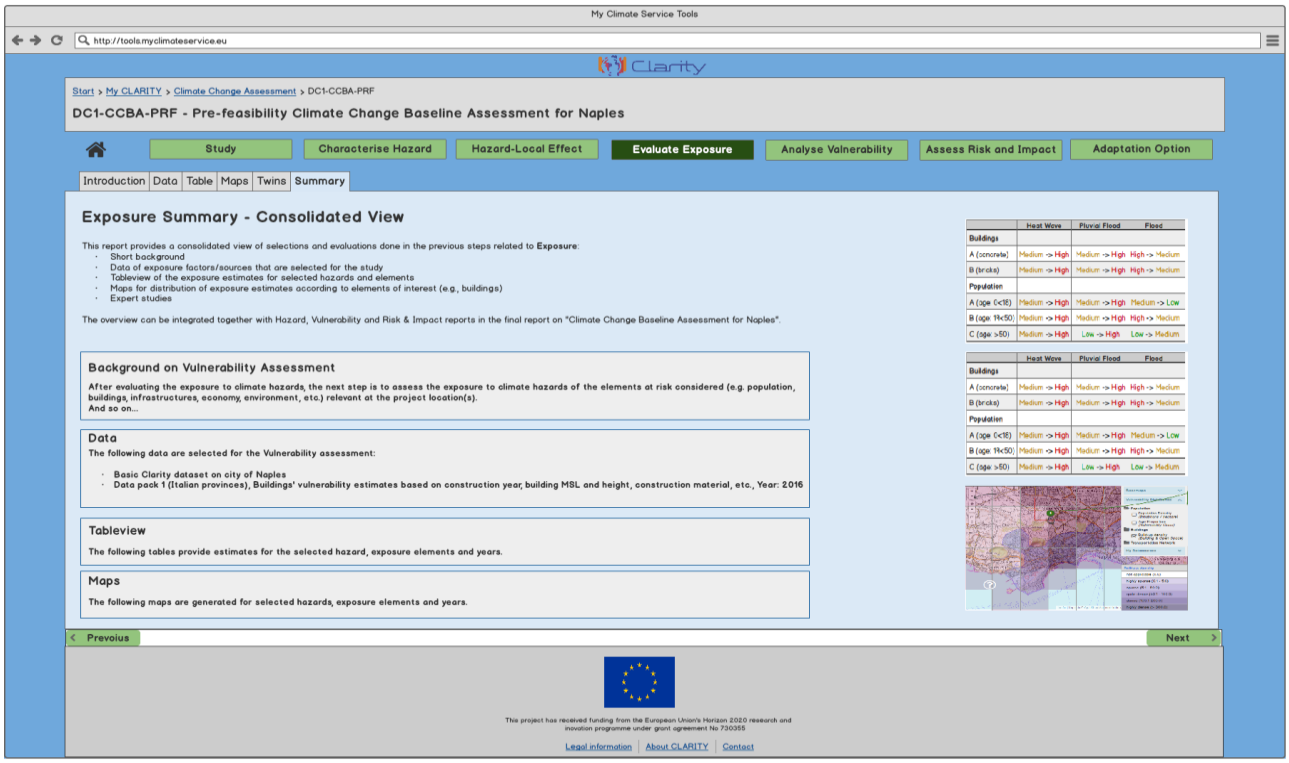

Figure 27: Evaluate Exposure- Summary

Figure 27: Evaluate Exposure- Summary and Figure 28: Analyse Vulnerability- Introduction present the "exposure" section of the screening report and the instructions related to the "Analyse Vulnerability" step respectively. They work exactly in the same way as the "Introduction" and "Summary" tabs in previous steps.

Figure 28: Analyse Vulnerability- Introduction

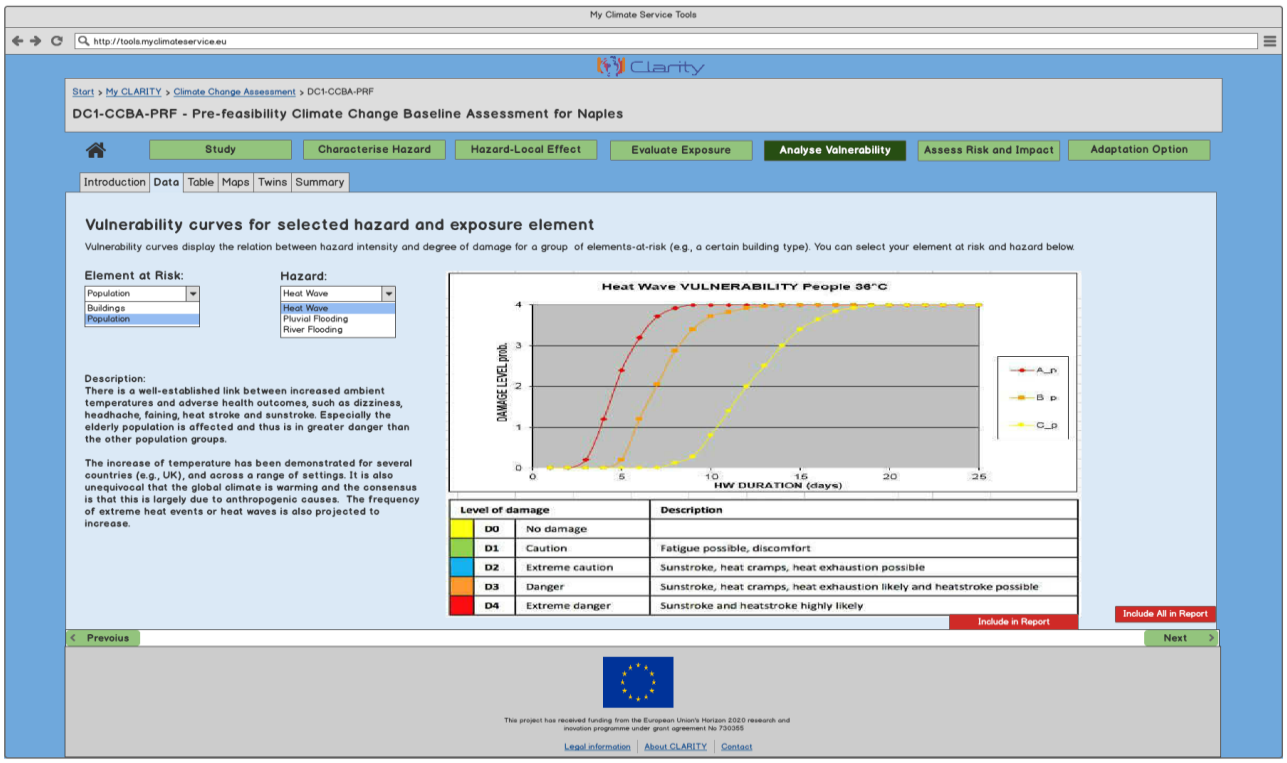

Figure 29: Analyse Vulnerability- Data

This step of the workflow informs the CSIS users about the Vulnerabilities of the different "vulnerability classes" of Elements at Risk to each of the relevant hazards. The information shown in the "Table2 tab is high level (3 different levels of vulnerability) and easy to understand. The bar chart shown on the right-hand side further increases the level of understanding. Both table and bar chart provide the possibility to be included in the automatically generated report for the project at hand.

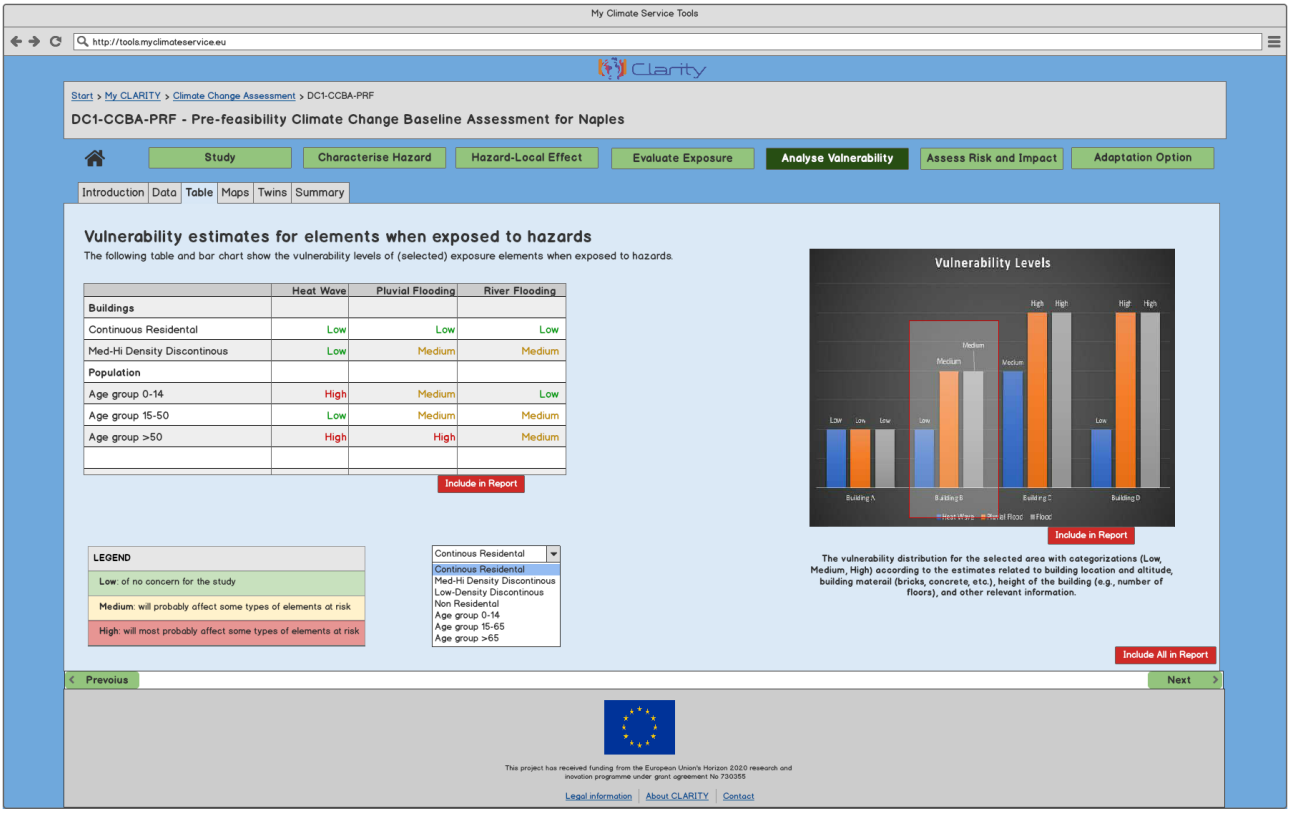

Figure 30: Analyse Vulnerability- Table

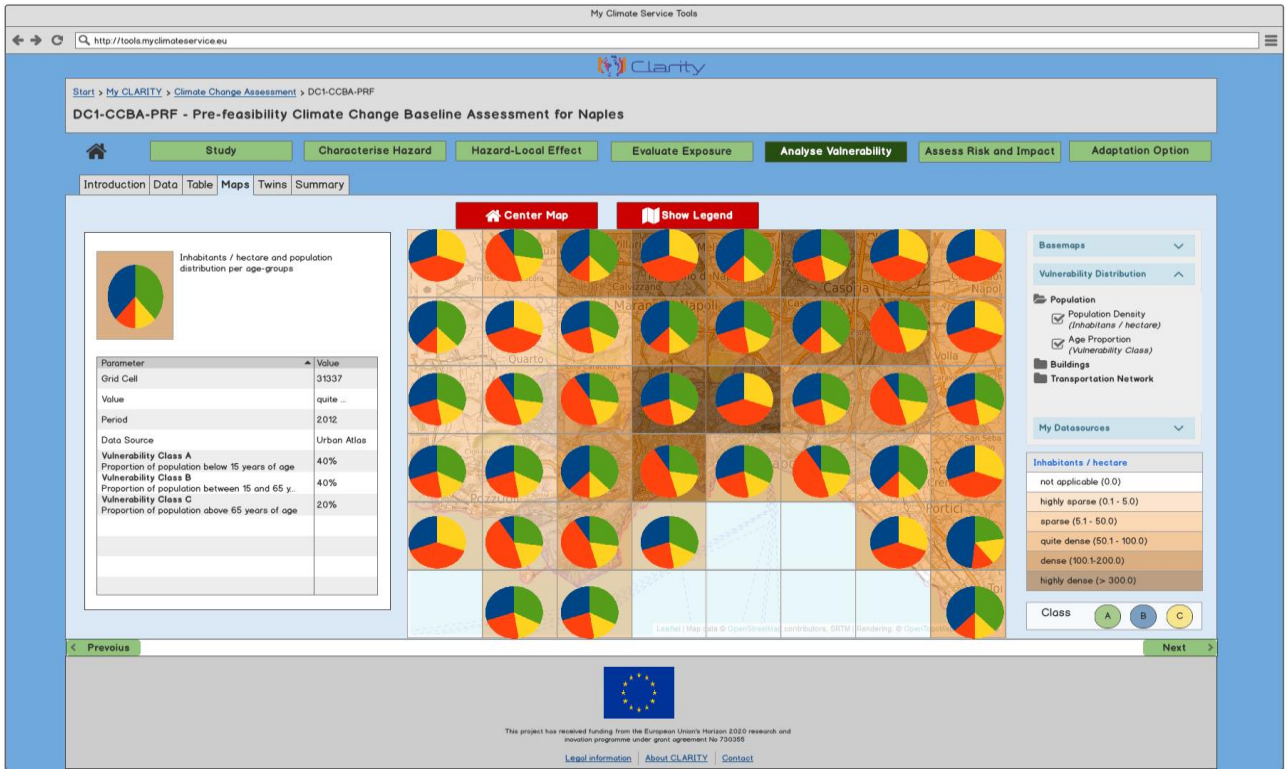

Figure 31: Analyse Vulnerability- Maps

Unlike Hazard and exposure, Vulnerability is a relation between hazard and element at risk class that indicates what will happen if a certain type of element at risk is exposed to a certain intensity of hazard for a certain time. Map view at this data doesn't really make sense, but we would like to keep it if a good use is found for it, so that the users aren't confronted with a different structure compared to other steps. "Twins" tab could e.g. provide examples of effects hazards have on elements at risk

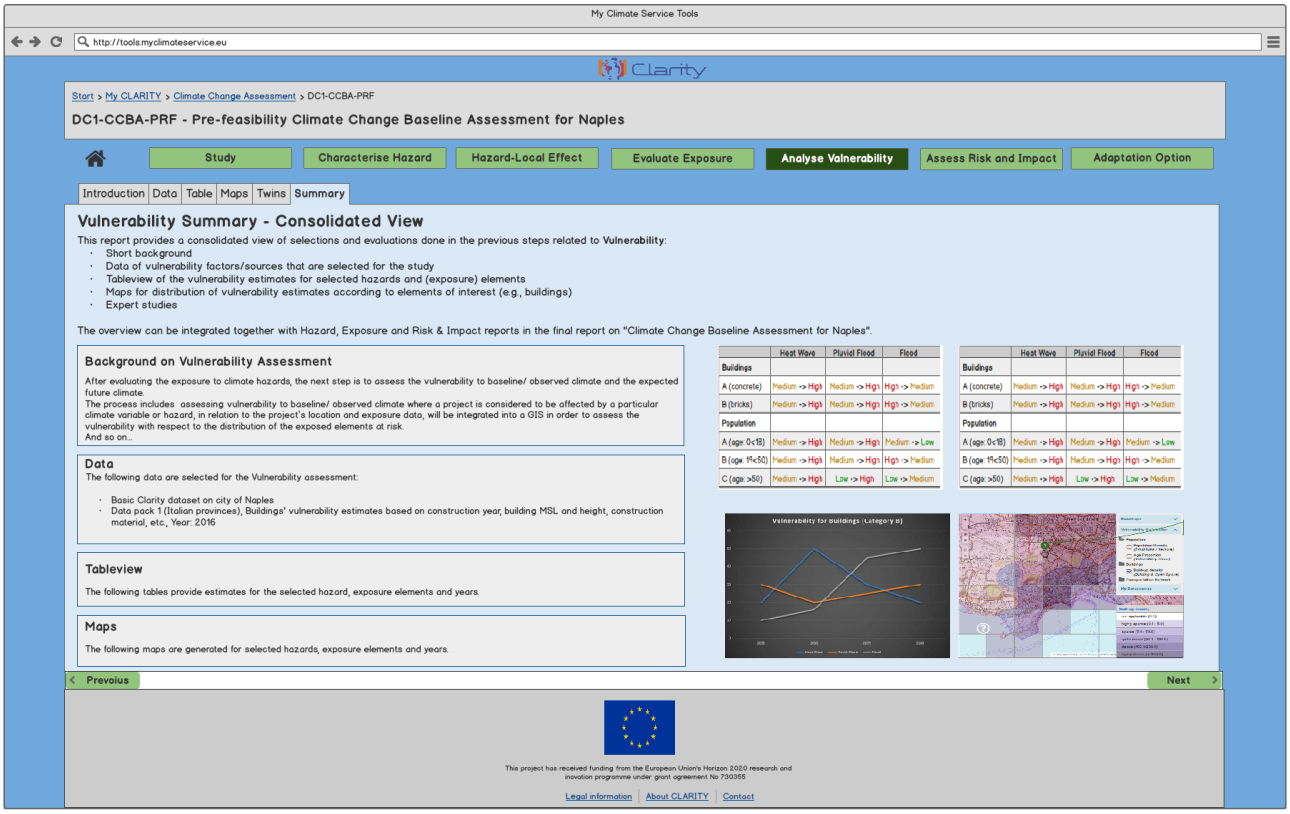

Figure 32: Analyse Vulnerability- Summary

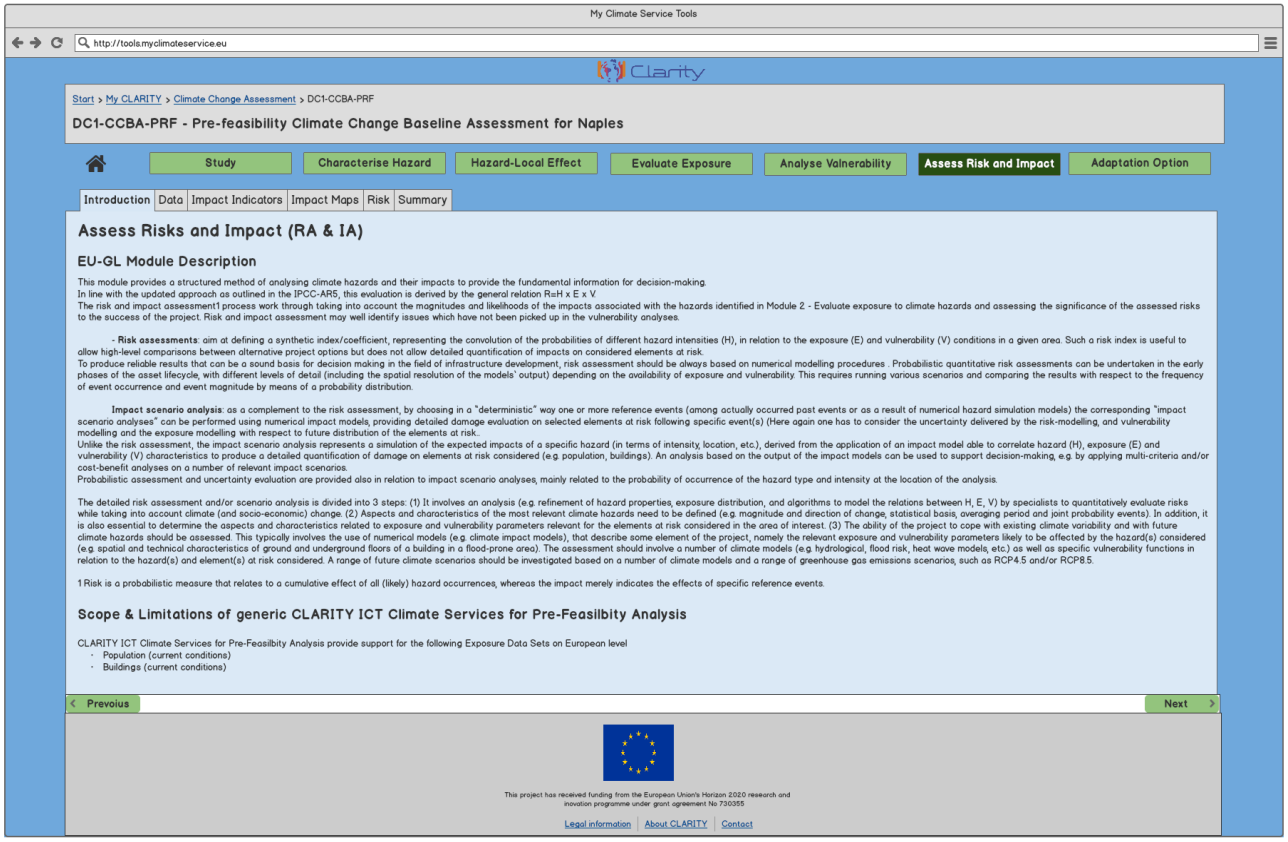

Figure 33: Assess Risk and Impact- Introduction

Finally, assessing the risks and impacts step provides the users with the actual decision support information:

- Which hazard/element at risk combinations are at high, medium or low risk today and in the future?
- What impacts would a specific future extreme weather episode have at different element at risk types?
- What does this mean in terms of expected costs and health effects?
- How does the use of adaptation options change the expected effects?
- Cost/benefit?

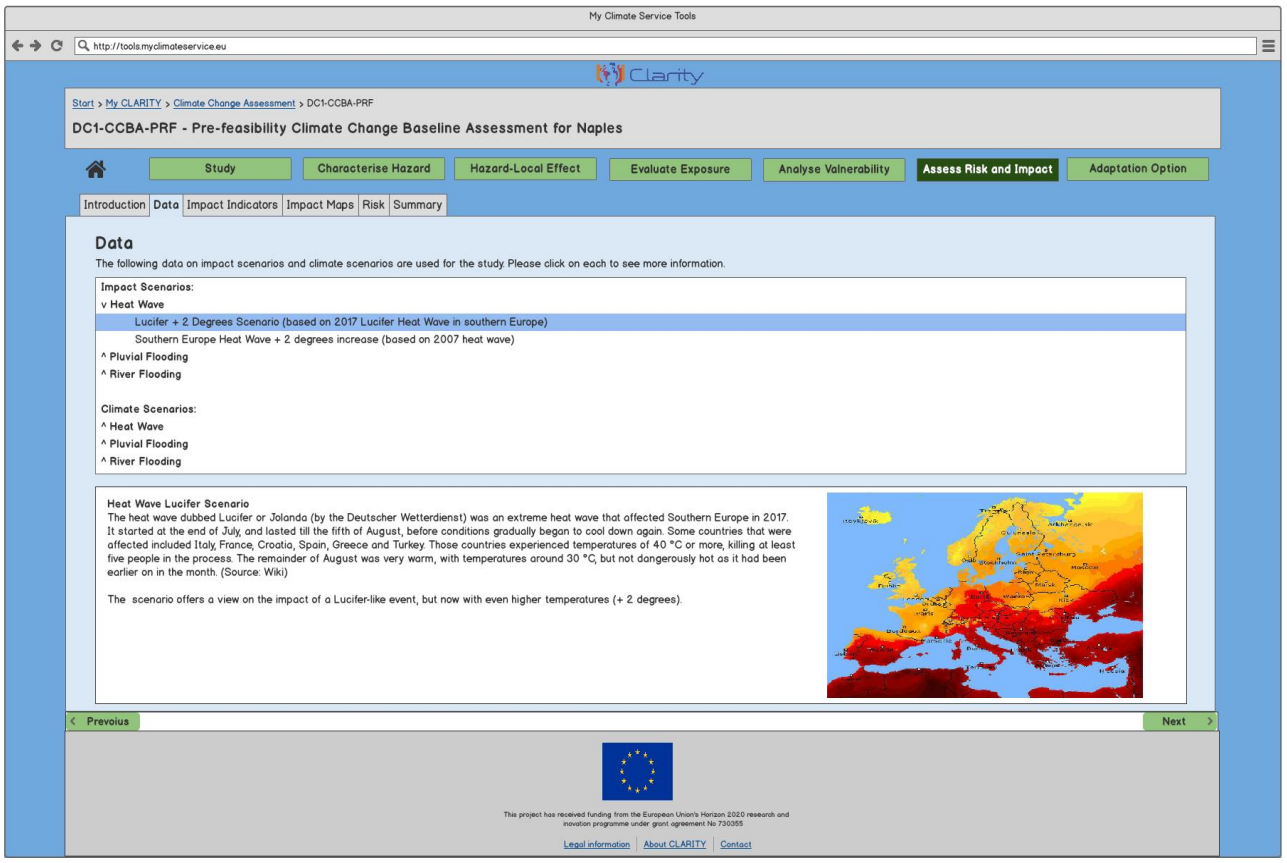

Figure 34: Assess Risk and Impact- Data

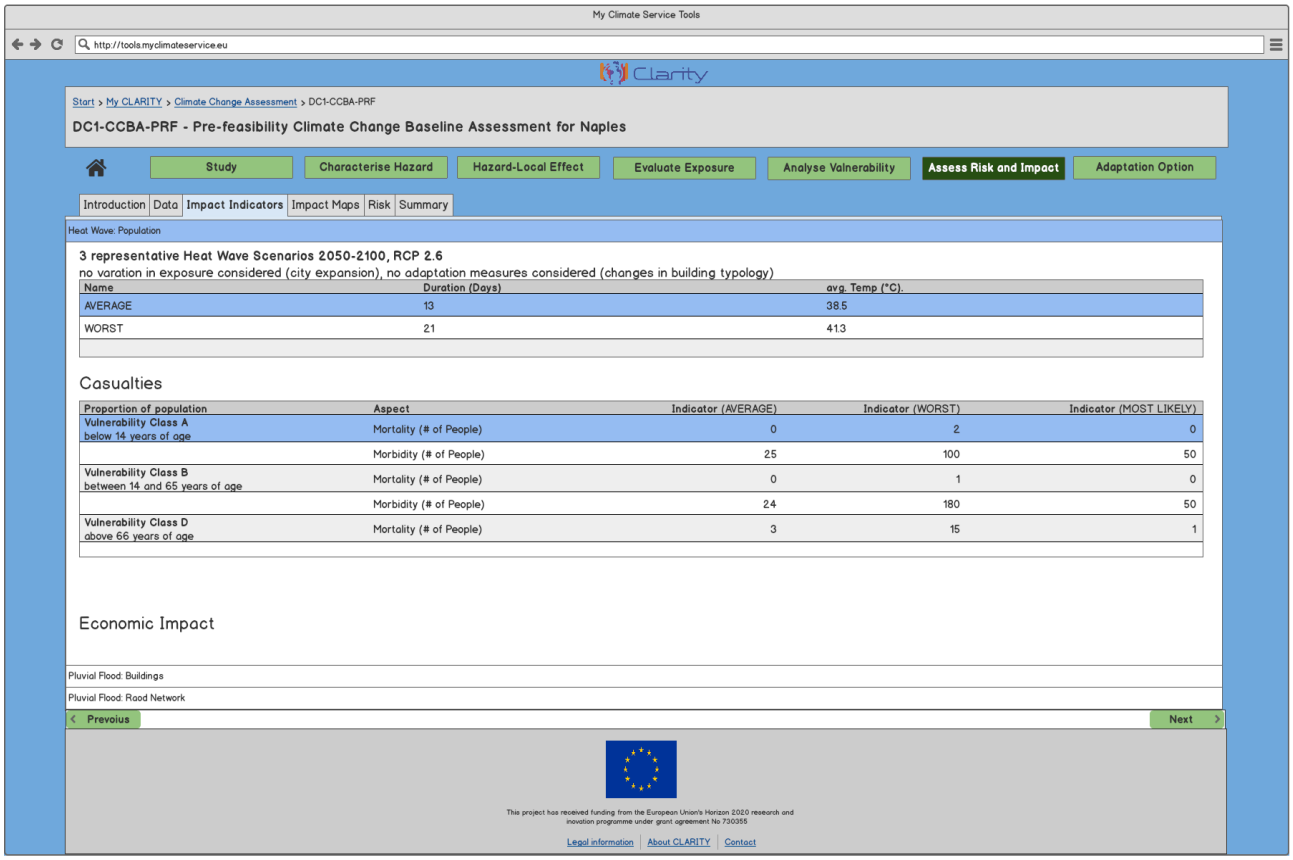

Figure 35: Assess Risk and Impact- Impact Indicators

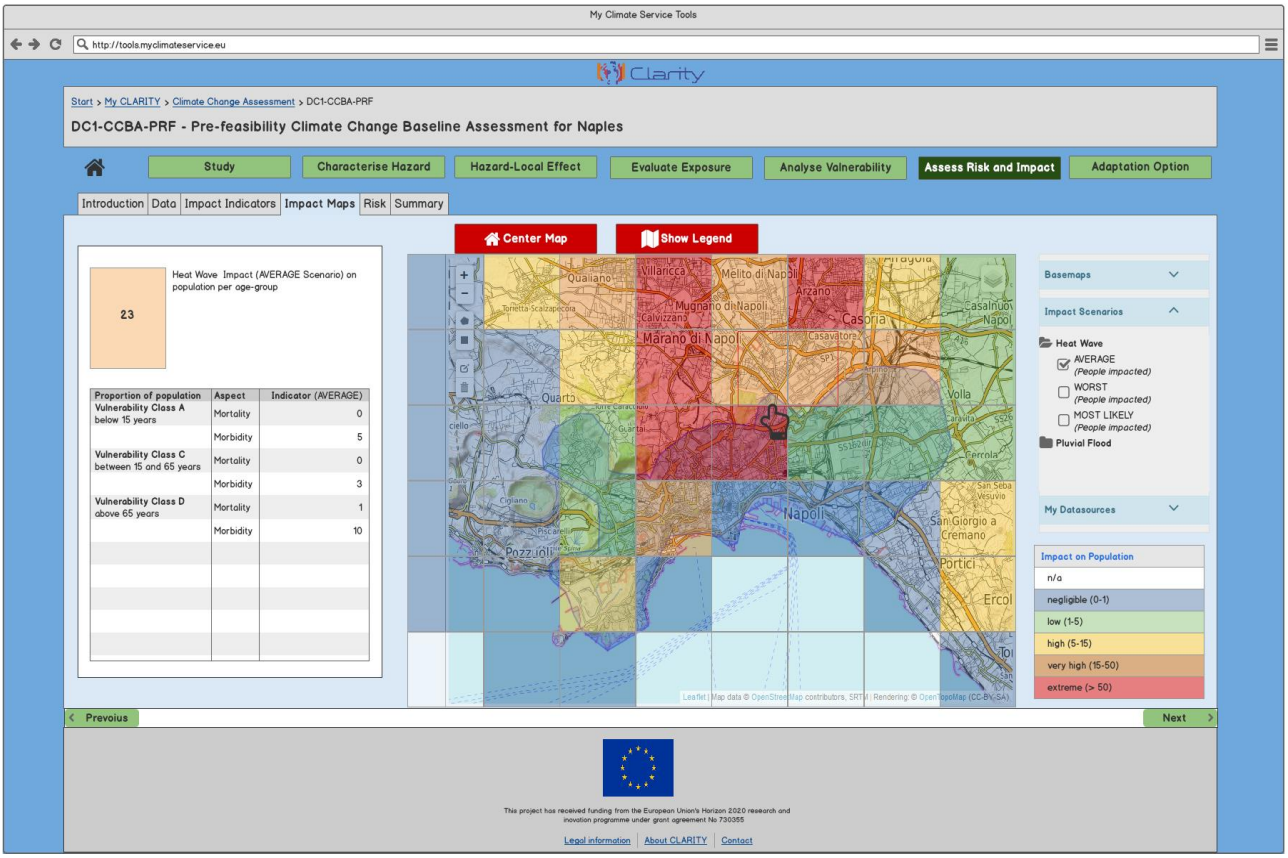

Figure 36: Assess Risk and Impact- Impact Maps

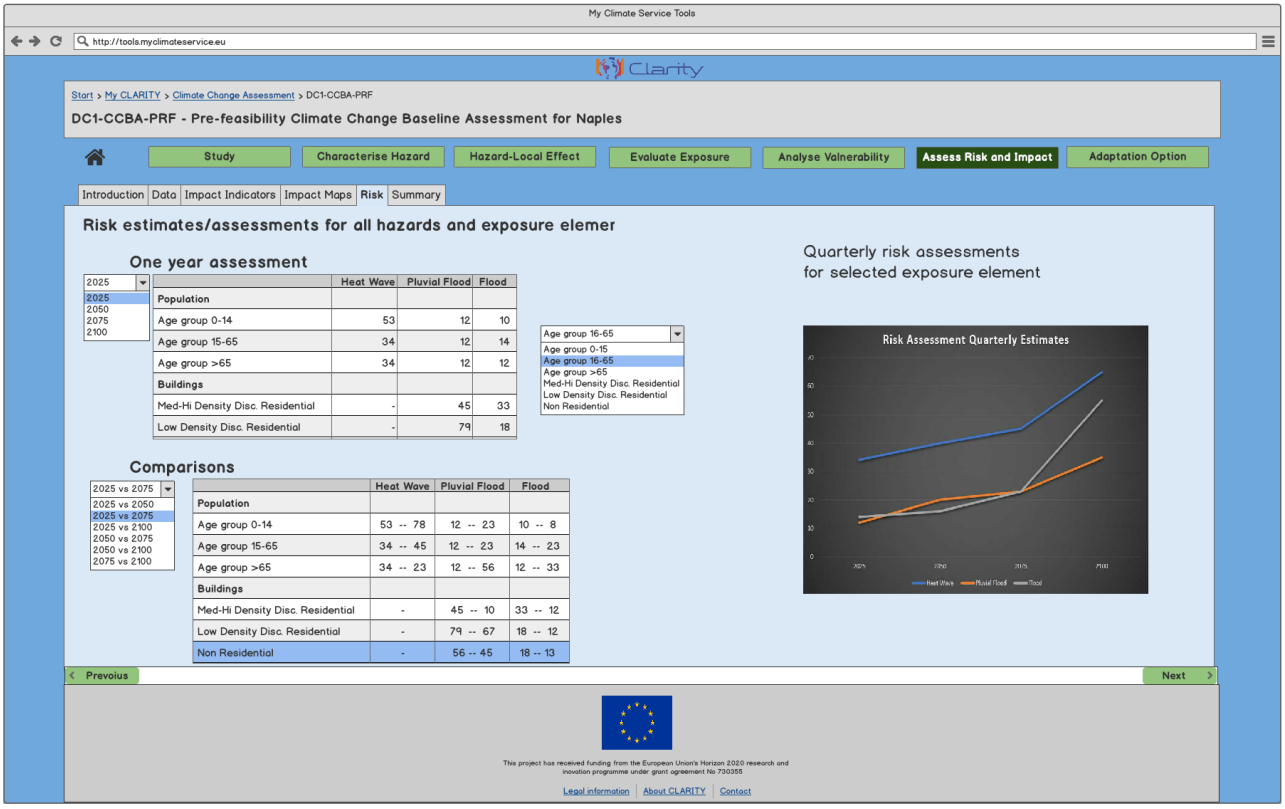

Figure 37: Assess Risk and Impact- Risk

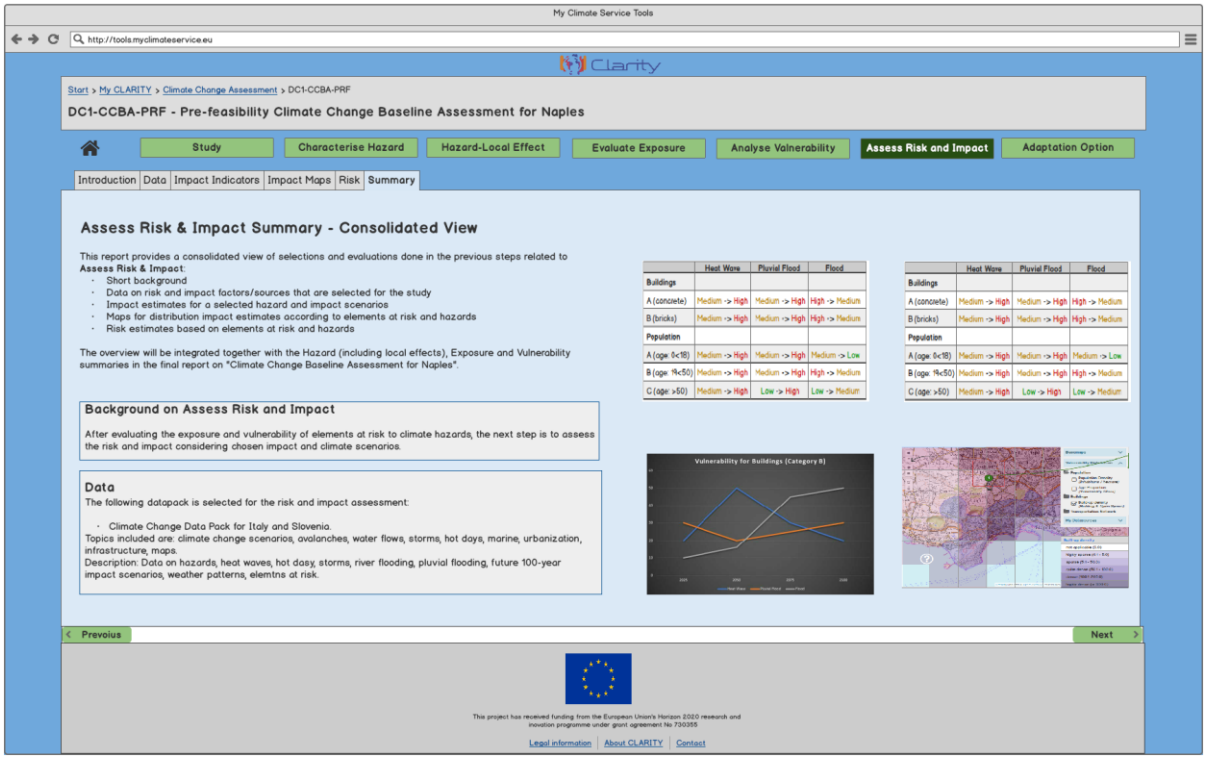

Figure 38: Assess Risk and Impact- Summary

Finally, the users can explore the adaptation options that are relevant to their project. In the initial demonstrator, the adaptation options will be presented just as a way to inform the users of the options they have and their co-benefits and adverse effects. Later in the project, it should be possible to see the effects of the chosen adaptation options to projects' risk and impact.

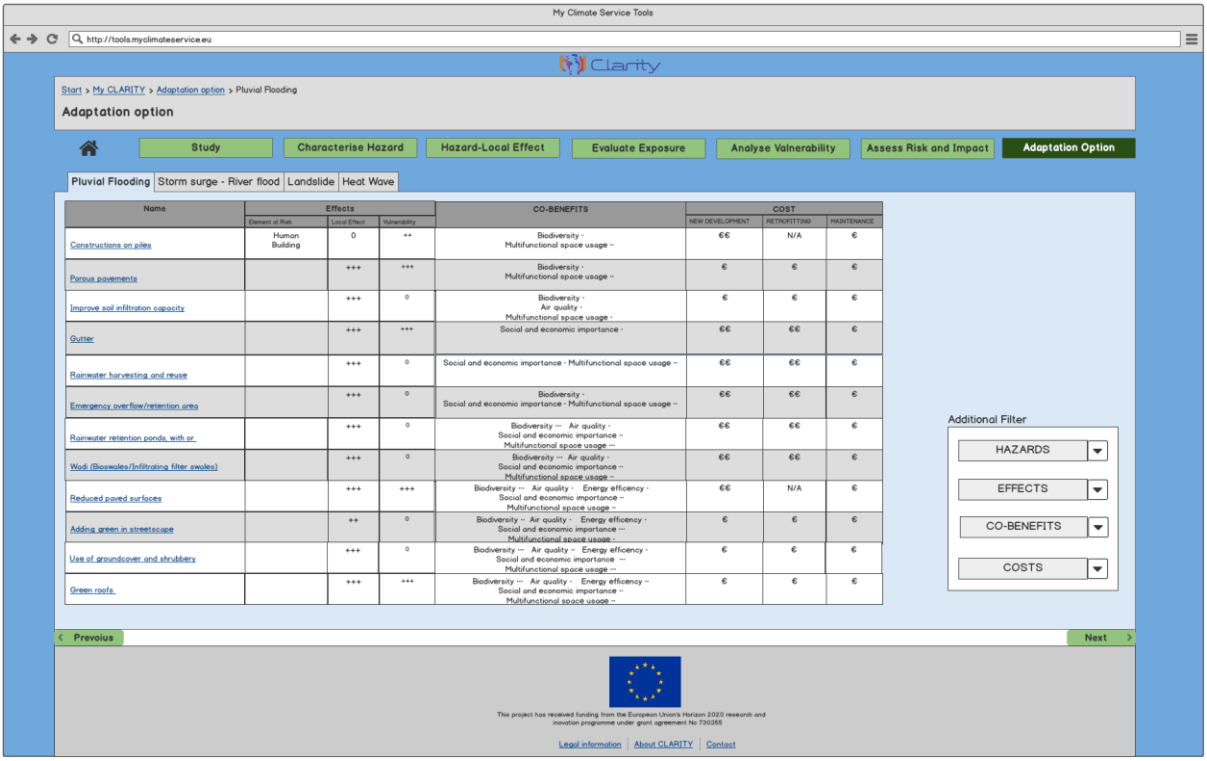

Figure 39: Adaptation Option- Pluvial Flooding

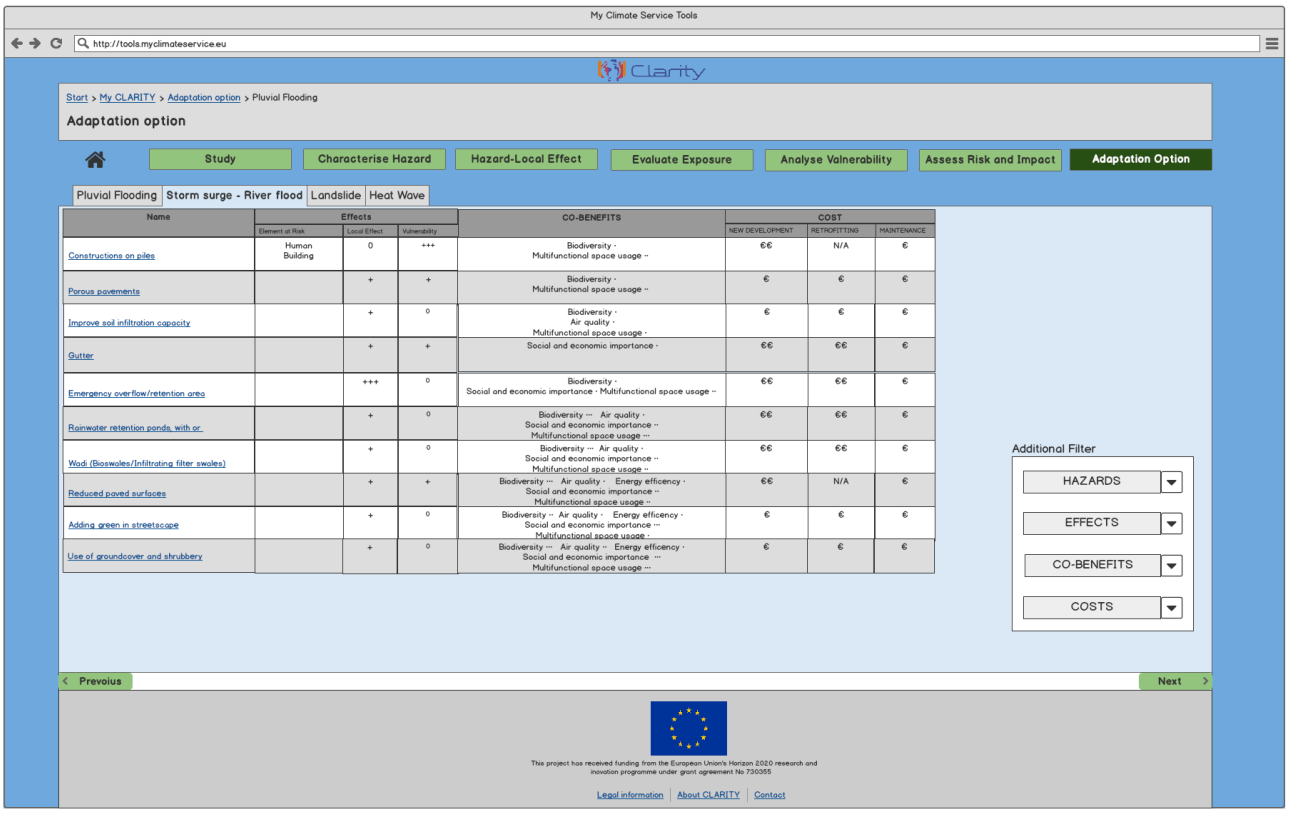

Figure 40: Assess Risk and Impact- Storm surge River flood

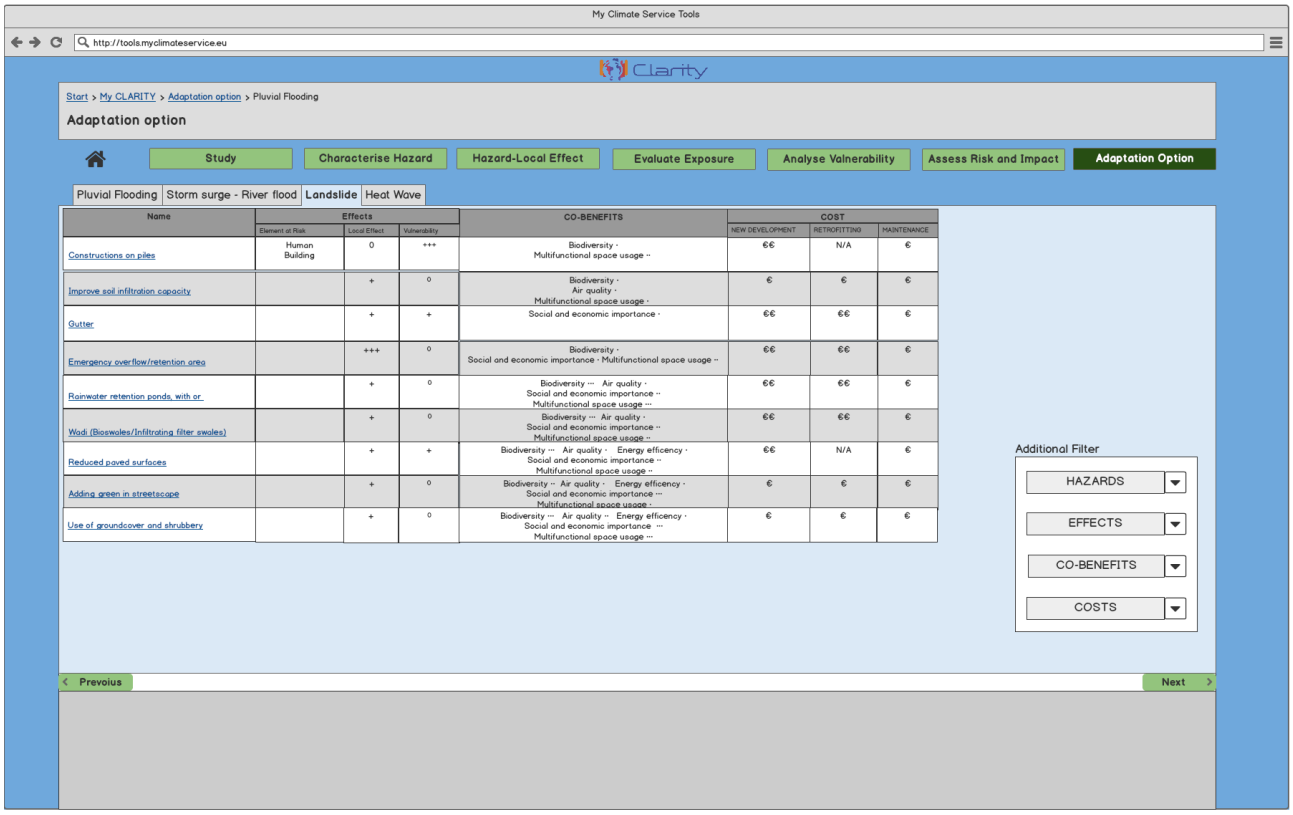

Figure 41: Adaptation Option- Landslide

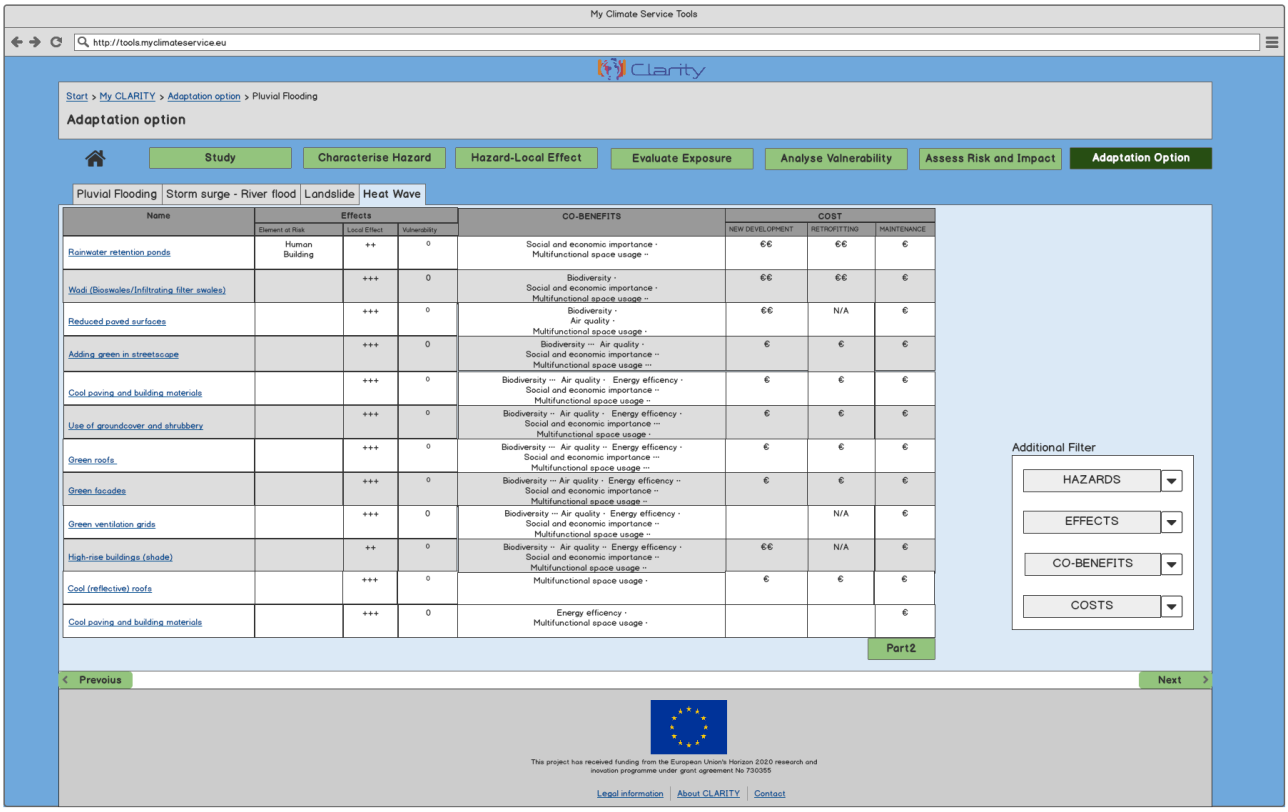

Figure 42: Adaptation Option- Heat Wave

3 Datasets and information models used in the prototype

3.1 Reference Modelling Workflow

The Reference Modelling Workflow describes the technical implementation of the EU-GL/CLARTIY Modelling Methodology (documented in CLARTIY deliverable D3.1 Science Support Plan) CLARTIY CSIS.

Aligned with the CLARITY adapted EU-GL methodology, in the CSIS prototype workflow tool, at each step, a series of datasets are required in order to present some information to the end-user or to perform certain calculations needed for a further step in the workflow tool.

In that regard, deliverable "D2.2 Data collection report" already made an initial compilation of datasets required at each EU-GL step at European level, and more specifically within each demonstration case (see sections 1. Methodology and 3. Development of the data collection task at screening and DC level).

In addition, deliverable "D3.2 Science support report" provides a complete and detailed description on how the various datasets have to be combined in order to produce the information that is required by the CSIS workflow tool (see sections 2. ICT (screening) Services and 3. Expert Services) for each of the DCs.

These detailed descriptions/instructions are used, in parallel to the implementation of the CIS workflow tool, to prepare and produce all required information for the CSIS prototype, concerning the Naples demonstrator case with focus on the heat-wave and pluvial flooding hazards (and their effects over population and buildings infrastructure).

This data preparation process comprehends:

1) Pre-processing of the base source datasets such as Urban Atlas, Street Tree Layers and European Settlement Map (from Copernicus), which included the extraction and adaptation of the origin data to required input formats, coordinate reference system, scale, attributes naming, etc.), produced as result the base layers to be used as input parameters for other datasets calculation processes (e.g., local effects, exposure evaluation, etc.). These new input parameter layers refer to:
    a. geospatial distribution of land use in the territory (e.g., water, agricultural areas, roads, building areas, etc.)
    b. Topographic characteristics of the territory (e.g., DEM, Basins, etc.)
    c. Outdoor and indoor features of the buildings (e.g., construction typology, albedo, emissivity, etc.)
    d. Population data (e.g., Census)
2) Calculation of heat-wave and pluvial flooding related hazard indexes for the three considered emissions scenarios, taking as basis EURO-CORDEX, E-OBS and SWICCA datasets respectively (work carried out by WP3 team).

These new sources of information will be used, in combination with the actual hazard information (as the hazard indexes are only used for informative purposes), as part of the inputs for other calculation processes in the EU-GL workflow.

Thus, for instance, the calculation of the local-effects of heat-waves and pluvial flooding hazards over population and buildings in the indoor and outdoor cases is done by using as inputs the data calculated in 1) and 2) (in deliverable D3.2, section 2.2 Local Data versus Local Effect, a series of formulas are provided for this purpose).

The following diagram (Figure 43: Reference Modelling Workflow) provides an overview about how datasets are used (as input/outputs) in each of the calculations required to produce the data ingested by the CSIS.

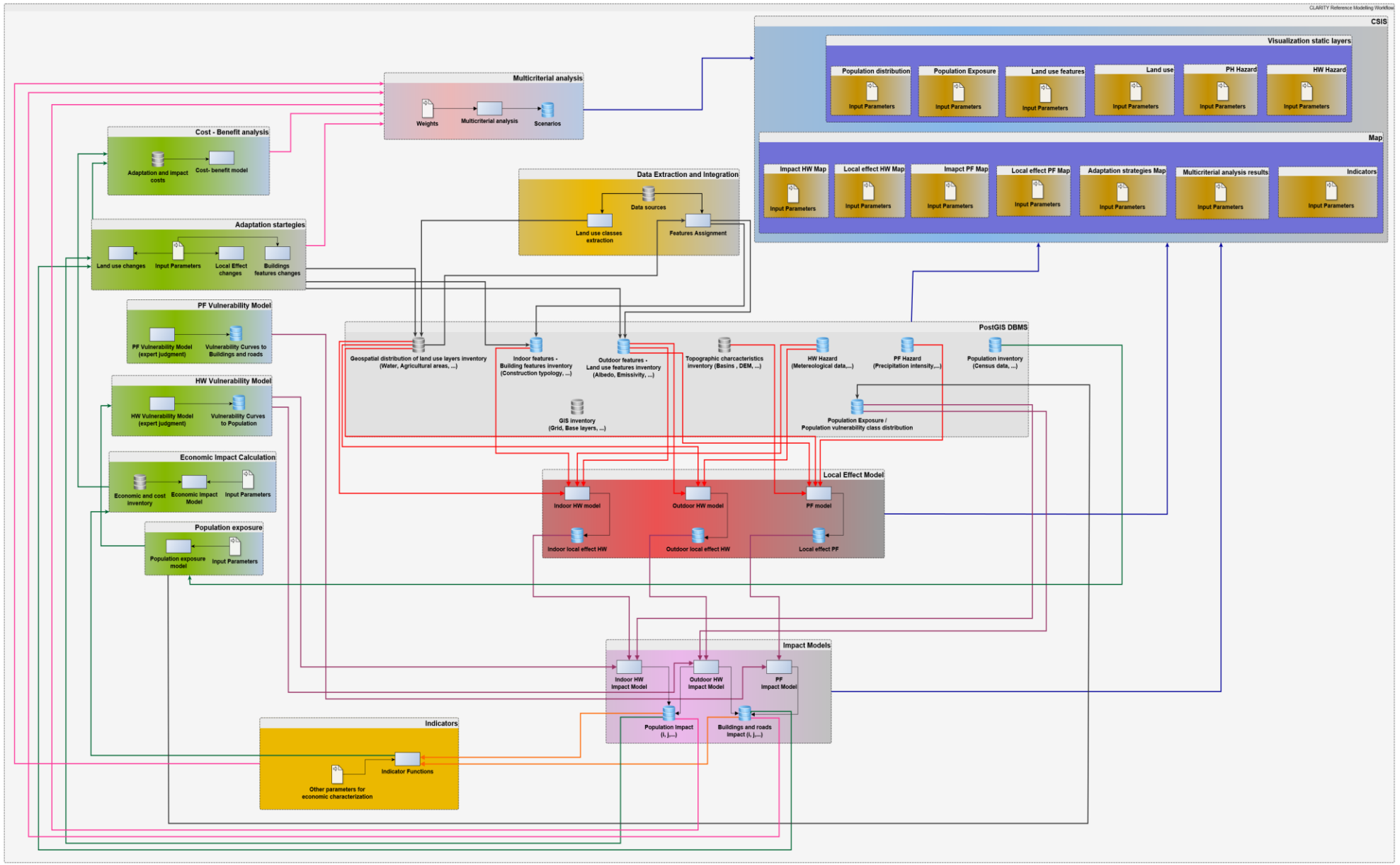

Figure 43: Reference Modelling Workflow

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3.2 Datasets used in the Naples demonstrator for the prototype

The following presents the list of datasets prepared for the first CSIS prototype focused on the Naples demonstrator. Please, note that at the time of writing this deliverable the list is not complete, as it mainly comprehends heat-wave hazard related data as well as generic datasets (e.g., buildings, roads, agriculture areas, etc.) that are hazard-independent. In the next weeks it is expected to increment this list with datasets concerning exposure, vulnerability, impact and risk as well as adaptation options. In the same manner data for the pluvial flooding for the metropolitan area of Naples will be included as well.

For further details about each specific dataset, please check deliverables ""D2.2 Data collection report" and "D7.9 Data Management Plan v2". Deliverable "D3.2 Science support report" provides detailed information on how the datasets are used as inputs (or as resulting outputs) for (from) various of the involved calculation processes (either offline and within the CSIS workflow).

When ingested as inputs within the CSIS workflow, they are provided as resources in a comprehensive data package – that are suited for each of the EU-GL methodology steps. Section 3.3 CLARITY data package specification provides further insights about CLARITY data package specification. Annex I provides an example of data package for Naples to be used as input for the CSIS prototype (latest version of the Naples data package can be downloaded from here: https://github.com/clarity-h2020/data-package/tree/master/examples/dc1-naples).

3.2.1 Pan-European Hazard Datasets

As input for the EU-GL steps "Characterise Hazard" and "Hazard Local Effects", both for European-level screening studies and demonstration case specific expert studies, ZAMG is calculating several climate indices for the hazard characterization at European scale. The indices are being calculated for several Global Climate Model – Regional Climate Model combinations from the EURO-CORDEX (https://ckan.myclimateservice.eu/dataset/euro-cordex-ensemble-climate-simulations) simulations at 0.11° resolution (EUR-11) to account for inter-model variability. For each climate index there will be an ensemble mean for each time period (1971-2000, 2011-2040, 2041-2070, 2071-2100) and each representative concentration pathway (RCP2.6, RCP4.5 and RCP8.5).

Hazard indexes currently used in Naples DC1 data package:

- *Tropical Nights (TN)*: https://ckan.myclimateservice.eu/dataset/tropical-nights-tn
- *Summer days (SD)*: https://ckan.myclimateservice.eu/dataset/summer-days-sd
- *Hot days > 75th percentile*: https://ckan.myclimateservice.eu/dataset/hot-days
- *Max. number of consecutive days when Tmax > 75th percentile (Apr-Sept)*: https://ckan.myclimateservice.eu/dataset/max-number-of-consecutive-days-when-tmax-75th-percentile-apr-sept
- *Consecutive Summer Days (CSU)*: https://ckan.myclimateservice.eu/dataset/consecutive-summer-days

3.2.2 Local Effects Input Datasets

These are the local effects datasets that are applied to the Pan-European Hazard Datasets in order to derive the downscaled datasets. They are mainly based on open Copernicus data and encompass detailed information related to key parameters linked to urban morphology and surface type, such as albedo, emissivity, buildings shadows, etc.

Currently, datasets are available for the metropolitan region Naples (DC1). The related meta-data is made available at CKAN Catalogue at https://ckan.myclimateservice.eu/dataset?tags=Local+Effects.

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Local Effects Datasets have been also published through OGC compliant web services at http://services.clarity-h2020.eu:8080/geoserver following WFS and WMS standards. They have been generated by using different data sources or some combinations of them:

- Urban Atlas
  - *Agricultural Areas*: https://ckan.myclimateservice.eu/dataset/agricultural-areas
  - *Water Areas*: https://ckan.myclimateservice.eu/dataset/naples-water
  - *Public, Military and Industrial Unit Areas*: https://ckan.myclimateservice.eu/dataset/public-military-and-industrial-units
  - Low, Medium and Dense Urban Fabric Areas:
    - https://ckan.myclimateservice.eu/dataset/low-urban-fabric
    - https://ckan.myclimateservice.eu/dataset/medium-urban-fabric
    - https://ckan.myclimateservice.eu/dataset/dense-urban-fabric
  - *Roads*: https://ckan.myclimateservice.eu/dataset/roads
  - *Railways*: https://ckan.myclimateservice.eu/dataset/railways
- European Settlement Map
  - *Built Open Spaces*: https://ckan.myclimateservice.eu/dataset/built-open-spaces
  - *Buildings*: https://ckan.myclimateservice.eu/dataset/buildings
- Urban atlas and Street Tree Layer (Vegetation): https://ckan.myclimateservice.eu/dataset/vegetation
- Urban Atlas and European Settlement Map (Trees): https://ckan.myclimateservice.eu/dataset/trees

3.3 CLARITY data package specification

3.3.1 Rationale

Information consumed by CLARITY Climate Services must be provided in a common data package format which contains all or part of the datasets necessary for carrying out the project climate proofing assessment (according to the steps defined in CLARITY EU-GL Methodology).

Technically, a standardized data package can be realized as “distributed data object“ so that not all data must reside in the same location (database, server). Here arises also the need for “Smart Links” that can combine, relate and describe different information entities (in this particular case the distinct elements of data package). Furthermore, a serialization feature for data packages is needed that allows to put all contents of package into a concrete (zip) file that can be shared, e.g. with other experts.

Besides, the output of Climate Services must be delivered as such a standardized data package to ensure technical interoperability to the CSIS and thus the Climate Services Ecosystem. Consequently, a data package can either reside on the CSIS as Virtual data package (distributed among several physical data stores) if the provider of the Expert Climate Service uses the CLARITY CSIS to provide its service, or as concrete file (Serialized data package) if the provider works offline.

3.3.2 Design principles

CLARITY data package specification builds on top of the existing data package specification provided by Frictionless Data (https://frictionlessdata.io) in accordance with their **design philosophy** (https://frictionlessdata.io/specs):

- *Simplicity*: seek simplicity in which there is nothing to add and nothing to take away.
- *Extensibility*: design for extensibility and customization. This makes hard things possible and allows for future evolution
- *Human-editable and machine-usable*: specifications should preserve human readability and editability whilst making machine-use easy.
- *Reuse*: reuse and build on existing standards and formats wherever possible.
- *Cross technology*: support a broad range of languages, technologies and infrastructures -- avoid being tied to any one specific system.

This philosophy is itself based on the overall design principles of the Frictionless Data project:

- *Focused*: sharp focus on one part of the data chain, one specific feature – packaging – and a few specific types of data (e.g. tabular).
- *Web Oriented*: build for the web using formats that are web "native" such as JSON, work naturally with HTTP such as plain text CSVs (which stream).
- *Distributed*: design for a distributed ecosystem with no centralized, single point of failure or dependence.
- *Open*: Anyone should be able to freely and openly use and reuse what we build.
- *Existing Software*: Integrate as easily as possible with existing software both by building integrations and designing for direct use – for example we like CSV because everyone has a tool that can access CSV.
- *Simple, Lightweight*: Add the minimum, do the least required, keep it simple. For example, use the most basic formats, require only the most essential metadata, data should have nothing extraneous.

3.3.3 Structure overview

Similarly to a common data package (https://frictionlessdata.io/specs/data-package), CLARITY data package consists of:

- **Metadata** that describes the structure and contents of the package
- **Resources** such as data files that form the contents of the package

The data package metadata is stored in a "descriptor". This descriptor is what makes a collection of data a CLARITY data package. The structure of this descriptor is the main content of the specification.

In addition to this descriptor a data package will include other resources such as data files. The CLARITY data package specification **does impose** some particular requirements on their form or structure -- in contraposition to the lack of any requirements in the original data package specification -- and it also extends the descriptor with additional properties which ensure that data contained in a CLARITY data package is valid and suitable for being ingested and processed by CLARITY Climatic Services.

The data included in the package may be provided as:

- Files bundled locally with the package descriptor
- Remote resources, referenced by URL

A typical CLARITY data package would be according to the following structure:

```
datapackage.json  # (required) metadata and schemas for this CLARITY data package
README.md         # (optional) README file (in markdown format) describing the purpose
of this data package

# data files MUST go in "data" subdirectory (this subdirectory may have additional
subdirectories for further
# organizing the datasets in the data package\n
data/mydata.csv
data/hazards/heat-waves/summer-days-index.tif

# the directory for code scripts (by convention scripts go in a scripts directory) for
processing or
# analyzing the data
scripts/my-preparation-script.py
```

Full CLARITY data package specification can be found at https://github.com/clarity-h2020/data-package

In the Annexes section of this document it can be found the current description of each of the properties that compose CLARITY data package Specification and the example developed for the Naples demonstrator.

4 Implementation and Deployment Status

As presented in section "2. CSIS specifications", current CSIS prototype is focused on the implementation of the features in the system (both UI and back-office services) that enable the CSIS users to perform the screening of the urban project at study (in this case, in Naples), leaving for the next phase the description and implementation of additional features required for carrying out an expert assessment.

In that regard, the following diagram (an adaptation of the CSIS component-based layered architecture presented in deliverable D4.2 CSIS Architecture) summarizes the components currently being implemented and deployed (circled in a green rectangle. In orange colour are those with some implementation work but not fully functional) in order to have a first operative CSIS prototype.

A detailed description of each component (and its related technologies) can be found in deliverables D4.1 Technology support plan and D4.2 CSIS Architecture. In addition, deliverable D4.3 Technology support report v1 provides further details on the present implementation status of each component.

Current version of the CSIS prototype is running in AIT's dedicated development server using Docker as means for deploying the various services (e.g., EMIKAT, Geoserver, CKAN), databases (e.g., Postgresql) and UI frontend (e.g., Drupal 8) that comprehend the CSIS.

The prototype is accessible here (please, note that a user account is needed in order to access to it): https://csis.myclimateservice.eu

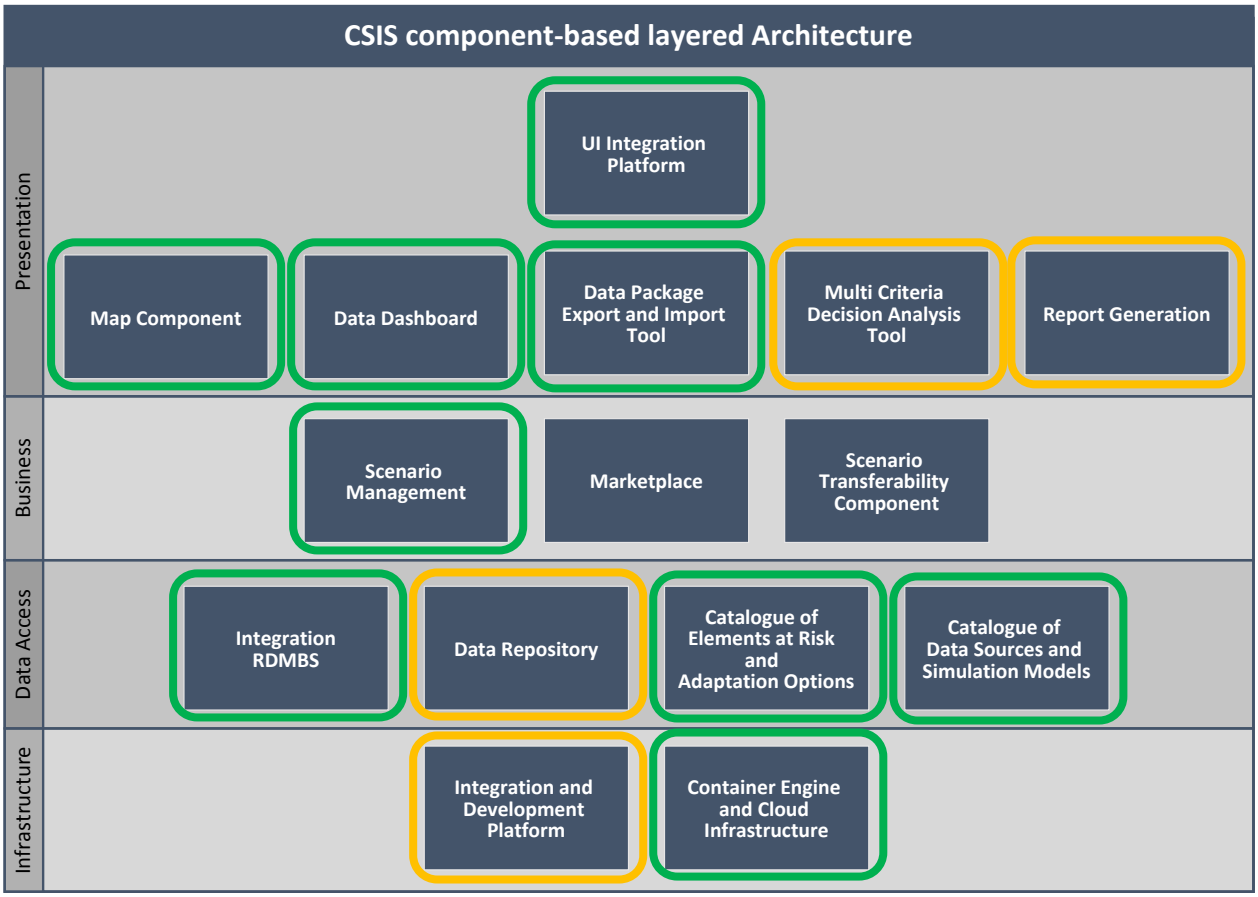

Figure 44 CSIS architecture components being implemented for first prototype

5 Conclusions

As presented in the previous sections, this report briefly describes the first prototype version of the CSIS (i.e., deliverable D1.3 CLARITY CSIS v1, marked as OTHER in the DoA).

CSIS prototype implementation work takes as basis the user requirements in the form of visual mock-ups depicting the features that the tool should provide to its users willing to carry out a preliminary climate proofing study.

The document also presents the Reference Modelling Workflow, which describes the technical implementation of the EU-GL/CLARTIY Modelling Methodology (documented in CLARTIY deliverable D3.1 Science Support Plan) CLARTIY CSIS. The Reference Modelling Workflow was used to support the data processing team in charge of preparing the datasets to be used by the CSIS prototype in relation to the Naples demonstrator.

CLARITY data package specification was presented (and further discussed and an example for the Naples region is provided in the annex sections) as the “glue” allowing to relate and describe (by means of metadata properties) the various datasets required by the CSIS at each stage of the EU-GL methodology.

Finally, the components currently being implemented and deployed in order to have a first operative CSIS prototype were listed. The implementation status of each of them varies, being more advanced those ones that are part of the core system and are required to provide the basic features identified for the first demonstrator.

Future work for the next months in the CSIS will focus on:

- Improving the prototype based on the feedback received from end-users and other stakeholders contacted/met in conferences and workshops organized by the project.
- Extend functionalities of the prototype in order to integrate features related to the expert services (to that end, additional mock-ups will be developed and validated with the end-users previous to their implementation)
- Prepare/produce additional datasets for the other DC’s but also include additional hazards in the workflow (e.g., pluvial floods, landslides, etc.).

6 Acknowledgement

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730355.

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8 Annexes

8.1 Annex I - CLARITY data package specification

8.1.1 Data package object

The following is a list of attributes contained in the general part of the descriptor

Table 2: data package object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
name	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A short url-usable (and preferably human-readable) name of the package. This MUST be lower-case and contain only alphanumeric characters along with ".", "_" or "-" characters. It will function as a unique identifier and therefore SHOULD be unique in relation to any registry in which this package will be deposited (and preferably globally unique). The name SHOULD be invariant, meaning that it SHOULD NOT change when a data package is updated, unless the new package version should be considered a distinct package, e.g. due to significant changes in structure or interpretation. Version distinction SHOULD be left to the version property. As a corollary, the name also SHOULD NOT include an indication of time range covered.
id	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A property reserved for globally unique identifiers. A common usage pattern for data packages is as a packaging format within the bounds of a system or platform. In these cases, a unique identifier for a package is desired for common data handling workflows, such as updating an existing package. While at the level

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Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					of the specification, global uniqueness cannot be validated, consumers using the id property MUST ensure identifiers are globally unique. For the CLARITY, we propose to use URLs as a means for ensuring gloabal uniqueness of the data package id. Taking as basis the Identifier String in data package Identifier specification (https://frictionlessdata.io/specs/data-package-identifier/#identifier-string), the following examples would be valid data package identifiers : • A URL that points directly to the datapackage.json file: http://data.myclimateservice.eu/datapackages/clarity-dc4.json • A URL that points directly to the data package: http://github.com/clarity-h2020/datapackages/clarity-dc4 • A GitHub URL: http://github.com/clarity-h2020/datapackages/clarity-dc4 Note 1: The 4th example provided in https://frictionlessdata.io/specs/data-package-identifier/#identifier-string (i.e., using the name of the dataset in the Core Datasets registry) would not be supported as it is not a URL, although it would be valid to use something like this (as it is a URL): https://datahub.io/core/clarity-dc4/datapackage.json Note 2: for the sake of coherence, the "name" attribute value MUST be the same as in the id (according to the examples above, "name" attribute value would "clarity-dc4". Note 3: adding versioning to the url (pending)
version	Character string	0/1	OPTIONAL	MANDATORY	A version string identifying the version of the package. It should conform to the Semantic Versioning requirements (http://semver.org/) and should follow the data package Version pattern (https://frictionlessdata.io/specs/patterns/#data-package-version): MAJOR.MINOR.PATCH (e.g., 1.0.0)
profile	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A string identifying the profile of this descriptor as per the profiles specification (https://frictionlessdata.io/specs/profiles/).

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					Different kinds of data need different data and metadata formats. To support these different data and metadata formats we need to extend and specialise the generic data package. These specialized types of data package (or Data Resource) are termed profiles. Thus, in the context of CLARITY, we define a specialized general data package profile. In the same manner, each of the specific resources contained in the "CLARITY data package" are defined according to the "CLARITY Data Resource" profile. The value of the profile property is a unique identifier for that profile. This unique identifier MUST be a string in the form of a fully-qualified URL, allowing thus ensuring its uniqueness, that points directly to a JSON Schema that can be used to validate the profile. The profile schema proposed for CLARITY data packages is "profile": http://csis.myclimateservice.eu/data/schemas/clarity-data-package-json-schema.json Note: pending to create clarity-data-package-json-schema.json schema
title	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A string providing a title or one sentence description for this package
description	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A description of the package. The description MUST be markdown formatted -- this also allows for simple plain text as plain text is itself valid markdown. The first paragraph (up to the first double line break) should be usable as summary information for the package.
keywords	List of character strings without length restriction	0/1	OPTIONAL	MANDATORY	An array of string keywords characterizing the package, assisting users searching for it in catalogs.
created	DateTime	0/1	OPTIONAL	MANDATORY	The datetime on which this was created.

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					Note: semantics may vary between publishers -- for some this is the datetime the data was created, for others the datetime the package was created. In CLARITY data packages, it refers to the datatime when the data package was created. The datetime must conform to the string formats for datetime as described in RFC3339 (https://tools.ietf.org/html/rfc3339#section-5.6). Example: { "created": "2018-09-20T23:20:50.52Z" }"
homepage	Character string without length restriction	0/1	OPTIONAL	OPTIONAL	A URL for the home on the web that is related to this data package.
sources	List of Source objects	0*	OPTIONAL	OPTIONAL	The raw sources for this data package. It MUST be an array of Source objects. Each Source object MUST have a title and MAY have path and/or email properties. Example: "sources": [{ "title": "World Bank and OECD", "path": "http://data.worldbank.org/indicator/NY.GDP.MKTP.CD" }]"
contributors	List of Contributor objects	0*	OPTIONAL	MANDATORY	The people or organizations who contributed to this data package. It MUST be an array. Each entry is a Contributor and MUST be an object. A Contributor MUST have a title property and MAY contain path, email, role and organization properties. Example: "contributors": [{ "title": "Joe Bloggs", "email": "joe@bloggs.com", "path": "http://www.bloggs.com", "role": "author" }]"
licenses	List of License objects	0*	OPTIONAL	MANDATORY	The license(s) under which the package is provided. This property is not legally binding and does not guarantee the package is licensed under the terms defined in this property. "licenses" MUST be an array. Each item in the array is a License object. The object MUST contain a name property and/or a path property. It MAY contain a title property.

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
image	Character string without length restriction	0/1	OPTIONAL	OPTIONAL	An image to use for this data package. For example, when showing the package in a listing. The value of the image property MUST be a string pointing to the location of the image. The string must be a url-or-path, that is a fully qualified HTTP address, or a relative POSIX path (see the url-or-path definition in Data Resource for details).
resources	List of Resource objects	1+	MANDATORY	MANDATORY	The resources property is required, with at least one resource. Packaged data resources are described in the resources property of the package descriptor. This property MUST be an array of objects. Each object MUST follow the Data Resource specification (https://frictionlessdata.io/specs/data-resource/) OR the CLARITY extension of the Data Resource specification for concrete resources needed as input for the CSIS (e.g., Hazard, Exposure, Vulnerability, etc. Maps Resources). See CLARITY Resources table for a detailed list of attributes of the object. Note1: According to the Data Resource specification: "A resource MUST contain a property describing the location of the data associated to the resource. The location of resource data MUST be specified by the presence of one (and only one) of these two properties: • path: for data in files located online or locally on disk. • data: for data inline in the descriptor itself." Note2: CLARITY data packages ONLY support resources that describe their location with the "path" property. This is to avoid having data package descriptors (.json) files bloated with thousands of text lines encoding the data which would make unmanageable and unreadable the descriptor. Instead of that, CLARITY data packages forces to store that data in a file and reference it within the data package itself or to a remote location.
language	String enumeration	0/1	N/A	OPTIONAL	ISO/TS 19139 alpha-3 (three characters) code denoting the language in which the textual information of the metadata is presented. IF empty, it is assumed English ("eng")

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
price	Price object	0/1	N/A	OPTIONAL	Price of the data package. If empty, then assume that it is free.

8.1.1.1 Source object

Table 3: Source object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
title	Character string without length restriction	0/1	OPTIONAL	MANDATORY	title of the source (e.g. document or organization name)
path	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A url-or-path string, that is a fully qualified HTTP address, or a relative POSIX path (see the url-or-path definition in Data Resource for details).
email	Character string without length restriction	0/1	OPTIONAL	OPTIONAL	An email address

8.1.1.2 Contributor object

Table 4: Contributor object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
title	Character string without length restriction	0/1	OPTIONAL	MANDATORY	name/title of the contributor (name for person, name/title of organization)
path	Character string without length restriction	0/1	OPTIONAL	OPTIONAL	A fully qualified http URL pointing to a relevant location online for the contributor.
email	Character string without length restriction	0/1	OPTIONAL	OPTIONAL	An email address
role	String enumeration	0/1	OPTIONAL	OPTIONAL	A string describing the role of the contributor. It MUST be one of: author, publisher, maintainer, wrangler, and contributor. Defaults to contributor. Note on semantics: use of the "author" property does not imply that that person was the original creator of the data in the data package - merely that they created and/or maintain the data package. It is common for data packages to "package" up data from elsewhere. The original origin of the data can be indicated with the sources property - see above.
organization	Character string without length restriction	0/1	OPTIONAL	OPTIONAL	A string describing the organization this contributor is affiliated to.

8.1.1.3 License object

Table 5: License object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
name	String enumeration	0/1	OPTIONAL	MANDATORY	The name MUST be an Open Definition license ID (see https://licenses.opendefinition.org/)
path	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A url-or-path string, that is a fully qualified HTTP address, or a relative POSIX path (see the url-or-path definition in Data Resource for details).
title	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A human-readable title

8.1.1.4 Price object

Table 6: Price object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
amount	Float	1	N/A	MANDATORY	The price of the data package. If the data package is free, then the value of this parameter MUST be 0.0
currency	String enumeration	1	N/A	MANDATORY	The currency property of a price is given. It must be one of of the codes listed here: https://www.currency-iso.org/en/home/tables/table-a1.html. By default, the currency code is "EUR"

8.1.2 Resource

The following is a list of attributes contained in the Data Resource section of the data package descriptor.

Table 7: Resource object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
id	CharacterString without length restriction	1	N/A	MANDATORY	Unique identifier of the resource within the data package. The id value is built by appending to the data package id the following string "#r" plus [auto-generated-sequential-number (starting from 1)] E.g., "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r1"
name	CharacterString without length restriction	1	MANDATORY	MANDATORY	A resource MUST contain a name property. The name is a simple name or identifier to be used for this resource. If present, the name MUST be unique amongst all resources in this data package. It MUST consist only of lowercase alphanumeric characters plus ".", "-" and "_". It would be usual for the name to correspond to the file name (minus the extension) of the data file the resource describes. The name SHOULD be invariant, meaning that it SHOULD NOT change when a resource is updated.
profile	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A string identifying the profile of this resource descriptor as per the profiles specification (see the profile property in "General" tab). For CLARITY: http://csis.myclimateservice.eu/data/schemas/clarity-data-resource-json-schema.json
title	Character string without length restriction	0/1	OPTIONAL	MANDATORY	A string providing a title or one sentence description for this resource
description	Character string without	0/1	OPTIONAL	MANDATORY	A description of the resource package (see the description property in "General" tab).

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
	length restriction				
sources	List of Source objects	0+	N/A	OPTIONAL	The raw sources that were used for producing this resource. For further information, please check the sources property description at data package level.
contributors	List of Contributor objects	0+	OPTIONAL	OPTIONAL	The people or organizations who contributed to produce this resource. For further information, please check the contributors property description at data package level.
licenses	List of License objects	0+	OPTIONAL	OPTIONAL	The license(s) under which the resource is provided. If not specified the resource inherits from the data package. For further information, please check the license property description at data package level.

format	String enumeration	0/1	OPTIONAL	MANDATORY	The value of this property would be expected to be the standard file extension for this type of resource.
					Currently, CLARITY data package supports the following resource formats:
					• Tabular data:
					  ○ "csv": Comma Separated Values
					• Vector based:
					  ○ "geojson": GeoJson
					  ○ "shape": ESRI Shapefiles
					  ○ "shape-zip": Compressed ESRI Shapefiles
					  ○ "gpkg": OGC GeoPackage
					  ○ "gml2": GML 2
					  ○ "gml3": GML 3
					  ○ "gml32": GML 3.2
					  ○ "kml": OGC Keyhole Markup Language
					  ○ "kmz": OGC Compressed Keyhole Markup Language
					• Raster based:
					  ○ tif | tiff: (.tif, .tiff)
					  ○ jpeg

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					○ png ○ gif ○ geotiff: Geo-tagged tif (.tif, .tiff) ○ Note: the use of GeoPackages allows to overcome the limitations of ESRI Shapefiles (Check the list of limitations at http://switchfromshapefile.org/ and https://www.gis-blog.com/geopackage-vs-shapefile) and therefore, its use in data packages should be preferrable. Nevertheless, when using GeoPackages as resources within the data packages, in order to comply with the data package specification, take into account that a resource of this type can only have ONE dataset within the GeoPackage (although its specification allows having one or more different datasets).
mediatype	String enumeration	0/1	OPTIONAL	OPTIONAL	The mediatype/mimetype of the resource e.g. ""text/csv"". Mediatypes are maintained by the Internet Assigned Numbers Authority (IANA) in a media type registry (https://www.iana.org/assignments/media-types/media-types.xhtml). Note: it is possible that some particular GIS formats are not listed in the media type registry. Some typically used media types used in OGC services are: • application/gml+xml • application/x-gzip • image/jpeg • image/png • image/tiff • text/plain • text/xml • application/json

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
encoding	String enumeration	0/1	OPTIONAL	OPTIONAL	Specify the character encoding of the resource's data file. The values should be one of the ""Preferred MIME Names"" for a character encoding registered with IANA (https://www.iana.org/assignments/character-sets/character-sets.xhtml). If no value for this key is specified then the default is UTF-8. Note: what happens if the resource is a raster?
bytes	Long	0/1	OPTIONAL	OPTIONAL	Size of the file in bytes. Note: This parameter is hepful for determining how to process the data package, thus for instance, if we know in advance that several of the resources are large, we can determine that it is better to process the contents in a batch process and later on inform the user when the results are ready. In this sense, the parameter is considered MANDATORY if the resource is included within the data package (the path parameter points to a local file within the data package), whereas it is considered OPTIONAL if the path parameter points to a remote location (e.g., HTTP request to a WFS service or ftp location). This is so because the size of the resource is unknown until it is requested to the server hosting it."
hash	Character string without length restriction	0/1	OPTIONAL	OPTIONAL	the MD5 hash for this resource. Other algorithms can be indicated by prefixing the hash's value with the algorithm name in lower-case. For example: "hash": "sha1:8843d7f92416211de9ebb963ff4ce28125932878"
data	Character string without length restriction	0/1	OPTIONAL	N/A	Resource data rather than being stored in external files can be shipped 'inline' on a Resource using the data property. Note: this property is not supported in CLARITY data package Resources.
path	url-path character string without length restriction	1+	OPTIONAL	MANDATORY	Location property for data in files located online or locally on disk (within the data package itself). The path property MUST be a string -- or an array of strings (see "Data in Multiple Files"). Each string MUST be a "url-or-path" string, defined as the following: • URLs MUST be fully qualified. MUST be using either http or https scheme. (Absence of a scheme indicates MUST be a POSIX path)

Attribute			Obligation / Condition		Description
Name	Type	Multiplicity	FrictionlessData	CLARITY	

					• POSIX paths (unix-style with / as separator) are supported for referencing local files, with the security restraint that they MUST be relative siblings or children of the descriptor. Absolute paths (/) and relative parent paths (../) MUST NOT be used, and implementations SHOULD NOT support these path types.
					
					Examples:
					
					• fully qualified url
					  ○ "path": "http://ex.datapackages.org/big-csv/my-big.csv"
					  ○ "path": "http://demo.geo-solutions.it/geoserver/tiger/ows?service=WFS&version=1.1.0&request=GetFeature&typeName=tiger:tiger_roads&srsName=EPSG:3857&bbox=40.7,-74,40.8,-73,urn:ogc:def:crs:EPSG:4326&maxFeatures=1"
					  ○ "path": "jdbc:postgresql://localhost:5432/database"
					  ○ "path": "sftp://clarityftp@w.x.y.z/clarityftp/europe/population/population_naples_age_groups_500_LAEA.zip"
					
					• relative path (note: this will work both as a relative path on disk and on online)
					  ○ "path": "data/my-csv.csv"
					
					SECURITY: / (absolute path) and ../ (relative parent path) are forbidden to avoid security vulnerabilities when implementing data package software. These limitations on resource path ensure that resource paths only point to files within the data package directory and its subdirectories. This prevents data package software being exploited by a malicious user to gain unintended access to sensitive information.
					
					Data in Multiple Files: Usually, a resource will have only a single file associated to it. However, sometimes it may be convenient to have a single resource whose data is split

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					across multiple files -- perhaps the data is large and having it in one file would be inconvenient. To support this use case the path property MAY be an array of strings rather than a single string: "path": ["myfile1.csv", "myfile2.csv"] It is NOT permitted to mix fully qualified URLs and relative paths in a path array: strings MUST either all be relative paths or all URLs. Best Practice (proposal): dataset resources MUST be located in a "data" folder in the root of the in a data package (where the json descriptor is also located) in order to have a better organization of the contents. Within the data folder, datasets MAY be further organized creating additional subfolders if necessary.
schema	url-path character string without length restriction	0/1	OPTIONAL	MANDATORY	In CLARITY data packages, a Data Resource MUST always have a schema property to describe the schema of the resource data. Note: even for raster-based resources, having the schema is necessary, as it can describe useful information like what is/are the paremeter(s) measured as well as its/their measurement unit(s), which may be necessary for the application in charge of process the resource afterwards. The value for the schema property on a resource MUST be an object representing the schema OR a string that identifies the location of the schema. If a string it must be a url-or-path as defined above, that is a fully qualified http URL or a relative POSIX path. The file at the location specified by this url-or-path string MUST be a JSON document containing the schema. The next section provide a complete schema description with the parameters for each of the typical resources included in a CLARITY data package.
service_type	CharacterString enumeration	0/1	N/A	OPTIONAL	This property is primarily to be used to support the client software (that has to process the data package) to identify if the resource is being offered via some commonly used (download) geoservice service (mainly OGC WFS or OGC WCS). Listed below there is a (non-exhaustive) list of possible protocol values: • ogc:wms

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					• ogc:wms-t • ogc:wfs • ogc:wcs • osm • tms
mapview	Mapview Object	0/1	N/A	OPTIONAL	This property provides another "view" of the data in the form of a visual map by indicating a path (url) to the mapping service. This property is to be typically used when the resource is available via wfs or wcs (or even an static geo-resource) and we want to be able to easily visualize the data (e.g., using for instance the wms o osm protocols) which is more convenient and efficient than loading the heavy raster or vector-based data into the in a map client.
quality	Quality object	0/1	OPTIONAL	OPTIONAL	Check with LUIS possible parameters: * uncertainty * fiability
spatial_context	SpatialContext object	0/1	OPTIONAL	OPTIONAL(*)	MANDATORY if the resource is a spatial dataset. Otherwise, this property is empty.
temporal_context	TemporalContext object	0/1	OPTIONAL	OPTIONAL(*)	MANDATORY if the resource is has a temporal component. Otherwise, this property is empty.
analysis_context	AnalysisContext object	1	N/A	MANDATORY	This property describes contextual information needed by the CSIS in order to understand how to process this specific resource (e.g., in which step of the CLARITY workflow it must be used, to which hazard the resource is related to, etc.

8.1.2.1 SpatialContext object

Table 8: SpatialContext object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
crs	CharacterString enumeration	1	N/A	OPTIONAL	Property indicating the Coordinate Reference System. Its value must be a valid EPSG code (https://sis.apache.org/tables/CoordinateReferenceSystems.html). By default, CLARITY data packages use EPSG:3035 Example: "crs": "EPSG:3035"
extent	SpatialExtent object	1	N/A	MANDATORY	The extent property defines the minimum bounding rectangle (xmin, ymin and xmax, ymax) defined by coordinate pairs of the spatial data resource. All coordinates for the data source fall within this boundary. E.g., "extent": { "xmin":-180.0, "ymin":-90.0, "xmax":180, "ymax":90.0 }
resolution	SpatialResolutionByDistance OR SpatialResolutionByScale object	1	N/A	MADATORY	The spatial resolution property refers to the level of detail of the data set. It shall be expressed as a resolution distance value (typically for gridded data and imagery-derived products) or an equivalent scale value (typically for maps or map-derived products). Note 1: An equivalent scale is generally expressed as an integer value expressing the scale denominator. A resolution distance shall be expressed as a numerical value associated with a unit of length. Note 2: For grids it is assumed that the resolution of the cells is the same in the x and y axis Examples: • "resolution": { "scale": 50000 } • "resolution": { "distance": 12.5, "uom": "km"}

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
grid_info	GridInfo object	0/1	N/A	OPTIONAL(*)	This property is MANDATORY if the resource is a raster. Please, see GridInfo object description for further details.

8.1.2.2 SpatialResolutionByDistance object

Table 9: SpatialResolutionByDistance object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
distance	Float	1	N/A	MANDATORY	The resolution expressed in distance
uom	CharacterString enumeration	1	N/A	OPTIONAL	The units of measurement used to define the distance. By default, in meters. Possible values are: • "m" // urn:ogc:def:uom:OGC::m • "km" // urn:ogc:def:uom:OGC::km • ...

8.1.2.3 SpatialResolutionByScale object

Table 10: SpatialResolutionByScale object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
scale	Long	1	N/A	MANDATORY	The resolution expressed in scale

8.1.2.4 SpatialExtent object

Table 11: SpatialExtent object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
xmin	Float	1	N/A	MANDATORY	Minimum coordinate value in the "x" axis that defines the spatial extent.
ymin	Float	1	N/A	MANDATORY	Minimum coordinate value in the "y" axis that defines the spatial extent.
xmax	Float	1	N/A	MANDATORY	Maximum coordinate value in the "x" axis that defines the spatial extent.
ymax	Float	1	N/A	MANDATORY	maximum coordinate value in the "y" axis that defines the spatial extent.

8.1.2.5 GridInfo object

Table 12: GridInfo object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
band_count	Integer	0/1	N/A	OPTIONAL	Number of bands contained in the gridded dataset. If absent, the raster is assumed with only one band.
bit_depth	CharacterString enumeration	1	N/A	MANDATORY	The bit depth (also known as pixel depth) of a cell determines the range of values that a particular raster file can store, which is based on the formula 2n (where n is the bit depth). For example, an 8-bit raster can have 256 unique values, which range from 0 to 255. Possible "bit_depth" values for this property: Bit depth (Range of values that each cell can contain): • 1-bit (0 to 1) • 2-bit (0 to 3) • 4-bit (0 to 15) • unsigned-8-bit (0 to 255) • signed-8-bit (-128 to 127) • unsigned-16-bit (0 to 65535) • signed-16-bit (-32768 to 32767) • unsigned-32-bit (0 to 4294967295) • signed-32-bit (-2147483648 to 2147483647) • floating-point-32-bit (-3.402823466e+38 to 3.402823466e+3)
columns	Long	1	N/A	MANDATORY	This property indicates the number of columns in the grid
rows	Long	1	N/A	MANDATORY	This property indicates the number of rows in the grid

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
no_data_value	Character string without length restriction	1	N/A	MANDATORY	Value used to represent the absence of data in a cell. The value must be in relation to the ranges used with the bit_depth property
start_cell	CharacterString enumeration	1	N/A	MANDATORY	This property indicates the starting cell of the raster. Possible values are: • "top-left" • "bottom-right"
compression_type	CharacterString enumeration	0/1	N/A	OPTIONAL	This property indicates compression method used to compress the information contained in the raster. Possible values are: • uncompressed • packbits • lzw • deflate • jpeg • ....

8.1.2.6 TemporalContext object

Table 13: TemporalContext object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
trs	CharacterString enumeration	0/1	N/A	OPTIONAL	This property indicates the temporal reference system used to represent the time information. If the property is absent, default time reference system is "ISO 8601:2004" will be assumed.
reference_period	List of dates	1	N/A	OPTIONAL	The temporal reference property indicates an ordered list with all the years (or dates) comprehended in the information present in the dataset. Example: "reference_period": [2005, 2006, 2007, 2008]
extent	TemporalExtent Object	1	N/A	MANDATORY	The temporal extent property defines the global temporal extent of all the indicator values present in the dataset. This is the start and the end marks of the union of all the time periods covered by the indicator values. For example, if the indicator values existing in the dataset cover the years 2005, 2006, 2007 and 2008, the extent property must have the value "extent": { "start": 2005, "end": 2008}.

8.1.2.7 TemporalExtent object

Table 14: TemporalExtent object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
start	Date	1	N/A	MANDATORY	The starting date

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
end	Date	1	N/A	MANDATORY	The ending date

8.1.2.8 Mapview object

Table 15: Mapview object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
service_type	CharacterString enumeration	1	N/A	MANDATORY	The protocol (service type) of the mapping service. Similar to "protocol" property defined at resource level, but possible values are limited to: • ogc:wms • ogc:wms-t • osm • (maybe others?)
url	url CharacterString without length restriction	1	N/A	MANDATORY	The url with the complete WMS GetMap request (or similar request) used to obtain the rendered map image of the geospatial resource. Map clients using it should be able to use and modify the url in order to specifiy a different image format, width and height of the image or even provide a different SLD styling (if supported by both the client and the mapping service).

8.1.2.9 EU-GL object

Table 16: EU-GL object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
workflow_step	List of CharacterString enumeration	1+	N/A	MANDATORY	The list of workflow steps where the resource can be used. Allowed values are: • eu-gl:hazard-characterization --> https://csis.myclimateservice.eu/taxonomy/eu-gl/hazard-characterization • eu-gl:hazard-characterization:local-effects --> https://csis.myclimateservice.eu/taxonomy/eu-gl/hazard-characterization/local-effects • eu-gl:exposure-evaluation --> https://csis.myclimateservice.eu/taxonomy/eu-gl/exposure-evaluation • eu-gl:vulnerability-analysis --> https://csis.myclimateservice.eu/taxonomy/eu-gl/vulnerability-analysis • eu-gl:risk-and-impact-assessment --> https://csis.myclimateservice.eu/taxonomy/eu-gl/risk-and-impact-assessment • eu-gl:adaptation-options:identification --> https://csis.myclimateservice.eu/taxonomy/eu-gl/adaptation-options/identification • eu-gl:adaptation-options:appraisal --> https://csis.myclimateservice.eu/taxonomy/eu-gl/adaptation-options/appraisal • eu-gl:adaptation-action-plans:implementation --> https://csis.myclimateservice.eu/taxonomy/eu-gl/adaptation-options/implementation • any
hazard	List of CharacterString enumeration	1+	N/A	MANDATORY	The hazard property describes to which hazard type is the resource related to. Its value can be one of the following list:

Attribute			Obligation / Condition		Description
Name	Type	Multiplicity	FrictionlessData	CLARITY	
					• hazard:heat:heat-wave -- > https://csis.myclimateservice.eu/taxonomy/hazard/heat/heat-weave • hazard:heat:extreme-heat -- > https://csis.myclimateservice.eu/taxonomy/hazard/heat/extreme-heat • hazard:flood:extreme-precipitation -- > https://csis.myclimateservice.eu/taxonomy/hazard/flood/extreme-precipitation • hazard:flood:wet-periods -- > https://csis.myclimateservice.eu/taxonomy/hazard/flood/wet-periods • hazard:flood:river-flooding -- > https://csis.myclimateservice.eu/taxonomy/hazard/flood/river-flooding • hazard:flood:pluvial-flooding -- > https://csis.myclimateservice.eu/taxonomy/hazard/flood/pluvial-flooding • hazard:drought -- > https://csis.myclimateservice.eu/taxonomy/hazard/drought • hazard:storm --> https://csis.myclimateservice.eu/taxonomy/hazard/storm • hazard:extreme-wind-speed -- > https://csis.myclimateservice.eu/taxonomy/hazard/extreme-wind-speed • hazard:forest-fire -- > https://csis.myclimateservice.eu/taxonomy/hazard/forest-fire • hazard:landslide -- > https://csis.myclimateservice.eu/taxonomy/hazard/landslide • hazard:earthquake -- > https://csis.myclimateservice.eu/taxonomy/hazard/earthquake • hazard:volcanic-eruption -- > https://csis.myclimateservice.eu/taxonomy/hazard/volcanic-eruption • any --> the resource can be used in relation to any hazard.

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
resource_type	CharacterString enumeration	1	N/A	MANDATORY	The resource_type property indicates which kind of resource is provided for the analysis within the CSIS. Possible values are: • feature-parameters: resource used as input for some internal process within the CSIS/external expert that will typically produce an output shown and analyzed by the user in the CSIS • index: raster resource refererring to a hazard, local effects, vulnerability, exposure or impact index. If this value is used, then the index property (corresponding to any of these index types hazard|local_effect|vulnerability|exposure|impact) MUST be filled in as well. • vulnerabilty-function: tbd • adaptation-measures: tbd • others to be defined
index	CharacterString enumeration	0/1	N/A	OPTIONAL(*)	This property is MANDATORY if the resource is an index. Possible values are: For hazard and local-effects indexes: • hazard:heat:heat-wave:index:consecutive-summer-days --> https://csis.myclimateservice.eu/taxonomy/hazard/heat/heat-weave/index/consecutive-summer-days • hazard:heat:heat-wave:index:hot-period-duration --> https://csis.myclimateservice.eu/taxonomy/hazard/heat/heat-weave/index/hot-period-duration • hazard:heat:extreme-heat:index:hot-days-75p --> https://csis.myclimateservice.eu/taxonomy/hazard/heat/heat-weaves • hazard:heat:extreme-heat:index:hot-days --> https://csis.myclimateservice.eu/taxonomy/hazard/heat/heat-weaves • hazard:heat:extreme-heat:index:summer-days --> https://csis.myclimateservice.eu/taxonomy/hazard/heat/extreme-heat/index/summer-days

Attribute			Obligation / Condition		Description
Name	Type	Multiplicity	FrictionlessData	CLARITY	
					• hazard:heat:extreme-heat:index:tropical-nights --> https://csis.myclimateservice.eu/taxonomy/hazard/heat/extreme-heat/index/tropical-nights • hazard:heat:extreme-heat:index:tx90p --> https://csis.myclimateservice.eu/taxonomy/hazard/heat/extreme-heat/index/tx90p • hazard:flood:extreme-precipitation:index:rx1day --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/extreme-precipitation/index/rx1day • hazard:flood:extreme-precipitation:index:rx5day --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/extreme-precipitation/index/rx5day • hazard:flood:extreme-precipitation:index:snow-days --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/extreme-precipitation/index/snow-days • hazard:flood:wet-periods:index:consecutive-wet-days --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/wet-periods/index/consecutive-wet-days • hazard:flood:wet-periods:index:wet-days --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/wet-periods/index/wet-days • hazard:flood:wet-periods:index:very-heavy-precipitation-days --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/wet-periods/index/very-heavy-precipitation-days • hazard:flood:wet-periods:index:wet-days-90p --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/wet-periods/index/wet-days-90p • hazard:flood:river-flooding:index:flood-recurrence --> https://csis.myclimateservice.eu/taxonomy/hazard/flood/river-flooding/index/

Attribute			Obligation / Condition		Description
Name	Type	Multiplicity	FrictionlessData	CLARITY	
					• hazard:flood:river-flooding:index:river-flow -- > https://csis.myclimateservice.eu/taxonomy/hazard/flood/river-flooding/index/ • hazard:flood:pluvial-flooding:index:water-runoff -- > https://csis.myclimateservice.eu/taxonomy/hazard/flood/pluvial-flooding/index/ • hazard:drought:index:standardized-precipitation-index -- > https://csis.myclimateservice.eu/taxonomy/hazard/drought/index/ • hazard:drought:index:consecutive-dry-days -- > https://csis.myclimateservice.eu/taxonomy/hazard/drought/index/ • hazard:storm:index:???? -- > https://csis.myclimateservice.eu/taxonomy/hazard/storm/index/???? • hazard:extreme-wind-speed:index:???? -- > https://csis.myclimateservice.eu/taxonomy/hazard/extreme-wind-speed/index/????? • hazard:forest-fire:index:fire-weather-index -- > https://csis.myclimateservice.eu/taxonomy/hazard/forest-fire/index/ • hazard:forest-fire:index:seasonal-severity-rating -- > https://csis.myclimateservice.eu/taxonomy/hazard/forest-fire/index/ • hazard:landslide:index:susceptibility-levels-at-continental-scale -- > https://csis.myclimateservice.eu/taxonomy/hazard/landslide/index/ • hazard:earthquake:index:???? -- > https://csis.myclimateservice.eu/taxonomy/hazard/earthquake/index/???? • hazard:volcanic-eruption:index:volcanic-explosivity-index -- > https://csis.myclimateservice.eu/taxonomy/hazard/volcanic-eruption/index/volcanic-explosivity-index For vulnerability indexes: • tbd • tbd

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					• tbd For exposure indexes: • tbd • tbd • tbd For impact indexes: • tbd • tbd • tbd
threshold	List of Threshold Objects	0+	N/A	OPTIONAL(*)	
emissions_scenario	CharacterString enumeration	0/1	N/A	OPTIONAL(*)	This property indicates to which emissions scenario this resource refers to. Possible emission scenario values are: • emissions-scenario:baseline --> https://csis.myclimateservice.eu/taxonomy/emissions-scenario/baseline • emissions-scenario:rcp26-early-response --> https://csis.myclimateservice.eu/taxonomy/emissions-scenario/rcp26-early-response • emissions-scenario:rcp45-effective-measures --> https://csis.myclimateservice.eu/taxonomy/emissions-scenario/rcp45-effective-measures

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					• emissions-scenario:rcp85-business-as-usual --> https://csis.myclimateservice.eu/taxonomy/emissions-scenario/rcp85-business-as-usual
category	List of CharacterString enumeration	0+	N/A	OPTIONAL(*)	Possible element at risk category values are: • element_at_risk:population • element_at_risk:buildings • element_at_risk:infrastructure Possible element at risks class values are: For population: • element_at_risk_class:population:age_group_0to14 • element_at_risk_class:population:age_group_15to65 • element_at_risk_class:population:age_group_greaterthan65 For buildings: • element_at_risk_class:building:continuous-residential • element_at_risk_class:building:discontinuous-residential:low-density • element_at_risk_class:building:discontinuous-residential:medium-high-density For infrastructure (TBC): • element_at_risk_class:infrastructure:roads

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
					• element_at_risk_class:infrastructure:railway

8.1.2.10 Threshold object

Table 17: Threshold object

Attribute			Obligation / Condition		Description
Name	**Type**	**Multiplicity**	**FrictionlessData**	**CLARITY**	
name	CharacterString	1	N/A	MANDATORY	The label of the threshold
lower	float	0/1	N/A	OPTIONAL	The lower boundary of the threshold
upper	float	0/1	N/A	OPTIONAL	The upper boundary of the threshold
relative_to	CharacterString enumeration	0/1	N/A	OPTIONAL	If present, it is used to indicate that upper and lower represent percentages of other values (e.g. "increase in baseline")

8.2 Annex II - CLARITY data package Example: DC1 – Naples

Table 18: CLARITY data package Example: DC1 – Naples


```
{
  "name": "dc1-naples",
  "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples",
  "version": "0.0.1",
  "profile": "http://github.com/clarity-h2020/data-package/schemas/clarity-data-package.json",
  "title": "Naples Metropolitan Area data package",
  "description": "This is the CLARITY data package for the Naples metropolitan area corresponding to
the Demonstrator Case (DC1). \r\n Further description to be completed",
  "keywords": [
    "naples",
    "dc1",
    "TBC"
  ],
  "created": "2019-01-02T16:23:43Z",
  "homepage": "http://www.clarity-h2020.eu",
  "language": "eng",
  "price": {
    "amount": 0.0,
    "currency": "EUR"
  },
  "sources": [],
  "contributors": [{
      "title": "Miguel Ángel Esbrí",
      "role": "author",
      "email": "miguel.esbri@atos.net",
      "organization": "Atos Spain",
      "path": "http://atos.net"
    },
    {
      "title": "Mario Núñez",
      "role": "author",
      "email": "mario.nunez@atos.net",
      "organization": "Atos Spain",
      "path": "http://atos.net"
    }
  ],
  "licenses": [{
    "name": "CC0-1.0",
    "title": "Creative Commons CCZero 1.0",
    "path": "https://creativecommons.org/publicdomain/zero/1.0/"
  }],
  "image": "data/logo/MyCS_48x48.png",
  "spatial_extent": {
    "xmin": 2145500,
    "ymin": 982500,
    "xmax": 6606000,
    "ymax": 5706500
  },
  "resources": [{
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r1",
      "name": "agricultural-areas",
      "title": "Agricultural areas in Naples metropolitan area",
      "description": "Agricultural areas in Naples metropolitan area",
      "profile": "http://github.com/clarity-h2020/data-package/schemas/clarity-data-package-
resource.json",
      "encoding": "binary",
      "format": "shape-zip",
      "mediatype": "application/shape-zip",
      "bytes": "37087552",
      "hash": "tbc",
      "path": "http://services.clarity-
h2020.eu:8080/geoserver/clarity/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=clarity:ag
ricultural_areas&outputFormat=shape-zip",
      "schema": "https://github.com/clarity-h2020/data-package/blob/master/schemas/input-
layers/agricultural-areas.schema.json",
      "sources": [],
      "licenses": [{
        "name": "CC0-1.0",
        "title": "Creative Commons CCZero 1.0",
```


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```
        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
      }],
      "service_type": "ogc:wfs",
      "mapview": {
        "service_type": "ogc:wms",
        "url": "http://services.clarity-
h2020.eu:8080/geoserver/clarity/ows?service=WMS&version=1.1.0&request=GetMap&layers=clarity:agricult
ural_areas&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3035&fo
rmat=image%2Fpng"
      },
      "crs": "EPSG:3035",
      "spatial_extent": {
        "xmin": 0.0,
        "ymin": 0.0,
        "xmax": 0.0,
        "ymax": 0.0
      },
      "spatial_resolution": {
        "scale": 50000
      },
      "eu_gl": {
        "workflow_step": "any",
        "hazard": "any",
        "resource_type": "feature-parameters"
      }
    },
    {
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r2",
      "name": "hot-days-historical_19710101-20001231",
      "title": "Hot days > 75th percentile for the baseline emissions scenario in the 1971-2000
period",
      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the baseline emissions scenario in the 1971-
2000 period",
      "profile": "http://github.com/clarity-h2020/data-package/schemas/clarity-data-package-
resource.json",
      "format": "tif",
      "mediatype": "application/x-gzip",
      "bytes": "358616146",
      "hash": "tbc",
      "path":
"https://clarity.meteogrid.com/geoserver/wcs?SERVICE=WCS&VERSION=2.0.1&REQUEST=GetCoverage&COVERAGEI
D=clarity:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_historical_r12i1p1_SMHI-RCA4_v1_day_19710101-
20001231_netcdf3&FORMAT=application/x-gzip",
      "schema": {},
      "sources": [],
      "licenses": [{
        "name": "CC0-1.0",
        "title": "Creative Commons CCZero 1.0",
        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
      }],
      "service_type": "ogc:wcs",
      "mapview": {
        "service_type": "ogc:wms",
        "url":
"https://clarity.meteogrid.com/geoserver/wms?service=WMS&version=1.1.0&request=GetMap&layers=clarity
:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_historical_r12i1p1_SMHI-RCA4_v1_day_19710101-
20001231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
      },
      "crs": "EPSG:3035",
      "spatial_extent": {
        "xmin": 2145500,
        "ymin": 982500,
        "xmax": 6606000,
        "ymax": 5706500
      },
      "resolution": {
        "distance": 500,
        "uom": "m"
      },
      "grid_info": {
        "band_count": 1,
        "bit_depth": "unsigned-32-bit",
        "columns": 9448,
        "rows": 8921,
        "no_data_value": 1e+20,
```

```
        "start_cell": "top-left",
        "compression_type": "none"
      },
      "trs": "ISO 8601:2004",
      "temporal_extent": {
        "start": "1971-01-01",
        "end": "2000-12-31"
      },
      "eu_gl": {
        "workflow_step": "hazard-characterization",
        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
        "index": "hazard:heat:extreme-heat:index:hot-days-75p",
        "emissions_scenario": "baseline",
        "threshold": [{
            "name": "low",
            "lower": "to-be-defined"
          },
          {
            "name": "medium",
            "lower": "to-be-defined",
            "upper": "to-be-defined"
          },
          {
            "name": "high",
            "upper": "to-be-defined"
          }
        ]
      }
    },
    {
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r3",
      "name": "hot-days-rcp26_20110101-20401231",
      "title": "Hot days > 75th percentile for the rcp26 emissions scenario in the 2011-2040
period",
      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2011-2040
period",
      "profile": "http://github.com/clarity-h2020/data-package/schemas/clarity-data-package-
resource.json",
      "format": "tif",
      "mediatype": "application/x-gzip",
      "bytes": "358616146",
      "hash": "tbc",
      "path":
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D=clarity:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_rcp26_r12i1p1_SMHI-RCA4_v1_day_20110101-
20401231_netcdf3&FORMAT=application/x-gzip",
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      "sources": [],
      "licenses": [{
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        "title": "Creative Commons CCZero 1.0",
        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
      }],
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      "mapview": {
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        "url":
"https://clarity.meteogrid.com/geoserver/wms?service=WMS&version=1.1.0&request=GetMap&layers=clarity
:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_rcp26_r12i1p1_SMHI-RCA4_v1_day_20110101-
20401231_netcdf&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A30
35&format=image%2Fpng"
      },
      "crs": "EPSG:3035",
      "spatial_extent": {
        "xmin": 2145500,
        "ymin": 982500,
        "xmax": 6606000,
        "ymax": 5706500
      },
      "spatial_resolution": {
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        "uom": "m"
      },
      "grid_info": {
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```

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        "bit_depth": "unsigned-32-bit",
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        "rows": 8921,
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      "temporal_extent": {
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        "end": "2040-12-31"
      },
      "eu_gl": {
        "workflow_step": "hazard-characterization",
        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
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        "emissions_scenario": "early-response:rcp26",
        "threshold": [{
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          },
          {
            "name": "medium",
            "lower": "to-be-defined",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          },
          {
            "name": "high",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          }
        ]
      }
    },
    {
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r4",
      "name": "hot-days-rcp26_20410101-20701231",
      "title": "Hot days > 75th percentile for the rcp26 emissions scenario in the 2041-2070
period",
      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2041-2070
period",
      "profile": "http://github.com/clarity-h2020/data-package/schemas/clarity-data-package-
resource.json",
      "format": "tif",
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      "bytes": "358616146",
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      "path":
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D=clarity:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_rcp26_r12i1p1_SMHI-RCA4_v1_day_20410101-
20701231_netcdf3&FORMAT=application/x-gzip",
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      "sources": [],
      "licenses": [{
        "name": "CC0-1.0",
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        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
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      "mapview": {
        "service_type": "ogc:wms",
        "url":
"https://clarity.meteogrid.com/geoserver/wms?service=WMS&version=1.1.0&request=GetMap&layers=clarity
:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_rcp26_r12i1p1_SMHI-RCA4_v1_day_20410101-
20701231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
      },
      "crs": "EPSG:3035",
      "spatial_extent": {
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        "ymin": 982500,
        "xmax": 6606000,
        "ymax": 5706500
```

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      },
      "spatial_resolution": {
        "distance": 500,
        "uom": "m"
      },
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        "bit_depth": "unsigned-32-bit",
        "columns": 9448,
        "rows": 8921,
        "no_data_value": 1e+20,
        "start_cell": "top-left",
        "compression_type": "none"
      },
      "trs": "ISO 8601:2004",
      "temporal_extent": {
        "start": "2041-01-01",
        "end": "2070-12-31"
      },
      "eu_gl": {
        "workflow_step": "hazard-characterization",
        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
        "index": "hazard:heat:extreme-heat:index:hot-days-75p",
        "emissions_scenario": "early-response:rcp26",
        "threshold": [{
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            "lower": "to-be-defined",
            "relative_to": "baseline"
          },
          {
            "name": "medium",
            "lower": "to-be-defined",
            "upper": "to-be-defined",
            "relative_to": "baseline"
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          {
            "name": "high",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          }
        ]
      }
    },
    {
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r5",
      "name": "hot-days-rcp26_20710101-21001231",
      "title": "Hot days > 75th percentile for the rcp26 emissions scenario in the 2071-2100
period",
      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2071-2100
period",
      "profile": "http://github.com/clarity-h2020/data-package/schemas/clarity-data-package-
resource.json",
      "format": "tif",
      "mediatype": "application/x-gzip",
      "bytes": "358616146",
      "hash": "tbc",
      "path":
"https://clarity.meteogrid.com/geoserver/wcs?SERVICE=WCS&VERSION=2.0.1&REQUEST=GetCoverage&COVERAGEI
D=clarity:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_rcp26_r12i1p1_SMHI-RCA4_v1_day_20710101-
21001231_netcdf3&FORMAT=application/x-gzip",
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      "sources": [],
      "licenses": [{
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        "title": "Creative Commons CCZero 1.0",
        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
      }],
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      "mapview": {
        "service_type": "ogc:wms",
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21001231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
```

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        "uom": "m"
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            "relative_to": "baseline"
          },
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            "name": "high",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          }
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      }
    }, {
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r6",
      "name": "hot-days-rcp45_20110101-20401231",
      "title": "Hot days > 75th percentile for the rcp45 emissions scenario in the 2011-2040
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      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2011-2040
period",
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      "sources": [],
      "licenses": [{
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        "title": "Creative Commons CCZero 1.0",
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      }],
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      "mapview": {
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        "service_type": "ogc:wms",
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:Tx75p_consecutive_max_EUR-11_ICHEC-EC-EARTH_rcp45_r12i1p1_SMHI-RCA4_v1_day_20110101-
20401231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
      },
      "crs": "EPSG:3035",
      "spatial_extent": {
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        "ymin": 982500,
        "xmax": 6606000,
        "ymax": 5706500
      },
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        "distance": 500,
        "uom": "m"
      },
      "grid_info": {
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        "columns": 9448,
        "rows": 8921,
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        "start_cell": "top-left",
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      "temporal_extent": {
        "start": "2011-01-01",
        "end": "2040-12-31"
      },
      "eu_gl": {
        "workflow_step": "hazard-characterization",
        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
        "index": "hazard:heat:extreme-heat:index:hot-days-75p",
        "emissions_scenario": "effective-measures:rcp45",
        "threshold": [{
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            "lower": "to-be-defined",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          },
          {
            "name": "high",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          }
        ]
      }
    }, {
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r7",
      "name": "hot-days-rcp45_20410101-20701231",
      "title": "Hot days > 75th percentile for the rcp45 emissions scenario in the 2041-2070
period",
      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2041-2070
period",
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resource.json",
      "format": "tif",
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20701231_netcdf3&FORMAT=application/x-gzip",
      "schema": {},
      "sources": [],
      "licenses": [{
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        "name": "CC0-1.0",
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        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
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20701231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
      },
      "crs": "EPSG:3035",
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        "xmin": 2145500,
        "ymin": 982500,
        "xmax": 6606000,
        "ymax": 5706500
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        "rows": 8921,
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      "temporal_extent": {
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        "end": "2070-12-31"
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      "eu_gl": {
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        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
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        "emissions_scenario": "effective-measures:rcp45",
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            "upper": "to-be-defined",
            "relative_to": "baseline"
          },
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            "upper": "to-be-defined",
            "relative_to": "baseline"
          }
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    }, {
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      "title": "Hot days > 75th percentile for the rcp45 emissions scenario in the 2071-2100
period",
      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2071-2100
period",
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        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
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      },
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      "trs": "ISO 8601:2004",
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        "end": "2100-12-31"
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        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
        "index": "hazard:index:heat:extreme-heat:hot-days-75p",
        "emissions_scenario": "effective-measures:rcp45",
        "threshold": [{
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            "upper": "to-be-defined",
            "relative_to": "baseline"
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            "upper": "to-be-defined",
            "relative_to": "baseline"
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    }, {
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      "title": "Hot days > 75th percentile for the rcp85 emissions scenario in the 2011-2040
period",
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```
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      "licenses": [{
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20401231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
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        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
        "index": "hazard:heat:extreme-heat:index:hot-days-75p",
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            "upper": "to-be-defined",
            "relative_to": "baseline"
          },
          {
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            "upper": "to-be-defined",
            "relative_to": "baseline"
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      }
    }, {
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      "title": "Hot days > 75th percentile for the rcp85 emissions scenario in the 2041-2070
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the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2041-2070
period",
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resource.json",
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20701231_netcdf3&FORMAT=application/x-gzip",
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20701231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
      },
      "crs": "EPSG:3035",
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        "ymax": 5706500
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        "uom": "m"
      },
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      },
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      "temporal_extent": {
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        "end": "2070-12-31"
      },
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        "resource_type": "index",
        "index": "hazard:index:heat:extreme-heat:hot-days-75p",
        "emissions_scenario": "business-as-usual:rcp85",
        "threshold": [{
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            "lower": "to-be-defined",
            "relative_to": "baseline"
          },
          {
            "name": "medium",
            "lower": "to-be-defined",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          },
```

```
          {
            "name": "high",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          }
        ]
      }
    }, {
      "id": "http://github.com/clarity-h2020/data-package/examples/dc1-naples#r10",
      "name": "hot-days_rcp85_20710101-21001231",
      "title": "Hot days > 75th percentile for the rcp85 emissions scenario in the 2071-2100
period",
      "description": "Number of days per year with a mean air temperature at 2 m above ground above
the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2071-2100
period",
      "profile": "http://github.com/clarity-h2020/data-package/schemas/clarity-data-package-
resource.json",
      "format": "tif",
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      "hash": "tbc",
      "path":
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21001231_netcdf3&FORMAT=application/x-gzip",
      "schema": {},
      "sources": [],
      "licenses": [{
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        "path": "https://creativecommons.org/publicdomain/zero/1.0/"
      }],
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      "mapview": {
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"https://clarity.meteogrid.com/geoserver/wms?service=WMS&version=1.1.0&request=GetMap&layers=clarity
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21001231_netcdf3&bbox=2145500.0%2C982500.0%2C6606000.0%2C5706500.0&width=725&height=768&srs=EPSG%3A3
035&format=image%2Fpng"
      },
      "crs": "EPSG:3035",
      "spatial_extent": {
        "xmin": 2145500,
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        "xmax": 6606000,
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      },
      "spatial_resolution": {
        "distance": 500,
        "uom": "m"
      },
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        "end": "2100-12-31"
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        "hazard": "hazard:heat:extreme-heat",
        "resource_type": "index",
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        "threshold": [{
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            "relative_to": "baseline"
          },
```

```
          {
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            "lower": "to-be-defined",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          },
          {
            "name": "high",
            "upper": "to-be-defined",
            "relative_to": "baseline"
          }
        ]
      }
    }
  ]
}
```