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1. Changes with respect to the DoA

None.

2. Dissemination and uptake

This deliverable describes the ACCREU Scenario Explorer, which will be documented in Deliverable 5.8 due on Month 41. So far, ACCREU's activity in this respect has focused on 1) gathering the feedback from partners and members of the advisory board based on the COACCH experience and 2) conceptualising the visualisation strategy for the new components of ACCREU, namely results on adaptation cost effectiveness and distributional implication of climate change impacts.

3. Short Summary of results

The ACCREU Scenario Explorer is conceived as a multi-level, Open Access, interactive tool navigating project quantitative results. It is mainly targeted to non-academic users, policymakers and practitioners. Accordingly, a particular effort in setting language and definitions was made to avoid unnecessary technicalities and increase accessibility.

The Explorer focuses on the economic impacts of climate change and the physical, direct drivers leading to those impacts. Results are reported with a sub-national and national resolution, for three combinations of social economic pathway (SSP) and representative concentration pathway (RCP) scenarios framing ACCREU analysis. Results are displayed through maps and graphs, with downloadable supporting data. A specific section of the explorer is dedicated to showcase adaptation cost and effectiveness.

4. Evidence of accomplishment

The present report is evidence of the Deliverable 5.8.

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1. Introduction

One of the objectives of the ACCREU project is to enable the effective uptake of the resulting risk and policy assessments by policy makers and practitioners. Another one is to facilitate the accessibility and usability of project's results together with the understanding of the research methods and development to non-experts. The final goal is to promote easier communication, and cooperation, between the communities of researchers, policy makers, practitioners and the general public.

Three main communication tools are set to this purpose:

- a Digital Handbook;
- an Open Access Database of project results;
- an ACCREU Scenario Explorer.

The Digital Handbook will provide a multi-media, narrative-driven guided tour through the main project results, with an emphasis on the findings from the case-studies and the related adaptation narratives. The Handbook is targeted to a broad audience, including non-experts and the general public. The platform will include a glossary of the relevant specific terms used in the stories to provide different users with personalised and informative navigation paths.

The Open Access ACCREU Database is targeted to expert users, mostly (but not exclusively) academics and modellers. It will contain the "downloadable" full body of quantitative evidence produced by the project related to the physical and economic impact and adaptation assessments conducted.

The ACCREU Scenario Explorer is a product meant to support/inform both experts, and a wider public of users interested to navigate and access project results in a more structured and quantitative way than that offered by the Digital Handbook, but still in a more user-friendly and interactive format than the Database.

The Scenario Explorer builds and improves upon the experience of the COACCH Scenario Explorer (https://www.coacch.eu/interactive-tool).

This deliverable describes the development of the ACCREU Scenario Explorer. It outlines the design and content, which is the result of:

- collection of feedback from the COACCH experience;
- first brainstorming concerning the representation of new components;
- assessment of the technical feasibility of various data visualisation opportunities;
- discussion of the target groups.

2. Major feedback from and novelties compared to the COACCH scenario explorer

The ACCREU Scenario Explorer benefits from the experience gathered during the development of a similar tool within the H2020 COACCH project and from the feedback received by users of that tool. Furthermore, a presentation of the main features of the Explorer to the ACCREU consortium and a feedback plenary discussion took place during the 3rd ACCREU project meeting in Bilbao in October 2024. Preliminary exchanges with the ACCREU stakeholder community on the project dissemination strategy, useful to tailor the explorer, took place during the first ACCREU stakeholder meeting in Bruxelles in January 2024. More recent exchanges to collect feedback and present the beta version of the ACCREU Scenario Explorer took place on April 28th-29th 2026 during the reflexive and stakeholders workshops.

The major feedback received were the following:

- The COACCH Scenario Explorer, although conceived as a user-friendly tool, was still perceived as somewhat “too technical” for non-expert users. This was mostly linked to an excessive use of technical terms/acronyms (for instance to define scenarios) that, although explained, constituted an entry barrier.
- There is an interest by users in “summarising messages”. For instance, in addition to regional results, there were the explicit requests by some users to also include nationally aggregated outcomes (these were included in other types of dissemination material, but not in the explorer).
- Non-expert users are not particularly interested in uncertainty ranges, while practitioners are used to working with uncertainty characterizations.

The ACCREU project offers considerable research advancements compared to the previous COACCH project. The Consortium decided to use the Explorer to give more visibility to the following items:

- New climate change impact sources: health, wildfires, biodiversity loss and the distributional implication
- A new dimension of adaptation cost and effectiveness. This analysis is developed by specific modelling exercises in WP2, at the case study level (15 case studies are being conducted in WP3), at the more “aggregated” level, mostly through literature survey, in WP3.

The main features of the ACCREU Explorer, in the light of the ongoing discussion, are detailed in the next session.

3. ACCREU Scenario explorer: purposes and main features

A multi-level, Open Access, interactive, climate change Scenario Explorer builds on the successful experiences from other projects, primarily the Horizon 2020 COACCH (Co designing the Assessment of Climate change Costs) project (https://www.coacch.eu/).

The tool is mainly targeted to non-academic users, policymakers and practitioners, but can support academic research with a particularly easy/user-friendly access to selected key quantitative findings from the project.

Using the Scenario Explorer will require some basic knowledge of climate change impacts, models and scenarios. Anyway, a particular effort in setting language and definitions will be made by the

communication team to avoid unnecessary technicalities and increase transparency while conveying the same level of information.

The Explorer is an Open Access interactive (the user chooses what to see) web tool accessible from the ACCREU project website and "complement" the Digital Handbook (see Deliverable 5.9) to which it will be connected through hyperlinks.

The Scenario Explorer showcases the results of the project multidisciplinary research effort leading to the macroeconomic assessment of climate change impacts on: agriculture, sea-level rise, riverine floods, labour (productivity and supply), energy supply, energy demand, health, biodiversity. It contains a selected subset of project results pertaining to the **economic impacts of climate change** in the EU (WP4) and the "physical" drivers leading to those impacts (quantified in ACCREU's WP2).

Each impact has been quantified firstly in physical terms or direct economic losses by specific process based or econometric models. Then physical impacts and direct losses have been translated into macroeconomic costs, i.e. impacts on economic performances, by a regionalized computable general equilibrium model. All the results are reported for the period 2025-2070, for 135 European Union territorial units and for the EU countries as well.

To fully characterize the uncertainty space, impacts are also specified for a low, a medium and a high impact case. The range is obtained using as input to the macroeconomic model, for each impact, in each year, in each region, the highest and the lowest value produced by the sectoral impact assessment exercises. These, on their turn, depend mostly upon the different climate model used to perturb the sectoral impact model.

4. Core set of scenarios

ACCREU impact assessments unfold across three different combinations of climate change and social economic scenarios.

One Shared Social Economic Pathway (SSP) and three Representative Concentration Pathways (RCPs) have been selected to span the uncertainty across economic and climatic futures. The scenarios depicted in the "Impact" section of the ACCREU explorer assume "current level of adaptation", adaptation (protection) levels are kept constant at today's level all along the simulation period. Specific information on the cost and effectiveness of adaptation is reported in the "Adaptation" section of the explorer and extensively in ACCREU D3.2 (van Tilburg et al., 2026).

ACCREU scenario mix couples the SSP2, or "middle of the road", socio-economic development path with the RCP2.6, RCP4.5, RCP7.0 climate change scenarios characterizing low, to medium, to high temperature increases respectively.

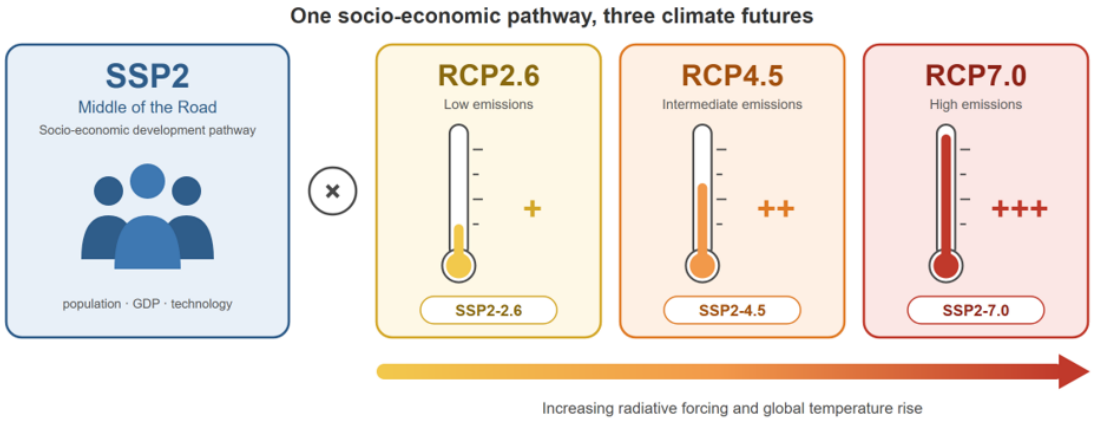


Figure 1: Socioeconomic and climatic scenarios featured in the ACCREU scenario explorer

The different RCPs, or climate scenarios span a range of possible future emissions, GHG concentration and temperature trajectories over the next century. Each corresponds to a level of total radiative forcing, a measure of warming potential (in W/m2) in the year 2100 which is reported in their name. Accordingly, RCP1.9 is a deep mitigation scenario that leads to a low forcing level of 1.9 W/m2 by the end of the century. This is consistent with the "aspirational goal" set during the 2015 climate negotiation round in Paris of limiting the global average temperature increase "well below" 2°C. The **RCP 2.6** is slightly less ambitious in term of emission reduction: it is a "peak-and-decline" scenario leading net zero emissions in 2060 and to very low greenhouse gas concentration levels. This scenario has a good chance of keeping the global mean temperature increase below 2°C respect to pre-industrial level that is considered by the scientific community as the minimum safety standard. **RCP4.5** is a medium emission scenario. Also in this scenario, annual emissions (of CO2) will need to sharply reduce in the second half of the century, which will require significant climate policy (mitigation), but not as hard as in RCP1.9 or 2.6. By the end of the century the best estimate temperature increases consistent with the RCP4.5 is 2.7°C respect to 1850-1900 period. **RCP7.0** is high emission scenarios. It includes the effects of mitigation actions that have been already enforced, but assumes no new, internationally coordinated climate policies will be then implemented. The projected temperature increases by the end of the century are above 4°C in the RCP8.5 and 3.6°C (best estimate) in the RCP7.0 compared with the 1850-1900 period.

The SSPs, that can be used in combination with or independently from RCPs, describe instead social economic futures. The five SSPs are characterized through storylines following different paths for macro drivers like GDP and population, by the type of development, more or less sustainability oriented, and by the challenges they pose to adaptation and mitigation action. In the scenario chosen for ACCREU, SSP2 (middle of the road), social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Slow progress is made in achieving sustainable development goals. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Global population growth is moderate and levels off in the second half of the century. Income inequality persists or improves only slowly and challenges to reducing vulnerability to societal and environmental changes remain.

5. Impact set

Agriculture

This impact category quantifies crop yield changes induced by climate change (D2.2, Palazzo et al., 2024) and the associated macroeconomic costs. These last are assessed by the ICES computable

general equilibrium model that uses yield changes as input information. Yield changes derive from the IIASA biophysical model EPIC (Balkovič et al., 2013). They have been aggregated to match the economic model regional and crop resolution using the GLOBIOM model (Havlík et al, 2011). The GLOBIOM model was improved to enable a more comprehensive analysis of the climate impacts across various agricultural and forest sectors. The model incorporated the latest revisions of the Shared Socioeconomic Pathways (SSP) data which directly affect the changes in food demand, well as changes in water demand from non-agricultural sectors as modeled by CWatM (Burek et al., 2019).
The Explorer reports the change in crop yield, as well as the resulting macroeconomic costs. Changes in crop yield and livestock production are implemented into the economic model as changes in the productivity of land that is a production factor used by agricultural firms in each of the model regions. We take the low level of adaptation in GLOBIOM as a reference (lower yield growth (0.5% p.a.), no improvement in irrigation efficiency) to derive the shock for the economic model.

Forestry

This impact category quantifies changes in net physical wood production induced by climate change (D2.2, Palazzo et al., 2024) and the associated macroeconomic costs. These last are assessed by the ICES computable general equilibrium model that uses as input information forest yield changes.

Impacts were derived using the forest growth model 3PGmix (Lin et al., 2022) mean annual increment (MAI). The MAI reflects the average wood production at a certain reference age and is a basis for the harvesting potentials. The standing stock refers to the total living biomass which can depend on the age class dynamics. The GLOBIOM model has then been used to match the model output to the regional resolution of the economic model. The Explorer reports the change in forest yield, as well as the resulting macroeconomic costs. Changes in net physical wood production are implemented in the economic model as changes in the productivity of wood natural resource that is a production factor used by the timber industry in each of the model regions. We take the low level of adaptation in GLOBIOM as a reference to derive the shock for the economic model.

Sea-level Rise

This impact category quantifies a set of direct physical and economic consequences from sea level rise (D2.1, Lincke et al. 2024), and the associated macroeconomic costs.

Direct impacts and adaptation costs are computed for a “no/low additional adaptation scenario”, assuming constant dike height.

Direct impacts assessed are:

- Annual land loss due to submergence (km²/year).
- Expected annual damages to assets by sea floods
- Expected annual number of people flooded per year.
- Annual protection costs including construction of new dikes, raising of existing dikes, and maintenance of existing dikes (million US$/year).

These data are obtained applying the DIVA model (Hinkel and Klein, 2009; Hinkel et al, 2013; Hinkel et al, 2014).

Macroeconomic costs are determined by applying the ICES computable general equilibrium model where SLR impacts affect regional economic performances through land loss, labour productivity loss, and capital loss. In particular:

- Land loss is implemented in the economic model decreasing the quantity of productive land available to agriculture.
- Labour productivity is reduced assuming that people flooded are not able to work. Following the literature, we assume that recovery from sea-level-rise events implies an average annual productivity loss equivalent to two weeks (Parrado et al., 2020; Bachner et al., 2022), while population relocation entails a longer disruption of approximately thirteen weeks (Athey et al., 2023). Land-loss impacts are modelled as shocks to the land endowment, computed relative to the available land in each country.
- Capital stock is decreased according to the expected annual damage to assets by sea floods.

The Explorer reports the change in capital, land stock, labour productivity as well as the resulting macroeconomic costs.

Riverine floods

This impact category quantifies a set of direct physical and economic consequences from riverine floods (D2.1, Lincke et al. 2024), and the associated macroeconomic costs. Direct impacts assessed are:

- Expected Annual Damages (EAD) determined for three macro-areas: industry, commerce, and residential sector,
- Population exposed to floods.

These impacts have been computed applying the GLOFRIS model (Tiggeloven et al., 2020; Ward et al., 2020; Ward et al., 2017; Winsemius et al., 2016). New developments of GLOFRIS in ACCREU are the improved spatial resolution from a NUTS2 level to a NUTS3 level, the estimation of coastal flood risk in addition to riverine flood risk, EAD estimates for the commercial and industrial sector alongside residential EAD, and the inclusion of more adaptation scenarios (constant dike heights, constant protection standards, optimal protection standards, exposure reduction via zoning restrictions, and the conservation of saltmarshes (coastal only)).

Macroeconomic costs are determined by applying the ICES computable general equilibrium model where riverine floods impacts affect regional performances through labour productivity loss, and capital productivity loss in the affected areas (for the matching between of GLOFRIS and the 23 sectors of the computable general equilibrium model) under the adaptation scenario of constant dike heights.

In particular:

- Loss of labour productivity is computed assuming that people affected by a flood event are unable to work for two weeks each year.
- Sectoral capital stock is reduced according to the expected annual damage to assets in each sector and region affected by floods.

The Explorer reports the change in labour productivity, capital stock, as well as the resulting macroeconomic costs.

Energy supply

This impact category quantifies extreme weather conditions to power supply unavailability of thermal (nuclear, coal, gas, and oil) and renewable (hydro) power generation across Europe (D2.2, Palazzo et al., 2024), and the associated macroeconomic costs. While indicators based on temperatures are the main driver of energy demand changes, energy supply shocks include the impact of water stress indicators based on hydrological projections from the CWatM model.

ACCREU empirically analyzed how extreme weather conditions affect renewable power generation across Europe. By matching high-frequency data on power outages with detailed weather exposure at the power plant level from 2017 to 2023 across 20 European countries, we investigated both unplanned (forced) disruptions and planned outage decisions during extreme weather events. We use panel data from the ENTSO-E Transparency Platform at the power plant level, detailing both forced and planned outages from 2017 to 2023 across 20 European countries. The dataset includes detailed characteristics of 929 power plants, encompassing different technologies: nuclear, coal, gas, and three hydro types (reservoir, run-of-river, pumped storage), along with their geographical coordinates (latitude and longitude) and nominal power capacity. We assume no adaptation for this impact category.

Macroeconomic costs are estimated by the ICES computable general equilibrium by implementing in the model these productivity changes in the renewables power generation sector. The Explorer reports the change in renewable productivity as well as the resulting macroeconomic costs.

Energy demand

This impact category assesses climate change impacts on energy demand (D2.2, Palazzo et al., 2024) and the associated macroeconomic costs.

ACCREU developed an econometric model aimed at providing new estimates for the climate change impacts on energy demand across fuels and sectors at global level and for the EU, using a panel dataset of annual observations across 134 countries and 50 years (1970-2019), comprising: i) population-weighted annual Cooling Degree Days (CDDs, with thresholds alternatively 18°C and 24°C) and Heating Degree Days (HDDs, with thresholds alternatively 15°C and 18°C) from gridded ERA5 data; ii) per capita energy consumption in four sectors (residential, commercial, industrial, agriculture) and for two energy carriers (electricity and fossil fuels) from the IEA statistics; iii) economy-wide per capita GDP and total capital stock per capita from the OECD dataset.

Accumulated temperature exposures were decomposed in the form of heating and cooling degree days (HDDs and CDDs, respectively), into decadal moving averages and annual anomalies from those slowly-varying means. These data was used to empirically model associations between final demands for electricity and fossil fuels in four economic sectors (residences, services, industry and agriculture) and high-frequency anomalies, attributed to intensive margin responses to weather fluctuations; and low-frequency trends, attributed to extensive margin responses to climate change, and interactions between the two. Location-specific climate shifts were measured the as the 10-year moving average of the variable of interest. For each of the two alternative weather variables, climatic exposure were computed combining the information of the weather realizations of the previous 10 years in that same location. We assume a low level of adaptation for this impact category (e.g. no upgraded technology level, only intensive margin included).

Macroeconomic consequences are assessed applying the ICES computable general equilibrium model. The desired change in energy demand in the agriculture, industry and services sectors are implemented as changes in the model sector-specific energy efficiency parameters. The residential sector has been approximated by the representative regional household. Residential energy

demand shifts are obtained imposing exogenous shocks to household energy expenditure while keeping fixed the household budget constraint. This implies a re-adjustment of household consumption across all consumption items.

Labour productivity and labour supply

This impact category assesses climate change effects on labour productivity and labour supply (D2.3, Sainz de Murieta et al., 2024) and the associated macroeconomic costs.

Changes in labour supply derive from Dasgupta et al. (2021), who empirically estimated response-functions with globally representative data for labour supply. The shock is introduced in the macroeconomic model as a change in total labour supply of each region.

Changes in labour productivity derive from macro panel data analysis exploring the relationship between labour productivity and impacts of climate change (D2.3, Sainz de Murieta et al., 2024). The shock is introduced in the macroeconomic model as a change in sectoral labour productivity of each region.

We assume no adaptation for this impact category.

Wildfires

This impact category assesses climate change effects of wildfires (D2.4 Gerber, Palazzo et al., 2025) and the associated macroeconomic costs in Europe.

We rely on advanced wildfire risk projections by integrating the ForeFire-Climate model with Fire Weather Index metrics, creating spatially explicit risk maps under three climate scenarios (RCP2.6, RCP4.5, RCP7.0) through 2100. Specifically, GLOBIOM provided consistent projections of land cover and biomass demand under the ACCREU scenario protocol which include adaptation. According to the ACCREU scenario protocol, the socioeconomic drivers (GDP, population growth, food demand projections) are held the same across all scenarios and follow the SSP2 middle-of-the-road assumptions.

The impacts from the ForeFire-Climate model are then introduced in the macroeconomic model as shocks on the productivity of the land production factor used by the livestock and crop sectors and on the productivity of the forest natural resource used by the timber sector. The Explorer reports the change in land as well as the resulting macroeconomic costs.

Biodiversity

This impact category quantifies the macroeconomic costs of crop yield changes induced by climate change pressure on pollination service.

Changes in pollinator habitat suitability derived from IIASA projections (D2.4 Gerber, Palazzo et al., 2025) are translated into pollination service changes starting from data provided from KIP-INCA pollination potential (Vallecillo et al, 2020). Then, compounding cropland areas with crop pollination service dependency and changes in the pollination service, yield changes for 129 crops are computed (Campoleoni Mansi, 2026) . Yield changes are implemented into the ICES model as changes in the productivity of agricultural land. We assume no adaptation for this impact category. The Explorer reports the change in yields as well as the resulting macroeconomic costs.

Compounded impact assessment

This simulation computes the macroeconomic estimates of all the sectoral impacts implemented jointly. It highlights the compounded effect and interactions of all the impacts on regional GDP.

Impact	Adaptation level
Agriculture	Low adaptation from Globiom model (e.g. lower yield growth (0.5% p.a.), no improvement in irrigation efficiency)
Forestry	Low adaptation from Globiom model
Sea level Rise	Constant dyke height
Riverine floods	Constant dyke eight
Energy supply	No adaptation
Energy demand	Low adaptation (no upgraded technology, only intensive margin included)
Labour	No adaptation
Wildfire	Consistent with SSP2 (GDP, population, food demand)
Biodiversity	No adaptation

6. Adaptation

The Explorer also includes a dedicated section to **adaptation cost and effectiveness**. This is a novelty of the ACCREU project with respect to COACCH. In its WP3, ACCREU developed 15 adaptation case studies as well as a comprehensive literature and WP2-based assessment of adaptation cost and benefits. The main findings from the adaptation cases are highlighted in the ACCREU's policy briefs (see Deliverable 5.6 and Milestone 5.1 and https://www.accreu.eu/policy-briefs/) and in the Digital Handbook. The explorer instead reports the benefit-Cost ratios for 9 out of the 15 case studies presented in the WP3 comprehensive assessment.

The ACCREU Scenario Explorer landing page includes a direct link to the new adaptation section as shown in Figure 2. Once in the adaptation section (Figure 3), the user finds a summary of the 9 case studies with specific links to a summary of each case study showing the Benefit-Cost ratios and links to deliverable D3.2 and the corresponding sections in the ACCREU's Digital Handbook.

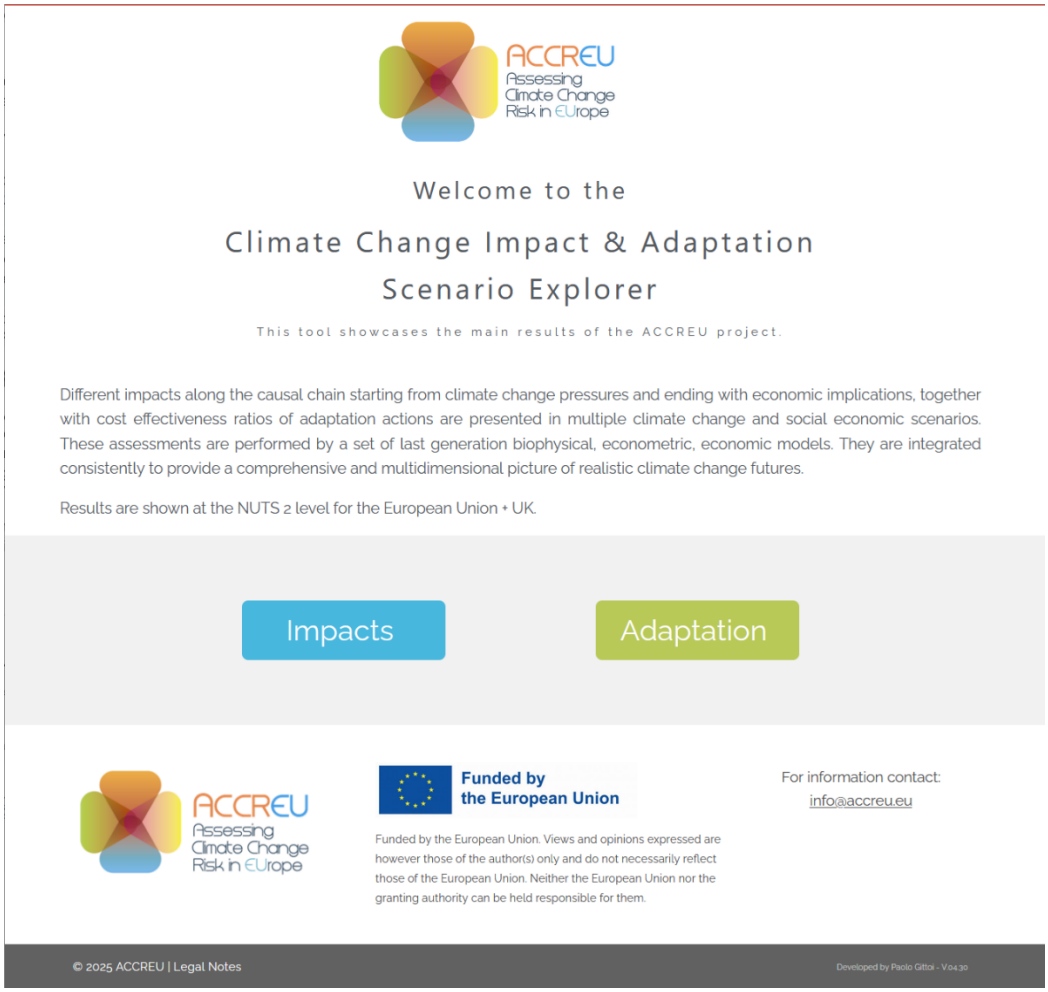


Figure 2: ACCREU scenario explorer landing page

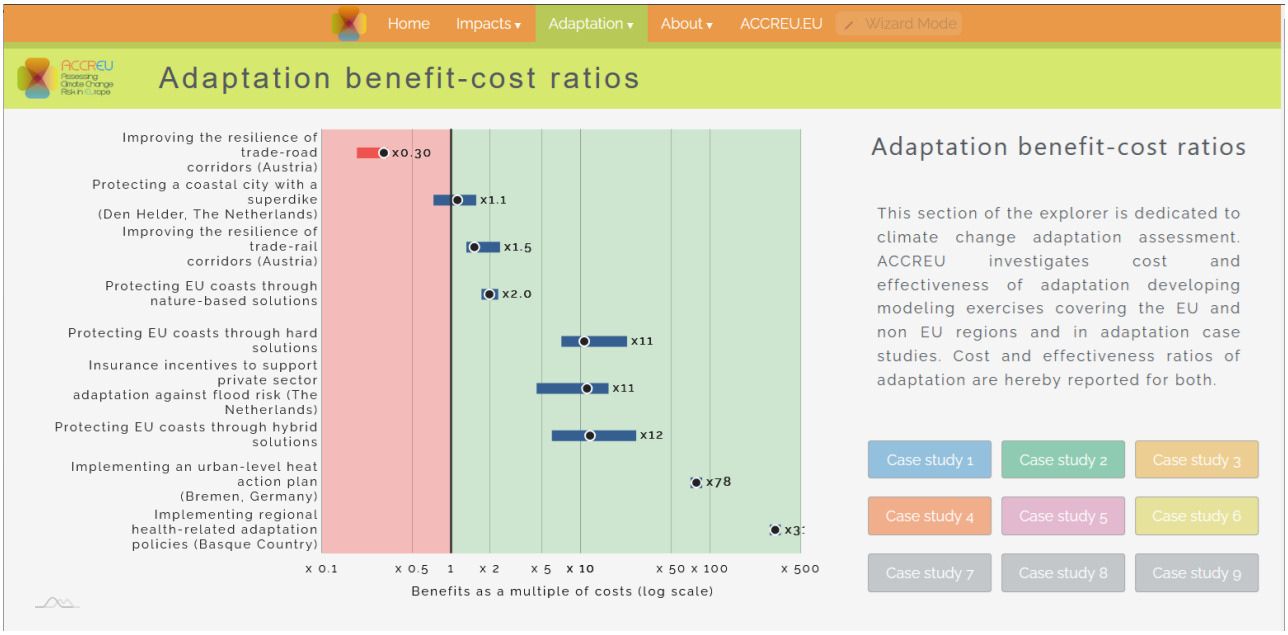


Figure 3: Adaptation section in the ACCREU scenario explorer

7. How to explore

The Explorer displays ACCREU's findings through a **double map-based and graph-based navigation** mode. The two options are complementary. While maps can offer a spatially explicit and immediate view of impacts, the graph mode enables an easier comparison across different scenarios and along the time dimension. The data reported in maps and graphs can be downloadable in CSV format. The scenario explorer is also equipped with a wizard mode that features interactive help ballons that guide the selections of options to produce maps and graphs (Figure 4).

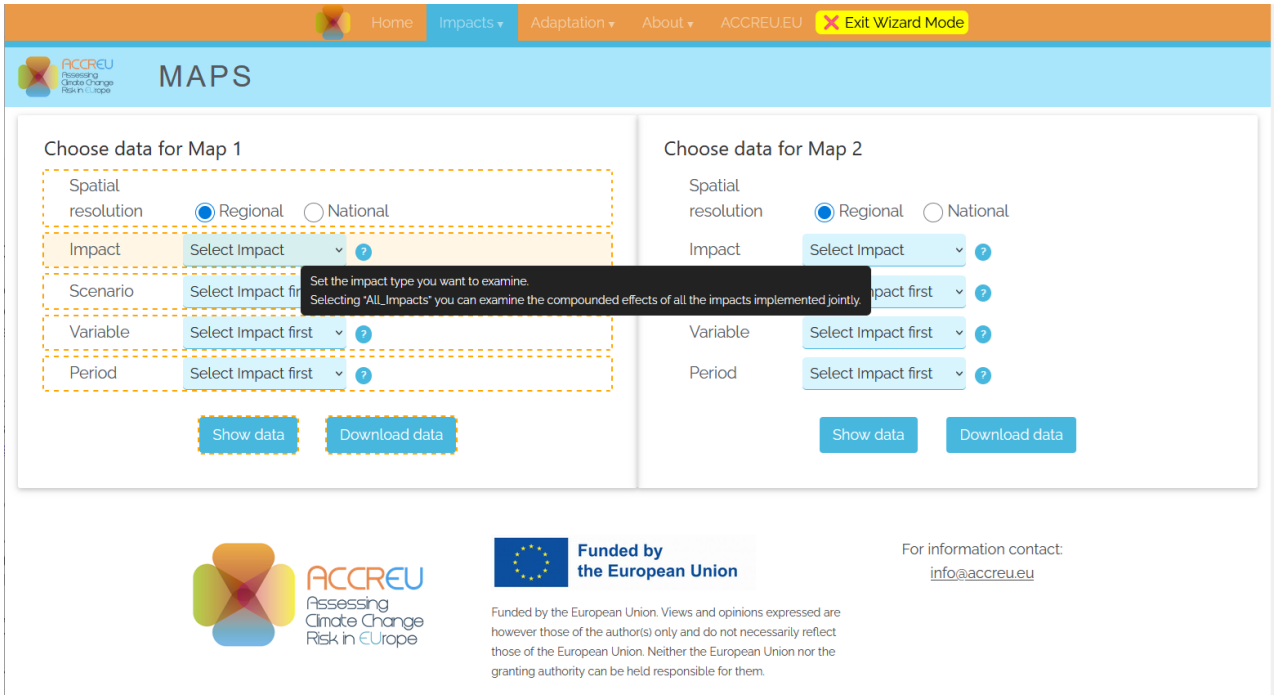


Figure 4: Interactive help balloons in the wizard mode of the ACCREU scenario explorer

The ACCREU Scenario Explorer presents just a partial, condensed and selected, albeit representative, overview of project findings. For a full overview of ACCREU results please visit the project website .

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