



**Climate Risk Information for Supporting ADaptation Planning and operAtion– Phase II**  
 The Demonstrator Project has been founded by the European Institute of Innovation and Technology (EIT) Climate-KIC

**Climate-KIC Partners involved**



**External co-designers**



**Problem owners**



**Name:** Climate Risk Information for Supporting ADaptation Planning and operation– Phase II

**Duration:** 36 months (July 2019 – June 2022)

**Budget:** 2,006,077.48 €

**EIT contribution:** 1,322,658.91 €

**Partners (8)**

Climate Research Foundation  
 Fundación Valenciaport  
 Aquatec  
 Faculdade de Ciências e Tecnologia-UNL  
 Cyprus University of Technology  
 Cyprus Energy Agency  
 Nomisma Energia  
 Paragon Europe

**Acronym**

FIC  
 FVP  
 Aquatec  
 FCT-NOVA  
 CUT  
 CEA  
 NE  
 Paragon Eu

**Main role in the project**

Coordinator and climate modelling  
 Impact modelling in port sectors  
 Impact modelling in urban water sector  
 Impact modelling in water sectors  
 Impact modelling in energy sectors  
 Impact modelling in energy sectors  
 Cost-benefit analysis  
 Cost-benefit analysis

**External co-designers (3)**

- CGSi
- Universidad Autónoma de Madrid
- Meteogrid

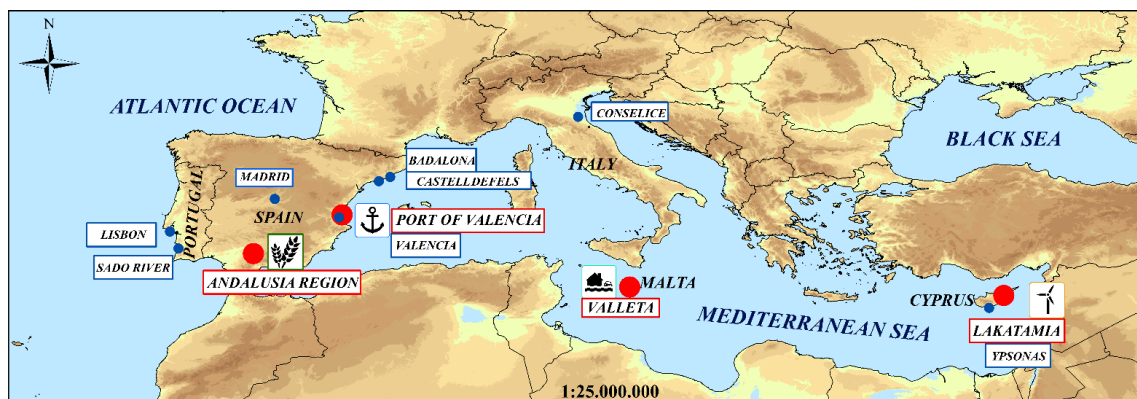
**Problem owners (15)**

**Demonstrations (4)**

- ✓ (1) Junta de Andalucía, Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible, D.G. de Calidad Ambiental y Cambio Climático
- ✓ (2) Port Authority of Valencia
- ✓ (2) SAGGAS
- ✓ (3) Lakatamia City Council
- ✓ (4) Red Cross in Malta

**Receiving Regions (9)**

- ✓ (1) Consell Agrari de l’Ajuntament de València
- ✓ (1) EMIVASA- Empresa Mixta Valenciana de Aguas S.A.
- ✓ (2) IMIDRA (Madrid)
- ✓ (3) Badalona City Council
- ✓ (4) Castelldefels City Council
- ✓ (5) Câmara Municipal de Lisboa
- ✓ (6) Águas de Portugal
- ✓ (7) Port of Lisbon
- ✓ (8) Ypsonas City Council
- ✓ (9) Conselice City Council



**LEGEND**

- Red dot: Demonstrations
- Blue dot: Receiving regions
- Flooding/Emergency response icon
- Anchor icon: Port infrastructures and operations
- Wind turbine icon: Energy planning
- Water tap icon: Water management for agriculture and supply

**Figure 1.** Geographical distribution of the four CRISI-ADAPT II demonstrations and nine receiving regions.

## Abstract

The challenge of the adaptation to climate-related risks is demanded for increasingly closer time horizons. Information on potential impacts modelled from near-term climate forecast is important to support adaptation planning and operation to deal with the main related natural disasters. CRISI-ADAPT II aims to monitor and improve the adaptation planning through a real-time implementation and validation according to near and seasonal range forecast of climate-related natural hazards (thanks to outputs from European projects as Copernicus or RESCCUE among others). Since risk and operation management requires a holistic treatment of all interconnected sectors affected, CRISI-ADAPT II will provide a democratisation of both the climate risk information required by each end-user and the vulnerability information of them that is required by each impact model. Therefore, identified available tools and data will be expanded and transparently used to support the adaptation and risk reduction activities planned by city governments, modellers, investors and traders related to all sectors potentially affected by climatic impacts (problem owners). **A total of four demonstrations will take place in three countries (Spain, Malta and Cyprus)** focus on four strategic sectors (**Table 1**): (1) flooding/emergency response, (2) water management for agriculture, (3) energy planning and (4) port infrastructures/operations. Additionally, **eight Receiving Regions are part of the consortium to scale methods and** results in the respective areas as a test of replicability. A total of five countries will be participate in these tests. The analysis will include public services and infrastructures, such as the water sector (urban drainage water source management, water treatment, supply, sanitation and emergency response), energy (generation and supply) and commodities (production and commercialisation), including agriculture among others. In order to achieve a consistent implementation of the project, it plans a standardisation of metrics and capacity building for the climatic analysis criteria to ensure a correct use and interpretation of the possible climate scenarios and forecast uncertainties.

**Table 1.** List of the four CRISI-ADAPT II demonstrations.

Demo ID	Sector (leader)	Country and region		
		Spain	Malta	Cyprus
1	<b>Flooding and emergency response</b> (Aquatec & Paragon Eu)		Malta	
2	<b>Water management for agriculture and supply</b> (FIC & FCT-NOVA)	Andalucía		
3	<b>Energy planning</b> (CUT & CEA)			Lakatamia
4	<b>Port infrastructures and operations</b> (FVP)	Valencia		

Replicability/scaling of results between demonstrations to the Receiving Regions:

- 1- From Malta to Lisbon (Portugal), Badalona, Castelldefels and Valencia (Spain).
- 2- From Andalucía to Valencia, Madrid (Spain), Sado River (Portugal) and Conselice (Italy)
- 3- From Lakatamia to Ypsona (Cyprus)
- 4- From Valencia to Lisbon (Portugal)

## S2. Project Summary

### S2.1. Background and Objectives

#### S.2.1.1. - Background

The challenge of the adaptation to climate-related risks is demanded for increasingly closer time horizons. Information on potential impacts modelled from near-term climate forecast is important to support adaptation planning and operation to deal with the main related natural disasters. Currently, European Horizon 2020 projects (e.g. BINGO, PLACARD or RESCCUE) are especially focused in long-term climate change projections, although they are beginning to explore closer horizons but without applying seasonal timescale for adaptation plans. The novelty of CRISI-ADAPT II is to extend the available climate services for monitoring extreme events, taking advantage of early warning systems and thus allow the implementation of adequate preventive/adaptive measures. Another innovation of the proposed project is the standardisation of climate analysis criteria to consistently interpret and manage the uncertainty related with the climate scenarios. The monitoring of the extreme events will provide an excellent opportunity to test adaptation measures and operations. This real time validation will allow adjusting the designed methodology and the standardised climate criteria.

#### S.2.1.1. - Objectives

**Objective 01:** Identify strategic sectors in urban areas and critical infrastructures affected by climate impacts. This is the first step to drive the following project tasks.

**Objective 02:** Collect and provide information on climate projections and extreme events forecasts at increasingly closer time horizons. This objective will contribute to the project outputs O1 and O2.

**Objective 03:** Identification of promising tools and novel models to be used to estimate climate-related impacts. This objective will contribute to the project output O3.

**Objective 04:** Holistic analysis of the expected climate-related impacts. This objective will contribute to the project output O3.

**Objective 05:** Standardisation of climate analysis criteria. This objective will contribute to the project output O3.

**Objective 06:** Adaptation of the selected sectors to the expected impacts. This objective will contribute to the project output O3.

An extended definition of all the outputs related to the previously defined objectives is done in section W4.b.

## S.3 - Impact

### S3.1. Summary

The CRISI-ADAPT II project is aligned with the 11<sup>th</sup> Impact Goal of the EIT Climate-KIC's 2030, "Democratise climate risk information". This is so since it enhances the access to risk information through capacity building, and has a great potential expansion of the climate services market thanks to one expected business product; this is interesting for any market segment affected by climate impacts. Particularly, the project will expand the availability of data, models and tools, and will support new users for maximum uptake at project and market-scale, including capacity building. Moreover, the project aims to standardise the climate analysis criteria to consistently mainstream the climate information and the related uncertainty management to the identified market segments (all those affected by climate impacts).

### S3.2. Potential Indirect Impacts including economic and/or Social Impact

The results of the project will allow cities to adapt to climate change and thus to minimise its impacts affecting not only to cities and their inhabitants, but also to the environment (ecosystems, biodiversity, etc.). This will result, for example, in a minimisation of flooding impacts, a minimisation of heat waves and droughts impacts, etc. Co-benefits resulting from such adaptation to climate change include:

- Economic co-benefits (cost savings from climate-related damages, reduced energy losses, reduced disruption to utilities and travel, increased economic production and property values, etc.).
- Social co-benefits (stable delivery of essential services, reduced mortality and health impacts from disasters and specific diseases, reduced travel disruptions leading to productivity gains, etc.).
- Environmental co-benefits (improved air quality, reduced water pollution, reduced land contamination, improved biodiversity and ecosystems, etc.).

Given the importance of critical infrastructures (such as water, energy, transport and port sectors) in the normal functioning of the cities and local economies, CRISI-ADAPT II will cause positive effects to all related supply-chain dependent businesses. Specifically, the project will provide weather information and warnings, contributing to prevent the negative impact of extreme events in services' operations and infrastructures. For example, having an early estimation of the temperature will allow the implementation of the appropriate measures in order to prevent heat strokes, among other impacts in health. Also, anticipation of drought risks will help improve water management and thus minimize potential costs related with water use. At the same time, the CRIT and MEET tools will allow the right flow of products through different services and infrastructures, avoiding or minimising bottlenecks and interruptions when extreme events may occur. The climate projections through CRIT will also contribute to improve or better design infrastructures to prevent their future devastation, reducing thus costs for reparation and maintenance.

## S.4 - Climate Impact

### S.4.1. Climate baseline and/or vulnerability

Climate has an important component of natural variability of the extreme events that is being magnified by the global warming. Following this, climate change is already producing several changes in the extreme events distribution and frequency around the world, like in heat waves, droughts or extreme rainfall events. Drought is an example of extreme events that are increasing in frequency and severity causing significant biophysical, economic and social impacts. These events are linked mainly to increases in temperature and heat waves that have been influencing Europe since 2000, in combination with reduced amounts of precipitation during the summer months. Recently Europe has experienced a series of extreme hot and dry summers (2003, 2010, 2013, 2015 and 2017). One of the most remarkable examples is the extreme heat wave which took place in 2003 and had fatal consequences along Europe.

These factors represent a major challenge for urban services such as water (source availability, treatment, supply and sanitation), energy (generation and supply), transport, ports or health that will directly cause impact on the citizens depending of such services and also on the environment. For example, extreme rainfall episodes may collapse the sewer system and thus untreated wastewater can reach receiving waters. Preventing disruptions in urban services due to climate change is a key aim, so an ambitious resilience plan is needed to cope with potential adverse situations. Drought is one of the major climatic risks affecting the south of Europe and has associated major impacts, such as reduced availability of water resources, loss in agricultural production, loss of pasture, silviculture decline and mortality, or the increase of forest fires.

### S.4.2. Contribution to adaptation and/or mitigation

CRISI-ADAPT II aims to reduce the impacts of the climate change and climate extreme events on critical infrastructures and activities framed in strategic sectors (as water, energy, agriculture, transport and port). To achieve this goal, the project will run along two paths:

- 1) Democratising and mainstreaming climate risk information to the decision-making systems in order to support adaptation and operation. The project plans a Capacity Building for end user to translate technical climate information to specific indicators encompassing a holistic view.
- 2) Forecasting and monitoring climate impacts through an Early Warning System (MEET and CRIT tools) based on near, long and seasonal range forecast of extreme events. This climate service will allow validating the adaptation measures in a real time implementation.

### S.4.3. Geographic Diversity

#### About the consortium

The consortium is formed by the Climate Research Foundation (Fundación para la Investigación del Clima –FIC-), Fundación Valenciaport, Business companies (Aquatec and Cyprus Energy Agency –CEA-), research institutions (University of Technology CUT, Faculdade de Ciências e Tecnologia-UNL–FCT-NOVA-), Nomisma Energia (NE), Paragon Europe.

The **FIC** – Fundación para la Investigación del Clima (in English, Climate Research Foundation) is a non-profit, private and fully independent foundation whose objectives focus on research in the field of climate change, as well as in the areas of climatology, meteorology and environment. FIC is highly specialized in climate change research, with a strong scientific profile, and whose scope of work has been spreading from Europe to worldwide (Central and South America, Central Asia, etc). Its foundation objectives are: 1) To deepen and broaden the scientific knowledge about the performance and predictability of the climate system and its relationship to the natural and socioeconomic systems. 2) To deepen and broaden the scientific knowledge on issues related to the environment in general, 3) Disseminate this knowledge to contribute to the achievement of a society increasingly responsible and conscientious in their relations with nature and 4) Encourage and facilitate research activities of third parties in the areas of knowledge mentioned above.

The **Foundation Valenciaport**-Foundation for Research, Promotion and Commercial Studies of the Valencian region- is a non-profit private entity. It has been conceived to further expand the reach of the logistics-ports community by serving as a research, training and cooperation centre of excellence. The Valenciaport Foundation manifests an initiative of the Port Authority of Valencia (PAV), in collaboration with various other associations, companies and institutions. The Valenciaport Foundation is presently active in numerous cooperation and internationalization projects in well over twenty countries, principally located in Europe, the Far East and Latin America.

**AQUATEC** (Suez Advanced Solutions) is a water and environmental technology company providing services including consulting, design services, integral project management, installation and implementation of advanced solutions for optimisation of integral water cycle processes and conservation of the environment. Within AQUATEC, the Urban Drainage and Resilience Direction is focused on the transformation of the traditional water management of cities into a smart and resilient one on the basis of knowledge and applied R+D+i. Main research areas include: smart and efficient management of water systems; water, climate change and resilience in urban context; reduction of environmental impacts of the water cycle; implementation of sustainable, smart and nature-based solutions for the water sector. AQUATEC has a vast experience on assessing the impact of extreme weather (mainly flooding) events on water quantity and the subsequent effects on urban drainage management (development of advanced modelling tools, hazard and risk maps, analysis of cascade effects between urban services, etc.) and to provide innovative adaptation measures, technologies and solutions to mitigate climate impacts on the water cycle, including structural measures such as nature-based solutions and non-structural measures such as early warning systems.

**Cyprus University of Technology** (CUT) is a state University in Cyprus with a strategic target to design and develop research activities both within the University and in cooperation with other research Institutes in Cyprus and abroad. CUT has already signed the Charter & Code, has endorsed the 'European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers' and it's in the procedure to get the "HR Excellence in Research" label. Moreover CUT is certified with the Standard "Investors in People" the only internationally recognized standard in the field of Management and Human Resource Development and received the EU

QUESTE-SI label for its Sustainability and Social Responsibility credentials. It has already managed to dispose of a significant number of National Research Projects funded by the Cyprus Research Promotion Foundation and of European Research Projects funded under the European Research Framework Programmes (FP6, FP7, H2020), the LIFE and IEE Programmes, the European Territorial Cooperation.

The **Cyprus Energy Agency (CEA)** is an independent, non-governmental, non-profit organization, founded in 2009. CEA was co-funded by the European Commission, through the Programme “Intelligent Energy for Europe” and by the Cyprus Union of Communities, for its establishment and first three years of operation. CEA has become an information point for the local society, providing education and vocational training. It participates in projects in partnership with local, European, and international organisations, contributing to innovation, research, and sustainable development. It enhances the role of local authorities in sustainable energy planning, providing technical support for developing and implementing actions to mitigate and adapt to climate change. CEA also participates in the Cypriot Consortium that coordinates the Regional Innovation and Entrepreneurship Plan of the European Institute of Innovation and Technology for the Levantine region (Climate-KIC RIS), focusing on education, networking, and the development and promotion of innovative solutions for the shaping of a low-carbon economy. Up to today, the Cyprus Energy Agency has participated in more than 40 EU/National co-funded projects that cover a wide range of topics, such as Sustainable Energy Action Plans, Building Capacity for public and private sector, energy efficiency of residential and public buildings and sport facilities among others.

**Faculdade de Ciências e Tecnologia-UNL (FCT-NOVA)** is one of the most prestigious Portuguese engineering and science public schools and it is engaged in extensive research activity developed in 16 research centres involving 1600 PhD and Master’s students of the total enrolment of 7800. With a total of 428 academic staff (90% holding a PhD) and 200 non-academic staff, FCT NOVA is organized in 14 departments and 14 support services. FCT NOVA partners with foreign universities such as the Massachusetts Institute of Technology (MIT), the University of Carnegie Mellon and the University of Texas at Austin to offer some of its advanced study programs. The entrepreneurial drive of the students and graduates of FCT NOVA has led to many successful spin-offs that transfer knowledge to the market and help create value and social impact. FCT NOVA, and its associated institutions, have participated as partner or coordinator in 69 EU FP7 projects, and in the H2020 program took part in 60 projects of which 7 ERC grants. Since 2011, the researchers at FCT NOVA have published more than 2500 papers indexed in the ISI Web of Science. Regarding patents, FCT NOVA has a portfolio of about 50 families.

**NE Nomisma Energia**, founded in 2007 by Nomisma SpA (born in 1981) and some energy consultants, now managers of NE Nomisma Energia, is an independent research company that deals with energy and environmental issues, committed to understand energy markets and their short and long-term trends. NE Nomisma Energia covers all issues concerning energy markets and environmental policies which extend from fossil fuels markets to renewable energies, from industrial and market regulation to development of new technologies, from international politics to local Energy planning. NE is specialized in providing consulting services in the fields of energy,



utilities and infrastructure, with main regards to markets and investments. Its team of experts, with a proven experience and knowledge of energy markets, provides research and technical consultancy in assessing the feasibility and economic sustainability of business initiatives developed in several sectors: oil and gas, power and utilities, electricity generation, renewable energy and waste treatment, working in close synergy with all the stakeholders involved (financial institutes, private equity funds, EPC and O&M contractors, local authorities, system operator, etc.).

**Paragon Europe (PRN)** is a Maltese company set up in June 2004 with the aim of participating and assisting public and private entities to access EU funding programmes. Paragon Europe has a diversified portfolio of services based on 3 major categories: Business Advisory; EU Advisory; Investment Advisory. Through its Business Advisory services, PRN assists its clients to develop their business needs through the formulation of business plans, market research, financial planning and so on. In EU Advisory mode, Paragon Europe assists clients by identifying appropriate opportunities in EU funding programmes, access quality partners for project collaboration and give excellent input at all stages of the project cycle. PRN is an active player in EU funded projects in the past three years it has participated in projects related to energy, climate change adaptation, and water and transport management. Furthermore, since 2009, PRN has been working on identifying opportunities for complementing public funding with private funding through Investor Advisory services. To this effect PRN has developed excellent links with the international community of public and private investors including World Bank, EIB, EVCA, EBA, private and public banks and institutional funds. Paragon Europe is an active speaker on and contributor to policy on Climate Change and Sustainable development amongst other entities.

### **About the geographies of the pilot cases**

CRISI-ADAPT consortium is from 5 countries (Portugal, Spain, Italy, Malta and Cyprus) with 4 demonstrations. Although the Mediterranean climate is predominant, the high complexity of their orography provides a high climate variability. The altitude in plateau and mountain areas causes wide thermal amplitude that can aggravate the summer drought and, by retention effect, the concentrated rainfall, that is recorded from late autumn to mid-winter, mainly due to cold fronts and cut-off lows.

## S.5 - Results

### S.5.1. What results/ assets will be produced from this project?

CRISI-ADAPT II will identify the most important variables related to the climate change that can seriously affect water uses, urban services, infrastructures, local economies and the health of the citizens. The project will identify the risk associated to climate change, and finally, provide a tool for early assessing and prevent the impact of the climate change in cities, citizens and critical infrastructures, including water, energy, transport and port sectors among others. Moreover, the increased open access to climate risk information will facilitate the adaptation in other sectors not included in this study.

### S.5.2. How will the project results be sustained and scaled in the future?

The replicability of the project results is key for the scaling and democratisation of the climate information. In this sense, the rest of previous demonstrations have been transformed into destination areas. That is, the corresponding stakeholders will participate especially in the last phases of the project to foster two-way learning between the Project Demonstrations and the other regions interested in the tools and results. Particularly, the adaptation of the results will be transferred from each demonstration to the same-sector. Receiving Regions:

- 1- From Andalucía to Valencia, Madrid (Spain), Sado River (Portugal) and Conselice (Italy)
- 2- From Malta to Lisbon (Portugal), Badalona, Castelldefels and Valencia (Spain).
- 3- From Lakatamia to Ypsona (Cyprus)
- 4- From Valencia to Lisbon (Portugal)

The service that will result as output from CRISI-ADAPT II (with two linked modules or tools: CRIT and MEET) will be 100% self-sustained through the financing of customers, and will be exploited by all partners. Some of the customers could be identified from stakeholders (problem owners) that participate as end-users during its development and test in the Demonstrator phase and might be willing to continue taking benefit of it. To this we ought to include other potential stakeholders that could be identified while disseminating the project and during the next phases (Scaler). The expected economic cost of each module would be of 15k €/year.

To support the potential future use of both the climate service of the Climate Risk Information Tool (CRIT) and the Early Warning System, i.e. the Monitoring of Extreme Events Tool (MEET), they can be expanded to any European or foreign city. This is so due to its great ability to be fitted at local scale for several timescales and the fact that it will be developed considering most of the climates present in Europe. This includes the generation of climate change scenarios, near-term decadal/climate predictions as well as seasonal, long and near-range forecast of extreme meteorological events.

The scalability is guaranteed because these services can be applied to any sector affected by the climate change or extreme events; i.e., water sectors (source availability, treatment, supply and sanitation), energy (generation and supply), other public services (as mobility or health systems), commodity (production and commercialisation) and a range of supply-chain dependent businesses.

### S.5.3. Dissemination plan.

#### Networking

Different activities are considered to disseminate and communicate the project and its outcomes. The main one is the organization of 6 workshops to promote both the participation of all the partners and the dissemination of the project through open sessions for networking with other international projects (e.g. ECCLIPSE, CLARITY and DD Forging Resilience among others). Workshops will take place, in average, every 6 months, covering each time one of the involved countries: Spain (Valencia and Andalusia), Portugal (Lisbon), Malta (La Valeta), Italy (Conselice) and Cyprus (Ypsonas or Lakatamia). Two more meetings will be held: kick-off and closure, also with an informative nature. Researchers and stakeholders from other international projects will be invited to attend the open sessions of the workshops for transferring results and improving CRISI-ADAPT II with feedback. Thus, workshops are a good opportunity to ensure a further scalability of the project. Added to this, a total of 3-5 press releases will be distributed to divulge the outputs expected/obtained from the meetings. All of this information will be communicated by the internal web platform and the project website, and spread through general social networks.

#### Open Access Products

To enhance the diffusion of the information generated in the project, an open version of the next deliverables will be made available in the website:

- D1 (M12). *Description of the study cases*
- D2 (M12). *Climate projections and monitoring information*
- D3 (M24). *Description of tools for modelling climate-related impacts in a holistic approach*
- D4 (M24). *Standardisation of climate risk analysis for capacity building in adaptation planning and operation*
- D5 (M18). *User guidelines*
- D6 (M36). *Validation report of operational measures for the adaptation in the pilot cases*
- D7 (M36). *Description of the roadmap for forging resilience in Andalusia (M6).*
- D9 (M36). *Summary of results*

It is important to remark that all these deliverables will have an open version. Most of them will be directly published in open platforms. However, some problem owners have asked us to omit certain information and treat it on a dissociated and anonymous manner concerning their vulnerable elements due to confidentiality or security reasons. In these cases, public versions of the deliverables will be considered in addition to the official submissions.

All the products of the CRISI-ADAPTII will be offered in the platform of the Oasis Project (<https://oasishub.co/>) among others (e.g. CLARITY - <https://myclimateservices.eu/>). Any end user will find all the data generated from CRISI-ADAPT with open access of two typologies:

- **Totally free:** raw climate data generated from models with a few statistical treatment
- **Open access commercial:** Data with extensive statistical treatment and specific adjustments to the end-user requirements.

Technical results (from D9) will also be disseminated in a scientific peer-reviewed journal (e.g. Ecology and Society IF3.26) and in, at least, two specialised congresses (e.g.: European Climate Change Adaptation (ECCA) conference, among others).

## W4. Task per EIT Climate-KIC Partner

### W4a. Work Plan and Work Packages

The work plan of the project is divided into six work packages (WP). An initial WP is required to identify vulnerable elements of the strategic sectors involved in the project (mainly water, energy and port/sea). This information will serve as a driver to collect all the climatic information in the second WP. The third WP is planned to identify and simulate potential climate-related impacts according to several novel and promising models, and a holistic approach of cascade effects and cost-benefit analysis based on all the previous information. The impact/risk assessment process will require the previous analysis and evaluation of climate hazards and vulnerability of each considered critical service. Risk assessment will consider the impacts directly produced by multi-climate related hazards on the specific strategic sectors and critical infrastructures. This will be done through the use of sectorial and integrated models and tools. Also cascade effects and the interdependencies among services and key infrastructures will be considered using holistic approaches. The fourth WP aims to integrate climate data and impact model outputs in a common platform with two modules: a Climate Risk Information Tool (CRIT) and a Monitoring Extreme Events Tool (MEET). The fifth WP is planned to generate adaptation measures on the basis of cost benefits and multi-criteria analysis through a capacity building of standardised climate analysis. This work package includes several tests on the replicability of results to eight Receiving Regions. The sixth WP is added to design a roadmap for forging resilience in one deep demonstration (for the case of Andalusia). Finally, the seventh WP is aimed to coordinate, communicate and disseminate project's results and promote exploitation of their final products.

With this work planning, CRISI-ADAPT II aims to monitor and improve the adaptation planning through a real time implementation and validation according to near, long and seasonal range forecast of climate-related natural hazards (Figure 1). Since risk management requires a holistic treatment of all interconnected sectors affected, CRISI-ADAPT II will provide a democratisation of both the climate risk information required by each end-user and the vulnerability information of them that is required by each impact model. Therefore, identified available tools and data will be expanded and transparently used to support the adaptation and risk reduction activities planned by city governments, modellers, investors and traders related to all sectors potentially affected by climatic impacts. This includes public services or critical infrastructures, such as: port infrastructures, the water sector (source availability, treatment, supply and sanitation), energy (generation and supply) and commodity (production and commercialisation) among others. In order to implement the project consistently, it plans a standardisation of metrics and capacity building for the climatic analysis criteria to ensure a correct use and interpretation of the possible climate scenarios and forecast uncertainties.

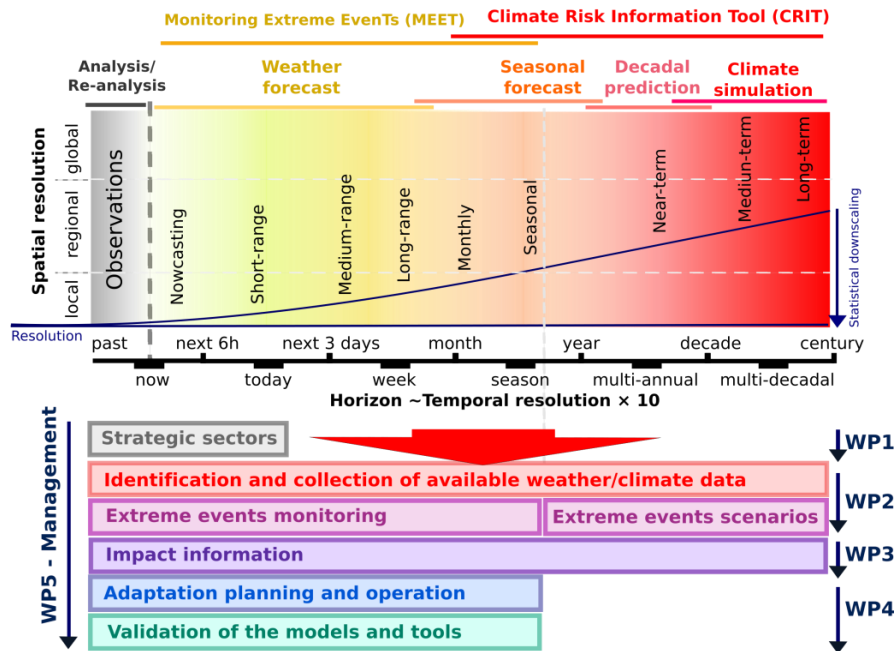


Figure 1. Scheme of the CRISI-ADAPT II project.

The expected impacts of this work are guaranteed by several international projects that support local-scale application of our methodology (Ribalaygua *et al.*, 2013). Since climate and seasonal forecasts present high uncertainty levels, it is planned to use ensemble-prediction strategies (Monjo *et al.*, 2016). For instance, seasonal forecast will be provided combining dynamical models like the Copernicus C3S multi-system seasonal forecast (Manubens *et al.*, 2017) and statistical forecast outputs, obtained from the European RESCCUE project, whose method is based on multi-perturbation prediction of teleconnection indexes (Redolat *et al.*, 2018). Finally, three representative scenarios (low, medium and high probability/danger levels) will be selected for each time horizon in order to feed impact models, whose results improve the management of uncertainty.

Available novel and promising models and tools for the simulation of climate-related natural hazards and their corresponding impacts on city services will be used. Moreover, cascade effects among different critical sectors will be analysed through a holistic approach (Velasco *et al.* 2018). Cost-benefit analysis will be also used to identify maximum risks and prioritize the adaptation strategies proposed and selected in a participative process involving local actors and end.-users (World Bank 2010, UNFCCC 2011).

## Work Packages

### WP1- Initial identification (M1-M9) [Leader: FVP]

- T1.1. **Identification of climate-related problems:** Each involved end-user will identify its specific problems or impacts related with the climate change or the climate variability including extreme events. This includes a list of its climate-related problems recorded in the past. [All]
- T1.2. **Identification of vulnerabilities:** For each studied problem, strategic elements (e.g. infrastructures or value chains) will be identified according to their vulnerability to extreme climate/weather conditions (e.g. from historical events). Derived variables will be defined by using relations between climate drivers and the most probable damages derived (by exceeding danger thresholds, high persistence, etc.) on each pilot case. [All]

## WP2- Climatic information (M1-M10) [Leader: FIC]

- T2.1. **Near and long term climate projections:** The most recent decadal and climate projections of the main atmospheric and oceanic variables will be collected, evaluated and treated to obtain *multi-model ensemble projections* for each climate driver and the derived variables defined in T1.2. [FIC, Meteogrid]
- T2.2. **Early Warning System:** The most skilful forecasts for the same climate variables will be collected, evaluated and treated for monitoring extreme values in the pilot cases at near, long and seasonal ranges, including uncertainty levels. [FIC, Meteogrid, CGSi]

## WP3- Impact information (M8-M18) [Leader: Aquatec]

- T3.1. **Modelling of climate-related impacts:** A reference set of synthetic extreme events (defined by return periods) will serve as input of impact models to simulate climate-related natural hazards and their corresponding impacts on each specific studied case. [Aquatec, FVP, NE, CEA, CUT, FCT-NOVA, UAM, CGSi]
- T3.2. **Multi-sector holistic analysis:** Links between strategic sectors involved will be identified. Therefore, vulnerable elements expected to be affected in each case will be mapped according to thresholds overpassed, subsequent cascade effects and sensitivity/risk analysis. [Aquatec]
- T3.3. **Cost-benefit analysis:** For end-users that require it, goals (impacts to maximise or minimise) will be identified and, according to a set of possible actions of stakeholders, cost/benefit will be measured or predicted taking into account sensitivity/risk analysis (T3.1 and T3.2), effects on users and non-users, gauge analysis and net value of each action. Finally, a recommendation will be provided. [Leader: NE, Contributions: FIC, FVP, Aquatec, and Paragon Eu]

## WP4- Integration platform (M8-M20) [leader: FIC]

- T4.1. **Climate Risk Information Tool (CRIT):** Results from task T2.1 and T3.1-T3.2 will be integrated in a same module (CRIT). That is, after selecting a particular timescale (near or long term climate) and scenario (low, medium or upper level), impact maps will be provided for each sector of interest. [FIC, Meteogrid and Aquatec]
- T4.2. **Monitoring Extreme Events Tool (MEET):** Results from task T2.2 and T3.1-T3.2 will be integrated in a same early warning system (MEET module). That is, after selecting a particular timescale (weather or seasonal forecast) and scenario (low, medium or upper level), impact maps will be provided for each sector of interest. [FIC, Meteogrid, CGSi, Aquatec]
- T4.3. **Integration of CRIT and MEET modules:** A platform will serve as integration node of the CRIT and MEET modules. The link between both services consists on identifying the climate risks in CRIT module and monitoring them throughout the MEET module. Therefore, platform will include both GIS information on possible impacted elements and automatic recommendations to serve as a decision-making tool. [FIC and Meteogrid]

## WP5- Training, adaptation and replicability (M10-M34) [Leader: CEA]

- T5.1. **Standardisation of climate criteria:** Climatic analysis criteria will be standardised to be interpreted in a consistent way among different users & sectors. [Leader: FIC; Contribution: Meteogrid, FVP, NE, ParagonEu, Aquatec]
- T5.2. **Capacity building:** End-users will be trained to manage adequately the scenarios and forecast uncertainties according to the standardised climate criteria applied to the CRIT and MEET modules. [Leader: FIC; Contribution: All]
- T5.3. **Adaptation, operation and validation:** Specific adaptation plans will be consistently performed with the CRIT results, and then end-users will act in accordance with the expected climate-related risks and opportunities. Finally, tangible or intangible

cost/benefits will be assessed to validate the decision-making platform. **[Leader: CEA; Contribution: All]**

- T5.4. **Replicability analysis:** The Receiving Regions will participate in the adaptation of the results in their corresponding areas. Receiving Regions will:
- o Learn about the project results, provide information about their particular requirements and give input for their final adaptation/transference;
  - o Have a direct exchange with the four demonstrations and with the other project partners on their experiences with respect to the climate services validated.
  - o Obtain training on how to use and adapt the results obtained in the project;
- [Leader: CEA; Contribution: All]**

**WP6- Forging resilience (M1-M6) [Leader: FIC]**

- T6.1. **Design of resilience roadmap:** Co-design of roadmap for an optimum work flow aligned with the Deep Demonstration Forging Resilience (case of Andalusia). In this task, Regional Government of Andalusia and FIC will identify the key steps to set an exhaustive resilience planning to face the most important challenges of the climate change in the region. One of these challenges (effects of increasing droughts on the water management for agriculture) will be addressed in the WP1-WP5. **[FIC and Government of Andalusia]**

**WP7- Project management (M1-M36) [Leader: FIC]**

- T7.1. **Coordination and management:** This transversal task includes planning and scheduling of coordination meetings, internal documents on implementation plans, project deliverables and other technical or economic managements for the project performance and justification. **[All partners]**
- T7.2. **Communication and dissemination:** Internal communication will be carried out thanks to an integration platform of discussion, to-do/task lists, schedules, news, data and documents. For that purpose, a framework will be developed to use a common logo, style and design in the project templates, the summary in one-slide, etc. On the other hand, an external dissemination of the project results will be performed linking with the project OASIS (<https://oasishub.co>) and CLARITY (<https://myclimateservices.eu/>), as well as throughout press releases, social networks, and technical but open communication papers. **[All partners and stakeholders, including Receiving Regions]**
- T7.3. **Exploitation model adjustments:** According to the lessons learned from the project results (technical deliverables, workshops summaries, end-user implication/response, etc.), the exploitation model will be improved and adapted to the specific needs and requirements of the end-users. **[All partners]**

**Table 2.** Expected schedule for CRISI-ADAPT II

Task	Year 1												Year 2												Year 3											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
<b>WP1- Initial identification (M1-M9)</b>																																				
1.1. Identification of the climate-related problems																																				
1.2. Identification of vulnerable elements																																				
<b>WP2- Climatic information (M1-M10)</b>																																				
2.1. Near- and long- term climate projections																																				
2.2. Early Warning System																																				
<b>WP3- Impact information (M8-M18)</b>																																				
3.1. Modelling of climate-related impacts																																				
3.2. Multi-sector holistic analysis																																				
3.3. Cost-benefit analysis																																				
<b>WP4- Integration platform (M8-M20)</b>																																				
4.1. Climate Risk Information Tool (CRIT)																																				
4.2. Monitoring Extreme Events Tool (MEET)																																				
4.3. Integration of CRIT and MEET modules																																				
<b>WP5- Training, adaptation and replicability (M10-M35)</b>																																				
5.1. Standardization of climate criteria																																				
5.2. Capacity building																																				
5.3. Adaptation, operation and validation																																				
5.4. Replicability analysis																																				
<b>WP6- Forging resilience [M1-M6]</b>																																				
6.1. Design of resilience roadmap																																				
<b>WP7- Project management (M1-M36)</b>																																				
7.1. Coordination and management																																				
7.2. Communication and dissemination																																				
7.3. Exploitation model adjustments																																				

Legend:





**Table 4.** Scheduled meetings for CRISI-ADAPT II based on at least one workshop per demonstration country.

Meetings	Country				
	Spain	Portugal	Italy	Malta	Cyprus
Kickoff meeting and I Workshop	2019-Sep, Seville, FIC and FVP				
II Workshop					2020-March, Ypsonas or Lakatamia, CUT/CEA
III Workshop		2020-Sep, Lisbon, FCT-NOVA			
IV Workshop			2021-March, Conselice, NE		
V Workshop	2021-Sep, Valencia FIC / Aquatec				
VI Workshop				2022-feb, La Valeta, Paragon	
Closure meeting	2022-June, Madrid, FIC				
Dissemination in international congress	x	x	x	x	x

**NOTA:** Assumed cost of 700 EUR per trip and person: up to three people are planned to travel per each partner. Additionally, 10 attendees will be invited from the rest of Pilot Cases and Receiving Regions (one representative per each Problem-Owner Entity):

**[Pilot cases]**

- Andalusia
- Malta
- Lakatamia
- Valencia

**[Receiving Regions]**

- Lisbon
- South Portugal (AdP)
- Ypsonas
- Conselice
- Badalona
- Castelldefels

## W4b. Outputs

**O1. Identification of climate-related vulnerabilities (M8):** The main climate-related problems and vulnerable elements will be enumerated for each pilot case.

**O2. Climate/weather scenarios (M10):** Scenarios of climate/weather variables, collected from the most recent climate/decadal projections and weather/seasonal forecast, will be provided through a common server, centralised for all the pilot cases.

**O3. Impact scenarios (M18).** This output corresponds to a list of climate-related effects generated by specific impact models (feed from synthetic extreme events provided in O2).

**O4. Integration platform (M20).** The integration of the climate/weather information and impact scenarios will be the fourth output. CRIT and MEET modules will provide impact information for the vulnerable elements (e.g. with maps) according to selected climate/weather scenarios.

**O5. Standard climate criteria for adaptation planning and operation (M17).** This output is a complete guide of the most useful concepts and recommendations as a result of the standardisation process of the climate risk analysis for capacity building in adaptation planning and operation.

**O6. Validation of operational measures for the adaptation in the pilot cases (M34).** The last output of the project is the result of validation of the operations carried out according to a list of adaptation measures for the pilot cases performed thanks to recommendations of CRIT/MEET modules.

**O7. Roadmap on forging resilience in Andalusia" (M6).** An additional output is planned as result of the WP6. This output corresponds to a roadmap on the key steps for an exhaustive resilience planning in Andalusia to face the most relevant challenges of the climate change.

**O8. Implementation plan (M6).** A list of scheduled tasks and subtasks will be assigned to the specific personnel involved in the project and it will be provided to optimise the coordination labour and to reduce possible overlapping works. This includes the scheduling of coordination meeting in the transversal level and in the WP level.

**O9. Dissemination of the results (M34).** Main results of the project will be disseminated in at least a scientific paper and at a European relevant conference (e.g. European Climate Change Adaptation conference –ECCA-). The corresponding data will be available in the OASIS Hub (<https://oasishub.co>) and CLARITY platform (<https://myclimateservices.eu/>).

## W4c. Deliverables

**[Mandatory:] DR. Project Performance Report (Q3):** The project performance report summarises the progress and key achievements of the project for the reporting year. This is sent to the EIT.

**Leader: FIC. Contributions: all partners**

**[Mandatory:] DC. Communications Deliverable (Q3):** The project will agree with Climate-KIC appropriate/ reasonable communications deliverables which might include one or more of: a high resolution image, a PowerPoint slide, a testimonial, or a case study.

**Leader: FIC. Contributions: all partners**

**D1. Description of the study cases (M12):** The first deliverable will present the identification of strategic sectors of the pilot cases, the vulnerability to climate change and the main historical impacts of climate extreme events.

**Leader: Fundación Valenciaport. Contributions: all partners and stakeholders**

**D2. Climate projections and monitoring information (M12):** This report will enumerate the data sources on the most current information for the near and long term climate projections and it will describe of the data outputs. Moreover, the deliverable will present the identification of the most skilful forecast systems for several timescales to fit an Early Warning System.

**Leader: FIC.**

**D3. Description of tools for modelling climate-related impacts (M24):** This deliverable will describe available models and tools useful to simulate climate-related natural hazards and their corresponding impacts. Moreover, links between strategic sectors involved will be identified and analysed in this report.

**Leader: Aquatec. Contributions: Fundación Valenciaport, FCT-NOVA, CUT, CEA,**

**D4. Standardisation of climate risk analysis for capacity building in adaptation planning and operation (M24):** In the last month of the project, a proposal of standardisation will be presented to homogenise the climatic analysis criteria for interpreting consistently the scenarios and their corresponding uncertainty level.

**Leader: FIC. Contributions: NE, ParagonEu, Aquatec, FVP**

**D5. User guidelines (M18).** An inventory of products and functionalities provided in the CRISI-ADAPT II platform will be documented as reference user guidelines. **Leader: FIC. Contributions: All partners.**

**D6. Validation report of operational measures for the adaptation in the pilot cases and replicability analysis (M36):** This deliverable corresponds to a validation report of the operations performed in each demonstration to face extreme events predicted by MEET and following the standardised climatic criteria. Finally, the deliverable will report about the replicability of results in the Receiving Regions. **Leader: CEA. Contributions: all partners and stakeholders.**

**D7. Description of the roadmap for forging resilience in Andalusia (M6).** This deliverable, planned for the WP6, will present details about the designed roadmap for resilience planning

in Andalusia. The report will provide the key steps for an exhaustive analysis of resilience needs to face the most relevant challenges of the climate change. **Leader: FIC.**

**D8. Implementation plan guidelines (M6):** This deliverable will serve as reference to communicate the implementation plan developed as Output O7. **Leader: FIC. Contributions: Aquatec and FVP**

**D9. Summary of results (M36).** The last deliverable contains an executive summary of the project results oriented to be published in specialised journals. In addition, this deliverable will contain a description of the open access data shared in OASIS and CLARITY platforms. **Leader: FIC. Contributions: all partners and stakeholders.**

#### **W4d. Project management structure**

- *General management and coordination*
  - Project coordinator: Robert Monjo (FIC)
  - Project manager: Alberto Martín (FIC)
  - Project administration: Sara Cano (FIC)
  - Pilot cases coordination: César Paradinas (FIC)
  
- *Leadership of WP*
  - WP1: Carles Pérez (FVP)
  - WP2: Emma Gaitán (FIC)
  - WP3: Beniamino Russo (Aquatec)
  - WP4: Ángela Rivera (FIC)
  - WP5: Savvas Vlachos (CEA)
  - WP6: Alberto Martin (FIC)
  - WP7: Robert Monjo (FIC)

**Profiles and contributions of the involved partners and stakeholders:**

- 1- **Near-term climate prediction:** FIC and Meteogrid will identify all long and near-term climate predictions available for the pilot cases.
- 2- **Seasonal forecast:** FIC and Meteogrid will identify all seasonal forecasts available for the pilot cases.
- 3- **Modelling of climate-related impacts:** FVP, Aquatec, NE, CEA/CUT, Meteogrid and CGSi will identify all models and tools available to simulate climate-related natural hazards and their corresponding impacts.
- 4- **Multi-sector holistic analysis:** Aquatec, FVP, NE, CEA/CUT will identify links between strategic sectors involved in the project and to perform a holistic analysis of these interconnections, especially in urban services.
- 5- **Cost-benefit analysis:** NE, Paragon Eu, FIC, FVP, Aquatec will assist in the cost-benefit analysis required by end-users.
- 6- **Water sectors:** Aquatec, CEA/CUT, FCT-NOVA will identify the climate problems/requirements for water sectors in the involved pilot cases.
- 7- **Energy sector:** NE, CEA/CUT will identify the climate problems/requirements for the energy sector in the urban area of the involved cities.
- 8- **City Councils:** They will provide information about strategic sectors of the city and will act in accordance with the expected climate-related risks and opportunities.
- 9- **Producers:** Possible participants to identify the climate problems/requirements in the production of strategic commodities. In addition they will act in accordance with the expected climate-related risks and opportunities.
- 10- **Traders:** Possible participants to identify the climate problems/requirements in the commercialization of strategic commodities.
- 11- **Insurance:** Possible participants to identify the climate problems/requirements in insurance managements.
- 12- **Mobility sector:** Possible participants to identify the climate problems/requirements for the mobility sector in the urban area of the involved cities.
- 13- **Health systems:** Possible participants to identify the climate problems/requirements in the health systems of the citizen of the involved cities.
- 14- **Other end-users:** The same that 10-12 but for other stakeholders.

In addition to the profiles described above, all end-users will act in accordance with the expected climate-related risks and opportunities.

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