Status report and results of the demonstrators' co-design process

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Contents

Abbreviations Used

CNRS-MF	Centre National de la Recherche Scientifique – Météo France
NORCE	Norwegian Research Centre
BSC	Barcelona Supercomputing Centre
CU	Charles University
LU	Leuphana University
I4C	Impetus4Change
UCS	urban climate services
WP	work package

1 Summary for Publication

This deliverable is a status report of I4C's co-design process with stakeholders in the demonstrator cities of Barcelona, Paris, Prague, and Bergen. It summarizes the initial results of this process, which will eventually feed into WPs 1-5 in I4C, especially WP4 in which climate hazard indices are being developed.

2 Contribution to the Top-level Objectives of Impetus4Change

This deliverable contributes to I4C's overall objectives SO4, SO6 and SO7.

Objective	Contribution from Deliverable
Overall Objective: to improve the quality, accessibility and usability of near-term climate information and services at local to regional scales – where impacts are most keenly felt and on-the-ground adaptation is implemented to strengthen and support end-user adaptation planning and action	Yes
1) Improve understanding and flow of climate information through knowledge networks;	No
2) Address persistent shortcomings to deliver seasonal to decadal predictions of improved quality;	No
3) Develop novel methods to downscale predictions to local scales;	No
4) Improve assessments of hazards and translate this into usable information for local risk assessments;	The dialogue with local stakeholders in the demonstrator cities will contribute to the assessment of relevant hazards and provide feedback to WP4, specifically D4.1.
5) Make advances towards the goal of end-to-end seamless climate services;	No
6) Through transdisciplinary co-production approaches develop fit-for-purpose "Adaptation support packs" at	Yes, especially by actively contributing to the first ADAPTALAB in Paris.

municipal scales through our so-called urban Demonstrators;	
7) Ensure high impact and visibility through robust and targeted communication and engagement;	Yes
8) Commit to Open Science through development of open access tools and exploitation of data/model outputs via relevant platforms thereby ensuring improved accessibility and usability of climate knowledge.	No

3 Detailed Report

3.1 Introduction

This deliverable presents the activities and results of task 6.2 of the project. The aim of this task is to co-design (Sanders & Stappers, 2008) the mock-ups[1] of the UCS that will be developed during the project, with specific features for each demonstrator. This process involves two approaches:

(1) Direct interaction between the I4C team and the local stakeholders of their respective demonstrator cities to identify and gain clarity on their issues and specific needs.

(2) Participation in Adaptalab events (originally called Klimathons in Task 7.3) which aim to bring together local stakeholders from the various demonstrators and physical and social scientists from the project (including those working directly with the demonstrators (WP6) and those involved in other WPs) to share their experience and exchange ideas.

Thus, this deliverable describes the progress made since deliverable D6.1, which was submitted in summer 2023, including the direct interactions between the I4C-team and stakeholders in the demonstrator cities as well as the results of the first Adaptalab. The deliverable also presents the networking activities initiated by BSC with the aim of anticipating and preparing for the climate service co-evaluation stage (task 6.4).

[1] According to Cambridge Dictionary a mock-up is a full-size model of something large that has not been built, showing how it will look or operate or a plan of how a page of a website, magazine, newspaper, etc. will look when it is finally created.

3.2 Work Carried Out and Main Results

Since D6.1, the I4C team has continued the stakeholder mapping and expanded the stakeholder network by organizing several activities. With respect to specific activities in task 6.2, we have made progress on the three approaches:

(1) We had direct interactions with local stakeholders by either inviting them to in-house meetings or visiting them at their workplace. We interacted with both smaller groups (< 10 people) and bigger audiences (> 10 people), gave tangible presentations and followed-up with discussions to receive feedback (see further details in Section 3.3 pertaining to each demonstrator city).

(2) A central part of the co-design process was facilitated in the 1st Adaptalab. The Adaptalab was conducted in Paris from November 29th to December 1st, 2023. This is described in more details in Section 3.4.

(3) Within the framework of the Adaptalab a networking activity was organized, which was a first step to developing the I4C co-evaluation framework (see Section 3.5).

There are no deviations from the Description of Action.

3.3 Direct Interactions Between I4C and Demonstrators

Here, we provide updates about activities and direct interactions of the I4C team with stakeholders in the demonstrator cities since summer 2023 (D6.1).

Barcelona (BSC)

In Barcelona, the co-production process has progressed considerably as we have begun to identify the types of urban climate services, we will produce during I4C. Most of our efforts have focused on deepening relationships with the users and defining the decision contexts and boundaries of the initial services we hope to develop. However, we have also continued to both expand the stakeholder network and establish our place within it (e.g. by continuing to push for meetings with the local meteorological agency and the Catalan government).

Following initial discussions with potential users as well as with the Barcelona I4C team (300K), we iteratively developed a Catalogue of Services that explains the climate information that I4C may be able to provide (in terms of the temporal scale and relative skill of the relevant parts of the D4.1list of hazards indices). This will form the basis of the types of services that can be developed over the course of the I4C project.

We have also begun focussing on nearer-term outputs such as to build trust and experience with climate services as well as testing their ability to support real-life decisions. Specifically, we have held a series of separate meetings with two municipal councils and the metropolitan authority to co-produce prototype services that can support local decision-making during (rather than at the end of) I4C. Here, guided by decision-makers' current concerns (i.e., for summer 2024) we have evaluated how existing data that is similar to that which will be produced at the end of I4C can be used to support decisions now. For example, we are exploring whether it is possible to

provide sub-seasonal temperature predictions for the upcoming summer to support the:

- Barcelona metropolitan authority if it should consider opening the climate shelter network before the conventional 15th June date;
- Granollers municipal government whether they should consider changing the planned activities for the summer schools (e.g. to plan more activities in the forest than at the playground if a heatwave is predicted).

To support this work, we carried out a case study of the skill of seasonal and sub-seasonal temperature predictions with respect to heatwaves and have created several "explainer" presentations (e.g. on spatial resolution and downscaling and the difference between climate variables and indicators).

Other potential themes are also progressing, though are less developed. These relate to supporting decisions over tree planting, energy vulnerability, and energy saving/predictability for municipal buildings. Initial conversations have revealed the interest of using climate information to know when to plant trees and evaluate their water needs considering the ongoing drought in Catalonia. Another avenue consists of better predicting hot and cold spells, and in particular, avoiding "fake cold alarms" where the municipality turns on heating only to turn it off a few days later (the older heating systems in use cannot easily be switched on and off when temperatures fluctuate). For each of these, we require input from outside of I4C (e.g. bioclimatic thresholds for plant viability and historical threshold temperatures for heating/cooling degree days).

We have also faced several challenges that were unforeseen. For example, the change in government in the city of Barcelona has stalled the council's climate adaptation efforts which we were hoping to support. Separately, the extreme drought in Catalonia led to the national water agency prohibiting the planting of new trees, limiting our (and many municipalities') plans for using climate services to support urban greening.

Bergen (NORCE)

The Bergen team has further followed up with two departments in the municipality (water and sewage system, planning and building). While preparing for the ADPATALAB in Paris (Task 7.3), the team also extended its stakeholder network to the regional administration of the county of Western Norway and SWECO (private company). Recently, I4C was approached by the "Norwegian Civil Defence Agency" (sivilforsvaret) to participate and contribute with a 30-minutes lecture at the annual gathering with regional leaders in Voss, Western Norway. Following the lecture, a short brainstorming session initiated with a 'mentimeter' survey led to an engaging discussion. We asked the questions - "How could a district and climate scientists collaborate? Which situation would be most relevant? What would be the goal of a collaboration?" Suggestions that repeatedly came up are shown in Figure 3.1.

Figure 3.1: Quotes from participants at the seminar with the Norwegian Civil Defence Agency ('sivilforsvaret').

Planning aspects such as purchase of material and storage, personnel, competences and training were mentioned several times. The main time horizon for planning purposes is the next couple of years, which fits very well with the modelling efforts in WP2-WP5.

Recently, we notice, the municipality of Bergen is falling short in climate-related areas for several reasons, e.g., election of a conservative local government and accompanied by uncertainty in long-term strategic planning with respect to climate change mitigation and adaptation policies, turnover of personnel and parental leave.

Paris (CNRS-MF)

The Paris team has expanded the stakeholder panel, based on a call for expressions of interest. A dozen stakeholders with diverse profiles from the institutional, voluntary, and private sectors agreed to participate (see Table 3.1).

Table 3.1: List of stakeholders in France who expressed their interest in I4C.

	Organization	Description
1.	Ville de Paris	Climate change adaptation service of the city of Paris
2.	CSTB	Scientific and technical centre for building which is a public institution that supports innovation in the building industry with activities include research, assessment, certification, testing and dissemination activities
3.	ADEME	French environment and energy management agency, public organization that supports the ecological transition, by working with local authorities and private individuals, and funding research projects
4.	ARS IDF	Health regional agency which implements regional health policy, in coordination with partners and considering the specific characteristics of the region and its territories
5.	SNCF	French national railway company (SNCF) Group Technologies, Innovation & Projects Division, working of the exposure of infrastructure to climate change (mission to prepare the rail industry for the challenges of tomorrow (safety, AI, low-carbon, hydrogen)

6.	Espaces Ferroviaires	Urban development and property development subsidiary of the French national railway company (SNCF), which works on the urban renewal of railway sites
7.	Agence de l'eau Seine Normandie	State public organization that helps define water policy for the river basin and the strategy for adapting to climate change, and funds projects by local stakeholders
8.	GREC francilien	Regional expertise group that collects and analyses data and scientific knowledge on climate, biodiversity, and pollutants in Ile-de-France region
9.	Réseau Action Climat	Group of 27 associations committed to ecological, fair trade and solidarity transition issues
10.	CDC Habitat	Private company of social housing involved in programs to renovate the rental housing stock
11.	Institute 4 Climate Economics	Non-profit research organization that provides independent policy analysis on climate change mitigation and adaptation
12.	Ethifinance company	European rating, research and advisory group serving sustainable finance and sustainable development

We have conducted several actions that included this group of stakeholders alongside those previously involved (the national agency for public health and the Paris region urban planning and development institute):

We interviewed each stakeholder individually to understand their organisation's missions, interests, expectations and needs regarding climate data, climate and impact indicators, data type and format, spatial coverage, resolution, and timeframes. We are currently analysing the interviews. Stakeholder profiles are fairly varied. Some of them have scientific expertise in a given sector (e.g. construction, health) and express a need for climate data to feed their own impact models. Others need comprehensible diagnoses, particularly in map form, which can support their planning and decision-making process, particularly for climate change adaptation plans, which are being drawn up in France at various territorial levels (municipalities, inter-communal bodies, regions, etc.). A key element in the development of future I4C UCS will be the need to align with stakeholders' expectations regarding the Reference Warming Trajectory for Adaptation to Climate Change established by the Ministry of Ecological Transition - the reference scenario to which adaptation plans must address is a scenario of +3°C global warming in 2100, which translates into +4°C warming in mainland France.

We organised a webinar series on various scientific topics related to the I4C project's issues and objectives, to foster stakeholder acculturation and dialogue with researchers (not only from WP6). So far, we have held two webinars; one on decadal projections and one on regional climate modelling. We will follow up with two more webinars; one on statistical emulators and another likely on shared-socioeconomic pathways scenarios.

The next step, planned for autumn 2024, will be the organisation of stakeholder workshops with the aim of presenting them with the first sets of climate data produced from observations and climate pre-simulations in the Paris area. We have yet to define the methodology and objectives, considering the diversity of the stakeholders and the initial climate data that we may provide as a basis for discussion and reflection.

Prague (CU)

I4C activities were further developed in two directions. First, we continued the analysis and discussions in connection to ongoing modelling activities in the CORDEX flagship pilot study on urban environments and regional climate change and the Horizon Europe project FOCI with relevant people of the Municipality authorities of the City of Prague. The discussions were in terms of potential availability of characteristics necessary for support of some climate services for the city. The second activity focused on the identification and obtaining relevant representatives for the Adaptalab in Paris.

The first pathway was largely covered in other I4C activities which have created a fairly stable level of activity throughout the first stage of the project and will be developed further when results arrive. For the preparation of the participation at Adaptalab, four representatives were identified to be able to bring the necessary engagement and expertise in the first steps of co-production of climate services for the City of Prague. Two of them covered the health effects, the third the issues of air quality and urban heat island, the fourth was a Head of the Environment Branch of the Municipality Authority (unfortunately, he was unable to attend the meeting). This corresponds well to the foreseen potential key climate impacts for of the City of Prague and thus the directions in which climate services should be oriented. We organized a preparatory meeting before the Paris event, where some themes for eventual climate services were discussed, focussing on their potential benefits and issues.

The main stressors identified are urban heat island, which in connection to climate change will significantly increase the number of hot days (> 30°C, in the worst scenarios it could be each third or second day in summer) and hot nights (> 20°C) with strong effects on health. These conditions can also contribute to photochemical smog formation, especially from transportation emissions. This is a strong source of particle matters, which can have severe health impacts, and which regularly exceeds EU ambient pollution limits (Directive 2008/50/EC). Measures partially in progress or to be developed focus on green and blue infrastructure, although these may be limited by historical monuments preservation measures and rules. Improvement can be achieved through media recommendations and increase of public and stakeholders' awareness and preparedness, which can go hand in hand in with modelling and prediction development within I4C and other activities. Some of these directions are already mentioned in the city's strategic development documents. Other potential aspects (beyond the scope of this project) include formulating action plans, making changes to building rules, and transportation regulations within the city.

3.4 Adaptalab – a recipe for a co-design process

The Adaptalab organised by Stiller-Reeve, Arctik, NORCE and CNRS-MF (Stiller-Reeve et al., 2024) is a key component of I4C's process of developing impactful UCS. The first Adaptalab, held in Paris from 29th November to 1st December 2023, brought together

participants from various disciplines and sectors to co-create innovative solutions ('mock-ups') for a specific problem. The work process at the Adaptalab was inspired by (and adapted from) a hackathon. A hackathon is a collaborative workshop where people from diverse backgrounds and skills work together to solve a problem and build a solution/product/service. The main goal of the first I4C Adaptalab was to facilitate collaboration between I4C researchers and stakeholders from the demonstrator cities to generate ideas for new urban climate services. These ideas serve as a basis for the mock-ups that I4C will further develop in Task 6.3. During the Adaptalab, eight interdisciplinary groups crafted a variety of novel and insightful project ideas for UCS (see a thorough poster analysis in the Appendix). The groups were carefully set together to embrace various views, professional experience and expertise from the stakeholders and the I4C team. The co-design process was guided by five steps:

1) **get to know each other** to kick-off the group work with an introduction round emphasizing the participants interest and experience with climate services, their roles and responsibilities;

2) **explore** critical solutions in the urban areas, collect information from stakeholders in a mind map centred around climate events and include elements that cause these events and the impacts they can create;

3) **define** the overarching goal of the UCS by finishing the sentence "The I4C climate service will ...";

4) **innovate** and discuss to develop a common vision for the UCS, basically develop a plan to make the UCS happen;

5) **communicate** by creating a poster to illustrate and explain the UCS mock-up.

Moreover, networking was crucial as Adaptalab also provided an opportunity for participants to connect with new collaborators within their own cities and across the I4C community. To encourage networking, various activities to promote meaningful interactions between working groups were included.

Main results of the ADAPTALAB

The groups concluded "Our climate service will ..."

"promote actions through a systemic analysis and sharing of knowledge and data",

"improve the communication of physical climate risk at the local scale for urban planning",

"help to localize and prioritize heatwave adaptation measures in metropolitan areas",

"provide an iterative kit on heat-drought systemic crisis to define stress tests and preventive action",

"empower individuals and communities to become climate influencers, using accurate and reliable scientific information",

"provide the Ville de Paris Climate Office with a map tool to identify the most at risk and resilient neighbourhoods to help support decision-making across the municipality for heat and droughts in the short and near term",

"provide a flexible modular architecture anchored by an interdisciplinary development team",

"develop an understandable impact warning and information system for climate events."

A clear requirement, suggested by five groups, was a decision support tool in the form of an interactive map/atlas, application or webservice. This result points directly to D4.4 and Task 6.3.

The other three groups had a more systemic approach and suggested establishing a house/department for UCS which would require long-term strategic planning and is beyond the scope of the work being conducted in I4C. However, it may provide a direction for the I4C roadmap (D6.5).

Most groups suggested not only to identify and illustrate climate hazards (e.g., heatwave, drought, intense precipitation, flooding), but also to provide guidance to implement adaptation measures to reduce both exposure and vulnerability of infrastructure and citizens in urban areas.

One group developed a more specific mock-up (poster: PARIS BRÛLE-T-IL?) which proposed an annual operational stress test exercise for the city of Paris.

All groups highlighted the necessity of establishing either an interdisciplinary and/or a transdisciplinary team to solve climate-related challenges in the demonstrator cities.

The main obstacles and challenges for the implementation of a successful UCS were identified as i) the lack of reliable long-term funding, ii) relevant comparable data - either local data is unavailable or there is such a myriad of data sets (urban, climate, social etc.) in different formats and on different temporal/spatial scales that they are difficult to combine, and iii) the lack/absence of software developers and UX-design expertise to implement information in a useful way.

The full analysis of all the participants' posters is in the Appendix where the finer details of each of the ideas can be found. Despite not being laid out in full in the main text, these ideas will play an important role in I4C moving forward.

3.5 Networking activity to prepare co-evaluation

BSC and Stiller-Reeve facilitated a collaborative networking activity to engage participants and to contribute to I4C efforts on the co-evaluation of climate services (Task 6.4). Participants were asked to form groups of two and four consecutively, employing a pyramid-style discussion format, to explore criteria for evaluating climate services across four dimensions of the climate service value chain: process, output,

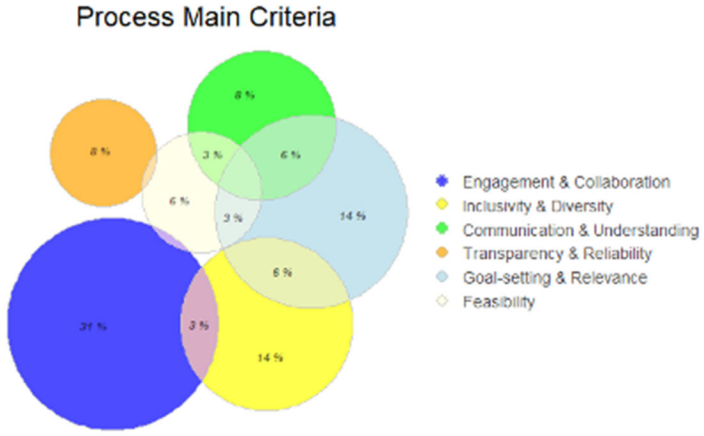
outcome, and impact. Different groups were formed for each dimension, maximising engagement, and facilitating diverse discourses.

Participants responded to open-ended questions regarding their evaluation criteria, and the ensuing analysis of their responses was carried out using the thematic analysis method. This approach involved systematically assigning codes to the raw responses and subsequently organizing them into thematic categories or "main criteria".

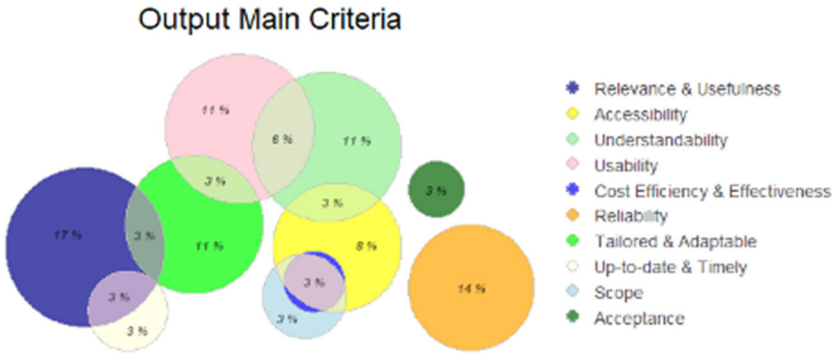
Main result from networking activity

Key results for each dimension (process, output, outcome and impact) are:

Process: Primary emphasis lay on 'Engagement & Collaboration' and 'Goal-setting & Relevance' as important criteria to evaluate co-production process of climate services, while 'Transparency & Reliability' received the least mention. Notable thematic overlap is observed.

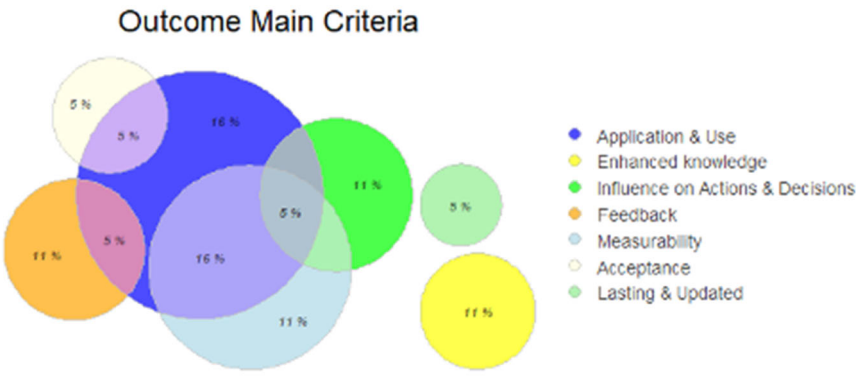


Output: In the evaluation of quality output, 'Relevance & Usefulness' emerged as the paramount criterion, closely followed by 'Usability' and 'Understandability', with less emphasis on 'Cost Efficiency & Effectiveness'. Thematic overlap is evident, except for the distinct emphasis on 'Reliability'.

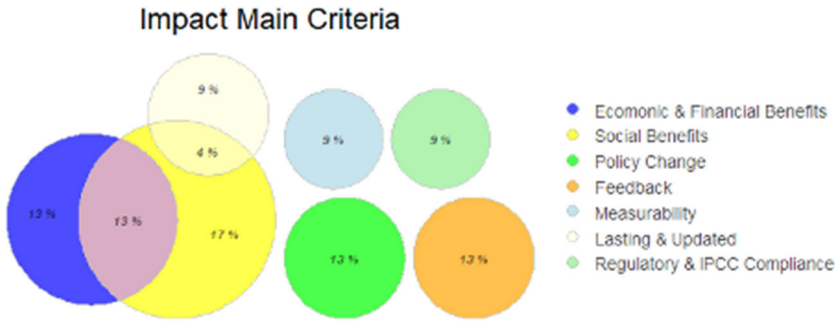


Outcome: Predominant criterion for evaluating the outcome of climate services is 'Application & Use,' substantially overlapping with 'Measurability,' implying a need for the applicability to be demonstrable. Less frequently stated criteria pertain to

'Enhanced Knowledge,' possibly indicative of measurement challenges. There is significant overlap between the themes with the notable exception of 'Enhanced Knowledge'.



Impact: The focal point for impact evaluation is 'Social Benefits', followed by and significantly overlapping with 'Economic & Financial Benefits'. 'Measurability' features less prominently. Criteria groups show less overlap compared to other dimensions.



Recurring themes across dimensions, such as 'Relevance', 'Reliability', 'Feedback', and 'Measurability' reflect common considerations in the evaluation of the dimensions.

Link with Co-Evaluation (T6.4)

The Adaptalab served as an idealised setting for experimenting with a co-evaluation approach (T6.4), wherein the evaluation criteria for climate services are determined by stakeholders. Drawing upon the insights derived from the networking activity, a co-evaluation framework has been developed, which holds the potential for application at the level of demonstrator cities. Specifically, the raw responses gathered under each dimension of the climate service value chain have been synthesised into key points (see Table 3.2), based on thematic closeness. These key points may direct stakeholder engagements in the demonstrator cities, shaping what will be unique evaluation criteria. For practical application, the information-rich key points will be further distilled into specific questions and examples for incorporation into interviews

and discussions with local stakeholders. Moreover, such a thematic synthesis sheds light on the themes recurring across dimensions (such as 'Relevance', 'Reliability', 'Feedback', and 'Measurability') in terms of their implications for each specific dimension.

Table 3.2: Synthesis of key points for each dimension of the climate service value chain.

Dimension	Key Points
Process	• Engaging stakeholders to identify current gaps in UCSs and setting a clear goal; defining the desired outcome upfront; establishing a common understanding. • Assessing strengths and weaknesses in meeting demands; understanding and communicating limitations to set realistic expectations. • Allocating sufficient time and resources for proper and sustained stakeholder engagement; ensuring availability; fostering connectivity and cooperation • Including all relevant stakeholders in co-production while emphasising representation across diverse sectors, cultures, and issues; ensuring equitable expression of all views • Defining demand-driven UCSs that address the needs of all stakeholders; ensuring targeted information relevant to each user • Ensuring transparency and the exchange of fact-checked, reliable information • Optimising on quality, not just frequency, of stakeholder inputs, discussions, and insights for co-production • Using commonly understood terminologies; explaining technical terms where necessary and avoiding vague or ambiguous terms. • Engaging stakeholders in an enjoyable and friendly environment
Output	• Fulfilling diverse stakeholder needs thereby ensuring relevance, acceptance and usefulness; having a clear service purpose. • Ensuring accessibility to all potential users and stakeholders • Iteratively co-developing the services through multiple feedback loops. • Producing technically sound and reliable climate information with high-quality data and models; taking responsibility for the services • Ensuring usability for decision-making in varied contexts, i.e. UCSs should be adaptable, functional and well-used; continuous, up-to-date and in required format.

	• Creating understandable, convenient, and user-friendly climate information and services for broad uptake • Ensuring cost-efficiency and effectiveness • Co-producing suitable services tailored to users' decision-making contexts, i.e. they should be fit-for-purpose, delivering targeted information. • Developing services that have cross-sector applications. • Directly informing policy making and implementation
Outcome	• Gauging user acceptance; demonstrating applicability through usage indicators such as frequency, involvement, number of users, and project adoption. • Documenting changes in decision-making processes and behaviour, including the number of actions influenced. • Enhancing understanding, awareness, and knowledge through the creation and dissemination of reliable climate information • Analysing scope for broad uptake • Collecting direct user feedback on changes in their decisions and knowledge • Generating lasting changes in users' decisions and knowledge by updating CSs to inform decision-making and raise awareness in a dynamic environment. • Quantifying changes in users' decisions and knowledge
Impact	• Generating social, economic, and financial benefits, thereby enhancing well-being (e.g. human safety, justice) and reducing costs associated with climate change (e.g. money-saving) • Strategizing influence on politics while ensuring compliance with local laws. • Integrating stakeholders into a strong and lasting community, enabling follow-up projects • Developing UCSs that result in cost-effectiveness and cost-efficiency. • Gathering stakeholder feedback for assessing impact • Aligning with and mitigating climate risks according to the IPCC risk framework • Establishing lasting impact; updating services to create impact in a changing environment. • Quantifying impact and success

3.6 Progress Beyond State of the Art

One of WP6's main aims is to implement a transdisciplinary co-development and co-production process involving iterative and collaborative dialogue between the project's scientists and the stakeholders in each demonstrator, as well as crossing experiences and approaches between demonstrators.

A particularly innovative approach that has been implemented to meet the challenges completing this aim entails is the organisation of the 1st Adaptalab. This event took place at the Académie du Climat in Paris (France) and brought together more than 50 participants from the various countries involved (France, Norway, Spain, Czech Republic, UK, Germany). In addition, the teams working in each demonstrator consist of various profiles. Such an interdisciplinary environment is argued to be more readily involved in transdisciplinary processes, i.e. in integrating other, non-academic, knowledge in the climate knowledge co-production processes (Bojovic et al. 2021).

3.7 Next steps

In collaboration with the I4C sister project ASPECT (and other projects), we are organizing a side-event for stakeholders during the workshop on "Climate Prediction and Services over the Atlantic-Arctic region" which will take place in Bergen in May 2024.

The next important steps include continuation of the coproduction process, in particular the climate services co-development and the creation of an adaptation support pack for each demonstrator (D6.3). We recommend considering the results of the poster analysis (see eight mock-ups in the Appendix) for the development of D4.4 (web-based tool to deliver region specific hazard information).

The 2nd Adaptalab is planned to take place in Barcelona in February/March 2025 where we expect many of the same stakeholder participants. While we intentionally designed the 1st Adaptalab to be thematically very open with *climate service* as the overarching topic, it will be appropriate to centre the next Adaptalab around a more concise/specific topic. This will be defined in due course with support from Task 6.3.

4 Impact

Within I4C, the deliverable impacts T6.3, T6.4 and D4.4, D6.3 and D6.4. and beyond the project it impacts all stakeholders, especially the participants of the 1st Adaptalab and the networking activity.

5 Links Built

The attendance of representatives from different WPs strengthened links between members of the I4C team as well as between them and stakeholders during the Adaptalab. Since summer 2023 (D6.1 on stakeholder mapping) the I4C stakeholder network has also continued to expand in the demonstrator cities.

6 Communication, Dissemination and Exploitation

Below you can see a list of CDE activities.

https://www.linkedin.com/company/impetus-4-change/

Visual impressions of the I4C-ADAPTALAB in Paris are collected on the I4C-webpage: https://impetus4change.eu/first-adaptalab/

Webinar with and for I4C-stakeholders in France (CNRS).

6.1 Peer Reviewed Articles

There are no peer-reviewed articles from this deliverable directly. However, NORCE has submitted a research article to Hydrol. Earth Syst. Sci. Discuss (HESS):

Xie, K., Li, L., Chen, H., Mayer, S., Dobler, A., Xu, C.-Y., and Gokturk, O. M.: Enhanced Evaluation of Sub-daily and Daily Extreme Precipitation in Norway from Convection-Permitting Models at Regional and Local Scales, Hydrol. Earth Syst. Sci. Discuss. [preprint], https://doi.org/10.5194/hess-2024-68, in review, 2024.;

and BSC has published a peer-reviewed article on user selection and engagement:

Baulenas, E., Bojovic, D., Urquiza, D., Terrado, M., Pickard, S., González, N., & Clair, A. L. st. (2023). User Selection and Engagement for Climate Services Coproduction. *Weather, Climate, and Society*, *15*(2), 381-392. https://doi.org/10.1175/WCAS-D-22-0112.1.

7 References

Bojovic, D., st. Clair, A. L., Christel, I., Terrado, M., Stanzel, P., Gonzalez, P., & Palin, E. J. (2021). Engagement, involvement and empowerment: Three realms of a coproduction framework for climate services. *Global Environmental Change*, *68*, 102271. https://doi.org/10.1016/J.GLOENVCHA.2021.102271

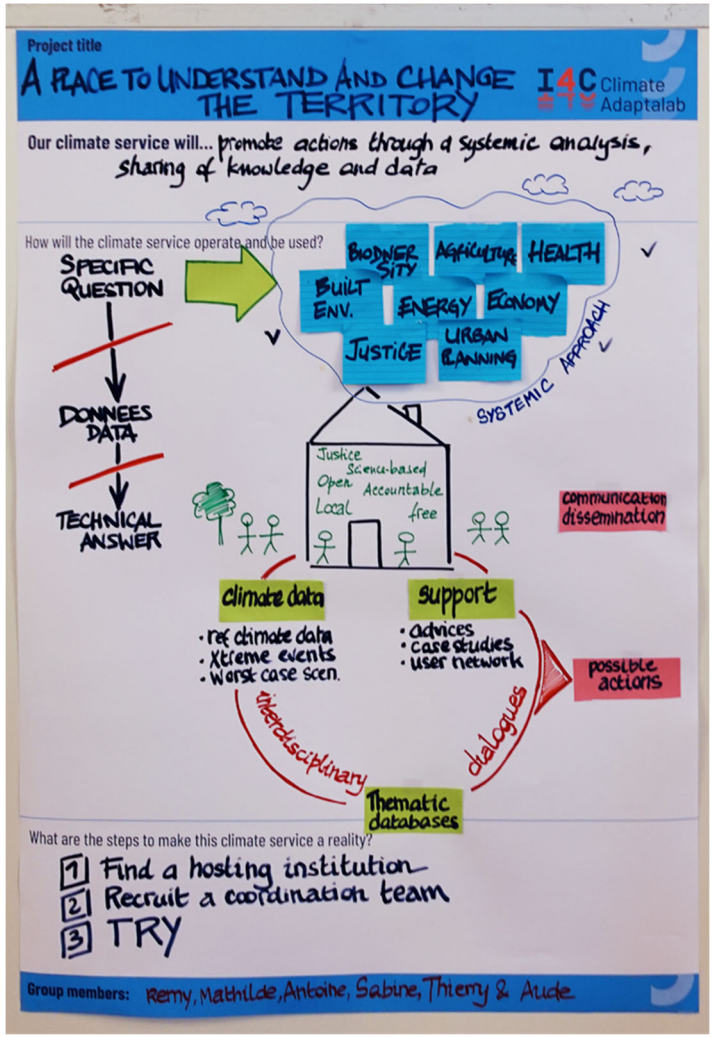
Directive 2008/50/EC, https://environment.ec.europa.eu/topics/air_en

E. B.-N. Sanders & P.J. Stappers (2008). Co-creation and the new landscapes of design, CoDesign, 4:1, 5-18, DOI: 10.1080/15710880701875068.

Stiller-Reeve et al., 2024, https://impetus4change.eu/wp-content/uploads/2024/01/REPORT-Adaptalab-v6.pdf

8 Appendix: ADAPTALAB mock-ups and analysis

Title of the poster: "A place to understand and change the territory".



General Overview

Team Introduction: a research scientist in decadal climate projections at CERFACS (I4C WP2), a specialist in ecological transition for housing renovation at CDC Habitat (private structure, landlord of affordable housing in France), a research scientist in statistical methods for climate regionalisation at CNRM (I4C WP3), an Environmental studies specialist at the Île-de-France Regional Health Observatory, a research scientist in urban-regional climate at CNRM (I4C WP6), an epidemiology researcher at Santé Publique France (national public health agency), and I4C partner (WP6, Paris demonstrator)

Poster synopsis: The poster entitled "A place to understand and change the territory" proposes an urban climate service (UCS) based on a systemic approach and analysis, combining knowledge and data on the multiple issues of health, biodiversity, urban planning, energy, justice, the economy, etc. The aim is to bring together a coordination team in a permanent institute with the role of (1) making climate data available; (2) cross-referencing climate data with other thematic data for interdisciplinary analyses; (3) supporting stakeholders/users in the use and interpretation of climate data. Ongoing dialogue with stakeholders/users should make it possible to propose adaptation measures and actions.

Keywords: systemic analysis - host institution - training and support - extreme events

Addressed Hazards

No specification of specific hazards. UCS focused on response to extreme climatic events, including the concept of "worst case scenario".

Target Audience

Intended Users: The aim is to set up a structure that can respond to varied and diversified demands. It brings together experts from different sectors such as climate sciences but also biodiversity, agriculture, urban planning, the built environment, health, energy, the economy, and justice. The UCS can therefore address a wide range of stakeholders whose actions affect one or other of these sectors. These stakeholders may be institutions, associations, or the private sector.

Purpose: UCS goes as far as the decision to implement adaptation actions/measures in response to extreme climatic events and the evaluation of those.

Information Provided

Content: UCS provide reference climate and extreme event data, as well as complementary thematic data that can be cross-referenced for multi-sectoral assessment and analysis (e.g. land use and socio-demographic data).

Format: The format of the data was not discussed, but the importance of training and close support in the use and interpretation of the data was stressed.

Scope: UCS can be used not only to diagnose impacts but also to make recommendations and propose actions to reduce these impacts.

Territorial Scales

Targeted Scales: No specific scale was really targeted. However, the spatial scale of interest that emerged from the discussions was the inter-municipal and regional scale, with a view to addressing the issues in a systemic way across the territory.

Required Skills

Necessary Expertise: The proposed UCS projects require a wide range of expertise, since they are based on a systems approach that addresses the multi-sectoral issues surrounding the impacts of climate change.

Availability: All this expertise is not directly brought together in the I4C project, but the aim is rather to design the modular structure and add to it as we go along. For the Paris demonstrator, the urban and regional planning agency is a central player in the Ile-de-France region; it brings together a wide range of expertise and knowledge and can help to bring together the players involved.

Challenges

Identified Obstacles: One of the major obstacles identified is undoubtedly the financing of a public institute that aims to be sustainable and independent to provide long-term support.

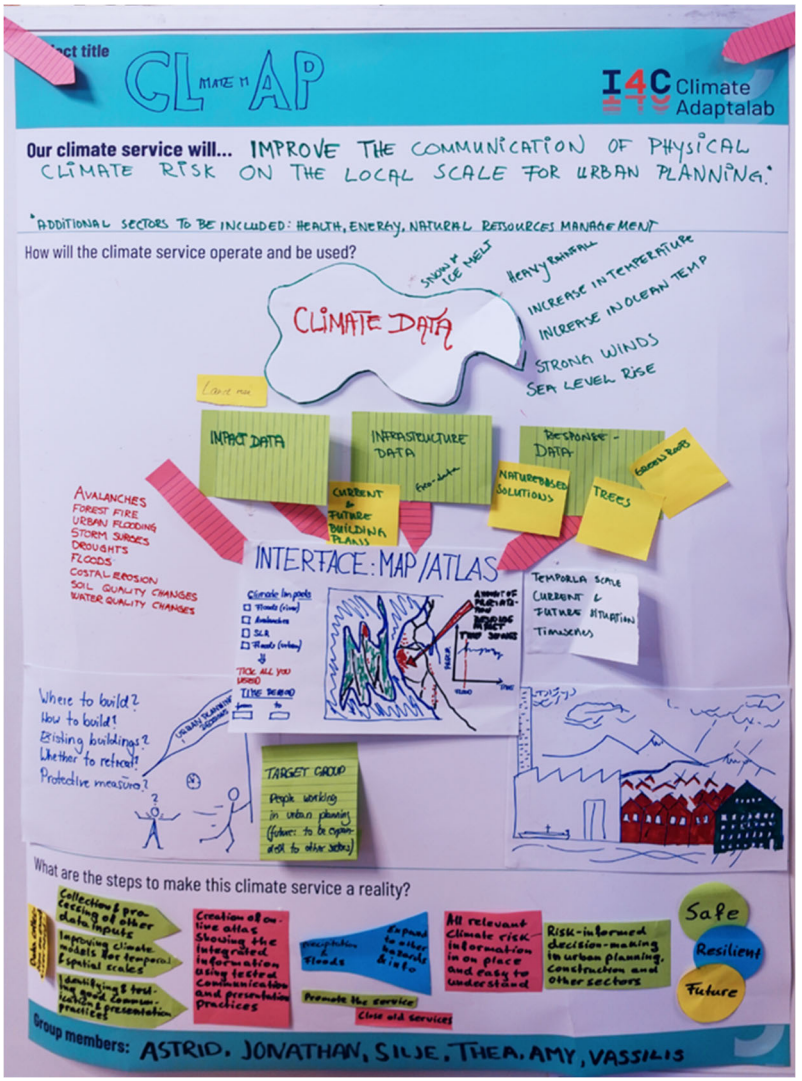
Title of the poster: "CLimate mAP"

General Overview
Team Introduction: a representative of Newcastle University, experts in psychology and climate information from Leuphana University (I4C WP6), meteorologist and senior climate advisor from SWECO, geologist and climate advisor from Bergen municipality, mathematician and modelling expert from Newcastle University

Poster synopsis: The proposed UCS "CLimate mAP" (CLAP) will improve communication of physical climate risks at the local scale for urban planners and related sectors. Initially it targets heavy precipitation and flooding, but the hazard and sectoral focus can be expanded later on to other relevant climate impacts. The ambition is to provide (1) hazard impact as well as (2) infrastructure information along with (3) information on adaptation responses to reduce physical climate risks in one place. The information will be provided in an online atlas. Using insights from cognitive science and psychology, the UCS will be designed using established and empirically tested principles for communicating information visually, numerically, and verbally in understandable ways.
Keywords: Map, Urban Planning, Physical climate risk, Adaptation response

Addressed Hazards
Initial focus: Heavy precipitation and flooding
Expansion: Other hazards such as avalanches, forest fires, storm surges, drought, costal erosion, and soil and water quality changes.

Target Audience
Intended Users: The primary intended users are people working in urban development and construction related sectors including policy makers, public administration staff, and the private sector (e.g. consultancies, planning offices, construction firms).



Purpose: The goal is to increase knowledge about physical climate risks at the local scale, as well as about effective adaptation responses, linked to (long-term?) urban planning of infrastructure, including roads, public buildings, water and sewage infrastructure etc.
Through a better understanding of climate hazard impacts, exposed and vulnerable infrastructure and potential adaptation response options, adaptation decision-making will be improved.

Information Provided
Content: Information on hazard impact combined with information on infrastructure and information on potential adaptation responses.
Format: The information is provided in a map-based online atlas.
Scope: This UCS will provide a hazard diagnosis, impacts assessments, and recommendations for adaptation.

Territorial Scales
Targeted scales: The information is provided at the local scale for Bergen, but this was not defined more specifically in the poster. In the discussions, it was however clear that information in the portal should be provided at the individual level of buildings and streets (e.g. which houses might be flooded or affected by landslides/avalanches). No clear requirements regarding the spatial resolution were established.

Required Skills
Necessary Expertise:
Improving climate models on temporal and spatial scale
Collection and processing of infrastructure information
Collection and processing of information on adaptation responses
Identification and testing of good communication and presentation practices
Availability: It is unlikely that all these skills are present in the I4C team as the proposed UCS covers different areas of work:
Climate info: It was not clear from the group work whether the I4C team has the necessary climate modelling skills. This is because the two climate scientists from Newcastle had to leave the Adaptalab early.
Infrastructure info: In the discussions, it was assumed that this information comes from other actors (e.g. urban planning departments of the city). Ideally, there are existing systems (e.g. GIS portal of a city) on which the UCS could build on.
Adaptation response info: It was not clear where this information should come from. The information and skill to integrate it into the USC is not present in I4C. Moreover, adaptation responses need to be contextualized as they will depend on local conditions. No clear way forward has been identified for this.

Communications: There is some expertise in the I4C team (e.g. Leuphana University) how climate information should be presented to be easily understandable.

Challenges

Obstacles to the creation were not discussed in detail during the group work.

Title of the poster: S_c^4HADE - Scenario for heatwave adaptation

General Overview

Team Introduction: The S_c^4HADE team comprised two stakeholders (a representative of the local government of the city of Paris, and a representative of an urban praxis collective in Barcelona from Aqui) and three scientists (a senior climatologist from Cerfacs, a junior climatologist with the focus on impact studies from MeteoFrance, and a social scientist from BSC (I4C-WP6)). It was a good balance of the profiles and expertise.

Poster synopsis: The poster shows the objectives of the *Scenario for Heatwave Adaptation* (S_c^4HADE) Urban Climate Service (UCS) which is to support localization and prioritization of heatwave adaptation measures in metropolitan areas, based on climate impact and vulnerability indicators. The poster presents three main steps: mapping of the vulnerability to heat by combing the extreme heat maps with vulnerability indicators; localization and prioritization of the areas for adaptation; and co-production of adaptation measures through participatory storylines development.

Addressed Hazards

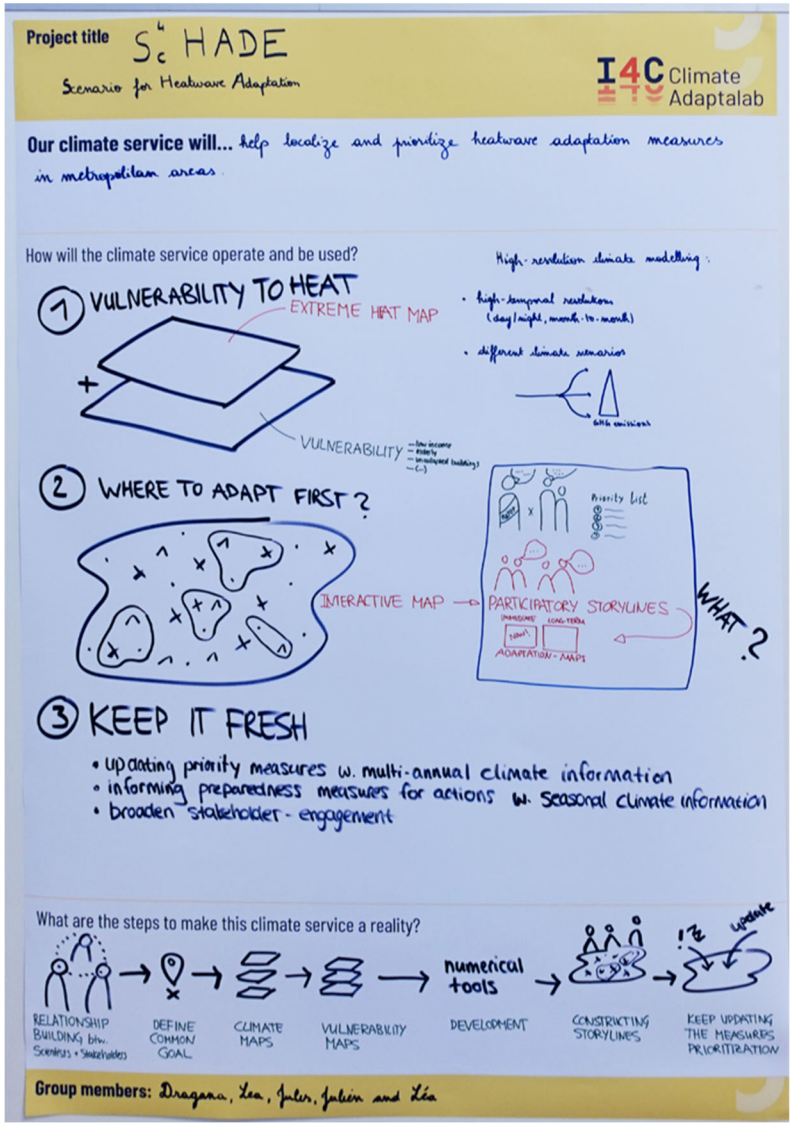
The S_c^4HADE UCS focuses on heatwaves.

Target Audience

Intended Users: The service is intended to various stakeholders, from citizens, over NGOs to public administration.

Purpose: The goal is to provide support in prioritizing areas and measures for the adaptation to heatwaves, such as urban planning. The use of multi-annual forecasts will keep updating these measures. S_c^4HADE will also support early warning and inform preparedness measures, by using seasonal forecasts. Finally, it will support citizens' awareness raising and urban long-term planning with participatory storylines and development of future scenarios.

Information Provided



Scope: The scope of S_c^4HADE is to provide information for the assessment of the most vulnerable areas, participatory future scenarios and recommendations of adaptation measures, including both short-term preparedness measures and longer-term adaptation planning. Participatory scenarios will use urban pathways, with different scenarios, e.g. drastic increase in traffic, and future climate information, to co-create long term adaptation strategies.
Content: The S_c^4HADE UCS provides climate and vulnerability maps that support prioritization of areas that need to adapt as well as a choice of co-produced adaptation measures. It matches the most needed locations with the most adequate measures.
The S_c^4HADE will apply climate information at different timescales to address different adaptation measures. Seasonal information will be applied for preventive measures, e.g. water and climate shelters management, while decadal predictions will be used to inform urban greening and long-term urban planning.

Format: The information will be provided in multiple formats. These include vulnerability maps and storylines, but also description of adaptation measures.

Territorial Scales
Targeted scales: The service will target the municipalities of a metropolitan area (e.g. of Paris or Barcelona) or provinces and prefectures. The information should be on a high spatial resolution to inform concrete adaptation measures for different urban areas. High climate data resolution will help better understand physical climate risk. The physical component of climate risk will hence be better integrated with socio-economic elements that normally guide the action.
Besides high spatial resolution, the climate data should also have high temporal resolution, to distinguish heat risk at day and night and accordingly inform adaptation measures. This will support the adequate use of public space at different times of day.

Required Skills
Necessary Expertise: The development of S_c^4HADE UCS will require an interdisciplinary team of experts and a close collaboration with stakeholders. The expertise includes climate and social scientists and software developers and user experience designers. The co-production process with stakeholders will provide storyline and future scenarios and co-define usable and acceptable adaptation measures.
Availability: Most of these skills are present in the I4C consortium: climate and social scientists and stakeholders from the consortium and beyond. However, S_c^4HADE will need to seek collaboration with software and user experience designers.

Challenges
To develop adaptation solutions that will guide the action effectively and efficiently, we need a network of citizens and knowledge sharing between science, public and private sectors. Lack of collaboration and funding are seen as main potential obstacles. Availability of climate and socio-economic data on local scale is seen as possible risk.

Title of the poster: "Paris Brûle-t-il? An iterative kit on heat-drought systemic crisis to define stress-tests and preventive action".

General Overview

Team Introduction: an expert in regional climate modeling (Météo-France) representing I4C-WP3, an expert on urban planning and development (L'Institut Paris Regional), and an expert on urban ecology and pollution (L'Institut Paris Regional). Demonstrator city: Paris.

Poster Synopsis: The climate service aimed at providing an operational stress-test for compound drought-heatwave events to support the design of preventive solutions. The service would be composed of three main pillars: a plausible storyline of the compound event, territorial information and an actor network. It is conceived as a yearly cycle which would be adapting the storyline, fine-tuning the information and strengthening actor linkages.

Keywords: stress-tests; preventive action; multi-stakeholder partnerships; iterativity

Addressed Hazards

Compound heatwave-drought events

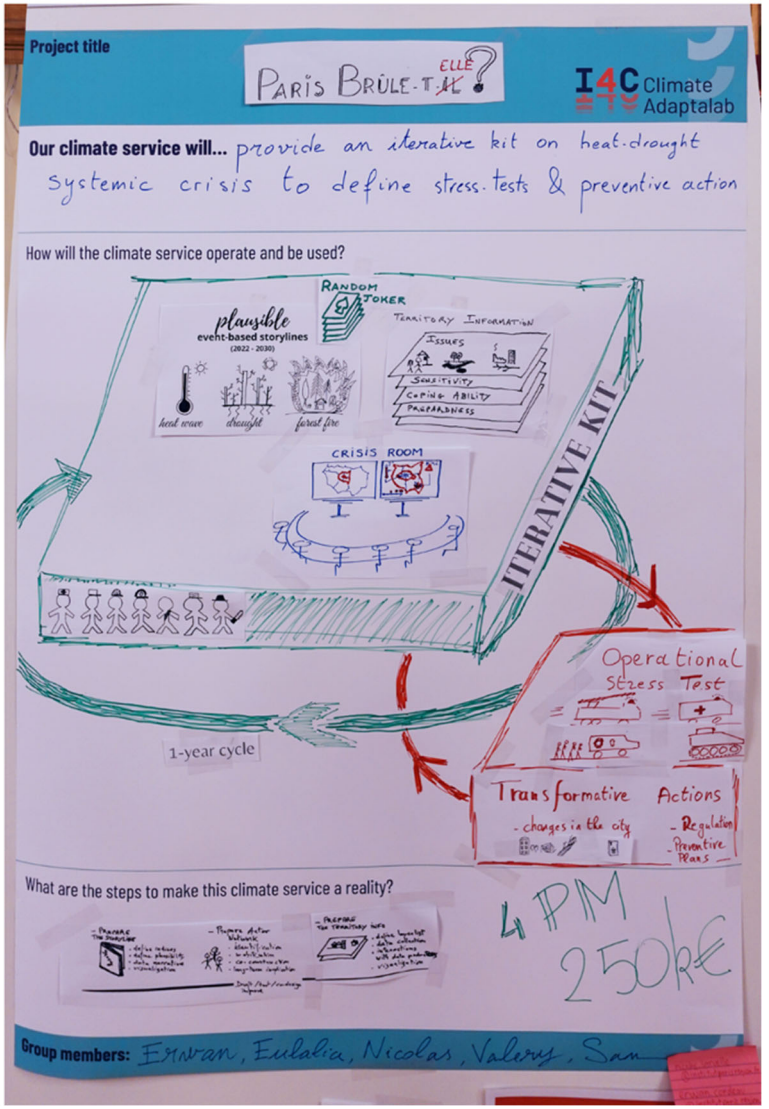
Target Audience

Intended Users: decision-makers and social services providers (public, private and NGOs)

Purpose: Prevention and management of extreme events through building an actor network that can be activated in the case of the event (development of a prevention plan and adequate regulation)

Information Provided

Content: The UCS gathers information from several sectors and creates a multi-stakeholder network. On the side of climate information, the main method would be a plausible storyline which explores the causal dynamics and expected impacts of the compound event. The territorial information includes data on issues, sensitivity, coping ability, preparedness of the region (Paris metropolitan area). Finally, the actor network includes the actors relevant in the event response.



Format: The operational stress-test would be simulated in an agent-based model to test how the prevention plan would perform in the face of the event.
Scope: The UCS supports the development (and testing) of transformative actions for adaptation, as well as the prevention plan.

Territorial Scales
Targeted Scales: The UCS was thought for areas in the Paris metropolitan area.

Required Skills
Necessary Expertise: Each of the three pillars requires a different type of expertise: climate scientist for the storyline, field expert with data science background, and social scientist for building the network. As it is thought of as an iterative co-production process, the actor network will also bring in their respective field expertise. For the agent-based modelling, a scientist trained in this method.
Availability: The skills are present in I4C except for the field-data handling expertise, which requires of local knowledge.

Challenges
Identified Obstacles: The main challenges for the UCS are operational: building the network and making time for the yearly exercise. The challenges emerge for the multiple stakeholders required for making a robust exercise, and the possible change in actors across the years. For this reason, institutional support or even an institutional-led promotion of this UCS would be required.

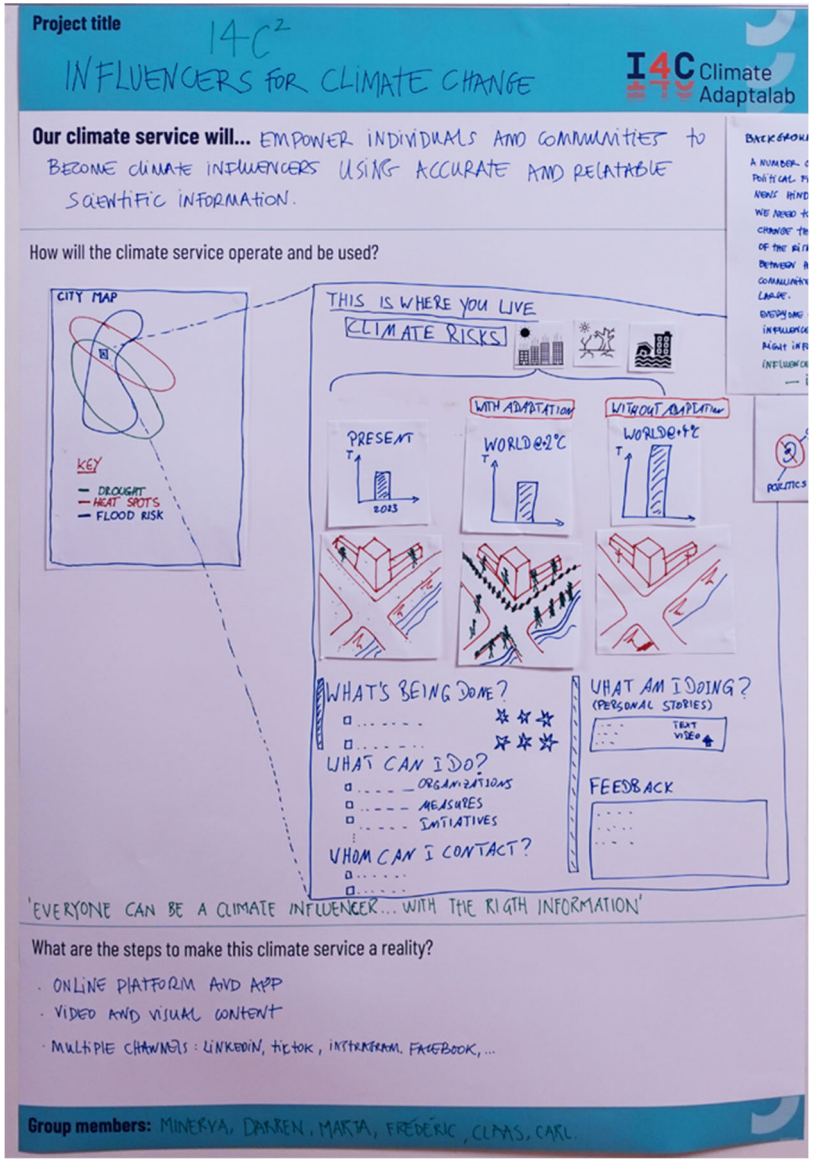
Title of the poster: I4C – Influencers for climate change

General Overview
Team Introduction: a representative of AMB - Àrea Metropolitana de Barcelona, two representatives of Newcastle City Council, a social scientist from NORCE representing I4C-WP1, a sustainable urban planner from Eco Designer, Barcelona, a regional climate modelling expert from (GERICS) representing I4C-WP3.
Poster Synopsis: The aim of the climate services is to empower individuals and communities to become climate influencers using accurate and reliable scientific information.
Key words: local action; actionable information; influence action

Addressed Hazards
Multiple hazards depending on the impact and risks at the local level but also focusing on key hazards and impacts such as flooding, heatwaves, drought.

Target Audience
Intended Users: Individuals and communities.
Purpose: Action at the local level by empowering individuals and communities with the knowledge required (i.e. climate information, adaptation options, etc) to influence politicians and organisations with agency and responsibilities to act on climate. The UCS can also be used to raise awareness and help inform other types of actions on the ground e.g. activism, lobbying, etc

Information Provided
Content: Information on the main risks and impacts of climate to the city looking at present and futures worlds of +2C and +4C with and without adaptation options. The UCS would also provide a range of information on what's being done in terms of adaptation efforts at that level in relation to those specific risks; provide information on what individual/communities can do (e.g. contact organisations, join existing initiatives, pursue specific adaptation measures, etc); provide information on local politicians and other relevant organisations with agency to act on climate adaptation at city level.



Format: This would be a web platform with GIS representation and other graphical inputs
Scope: Diagnosis of hazard and impact assessment would be provided but based on existing knowledge and studies; scenarios of future climate would be provided for +2C and +4C and recommendations for adaptation would be proposed on top of that.

Territorial Scales
City/municipality level broken down to neighbourhood level (or other useful scales of analysis below the city level)

Required Skills
Necessary Expertise: What skills are required for the proposed UCS?
Understanding of policy context for the cities included
Understanding the climate context at global and city scale (What do climate projections tell us and what does it possibly mean at city scale?)
Understanding of key climate hazards and risks in the cities (How is this related to exposure and vulnerability to climate change (long term and events)?)
Analysis of main adaptation recommendations in light of key risks and impacts in the city particularly actions at the individual/community level.
Availability: Are these skills present in I4C team, and if not, which ones are missing?
For the a/b/c/d skills listed above we do have these in the I4C team (in WP1 and 6)

Challenges
Identified Obstacles: What main obstacles or challenges have been identified that could hinder the implementation of the proposed UCS (scientific, organisational, financial, etc.)?
Amount of effort to collect and analyse the data at city level – would need to capitalise on existing knowledge and studies, e.g., conducting meta-analysis of information to compile an overview of the necessary fields of information to be made available through the platform.
Amount of effort to set up the platform, integrate the information and make it available to the intended users. Would need to think carefully how to deploy this on the ground and how to ensure it's used.
Legacy of the platform needs to be clarified, also to motivate collaborations. (Who ensures that is will sustain in the future?)

Title of the poster: ParisK

General Overview

Team Introduction: The ParisK team included two Paris-focussed stakeholders from the Paris City Government's Climate Office and a sustainability analyst in the private finance sector, and three members of the BSC team: two physical scientists working in I4C-WP3 and I4C-WP6, and one working in I4C-WP6, and one social scientist working in I4C-WP1 and I4C-WP6.

Poster Synopsis: The poster shows the process steps to create a tool that integrates climate information with socioeconomic and land-use/topological data to map the vulnerability and resilience of Paris neighbourhoods to heat and drought in the short and near term. It emphasises co-production activities throughout, identifies two user types, the sources of different data required and when different inputs are required during the design and maintenance of the tool.

Keywords: Map, vulnerability, heat, drought

Addressed Hazards

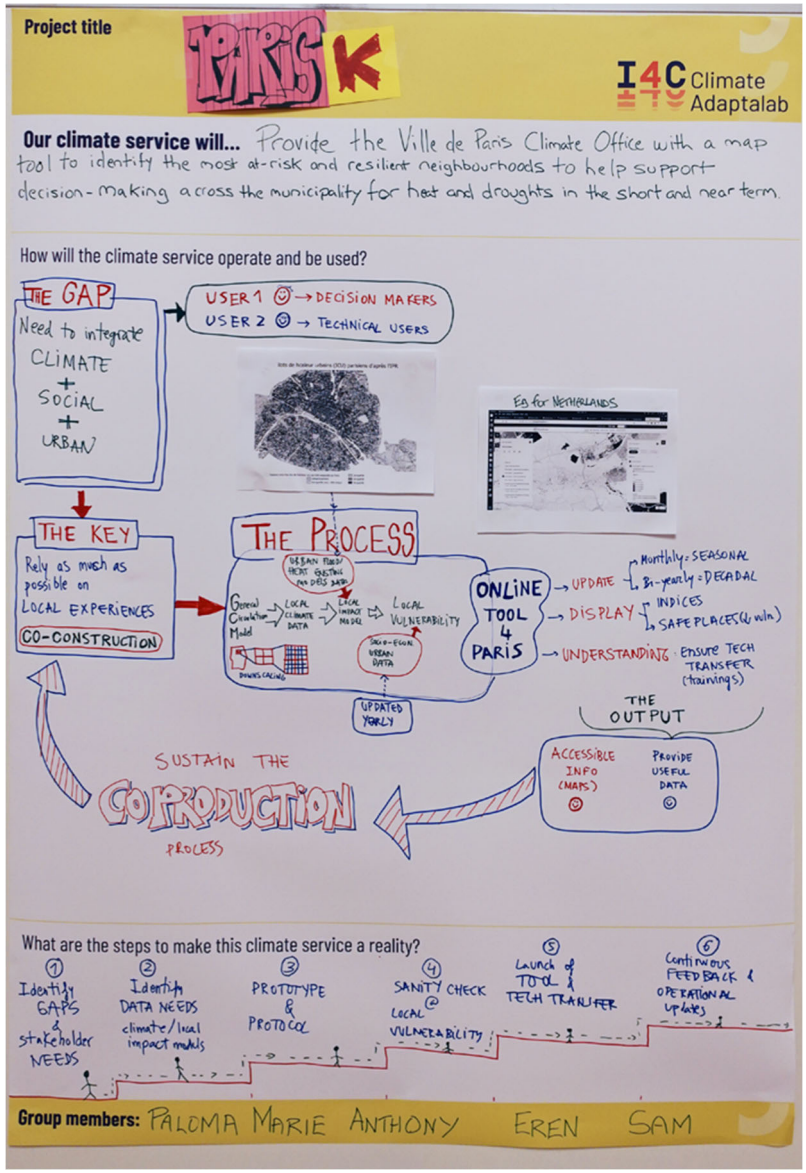
Urban heat and drought in the short and near term.

Target Audience

Intended Users: There are two types of intended users; for each ParisK aims to serve distinct purposes:

For technical users ParisK aims to provide raw and processed data. The aim is that this data can be further manipulated according to the user needs (this combined hazard/risk data is not currently compiled nor available)

Purpose: For decision-makers ParisK aims to provide accessible climate information in the form of vulnerability/resilience maps at the neighbourhood scale. The aim is to directly support decision making related to adaptation interventions by the Climate Office and to provide the Climate Office with materials to use in urban planning discussions with other local government stakeholders to raise awareness/facilitate understanding of the climate risks.



Information Provided

Content: Guided by the Paris stakeholder needs, the ParisK UCS provides visually appealing maps and the underlying climate vulnerability data to diagnose climate-change-aggravated hazards. At the highest level, ParisK provides a vulnerability index that will include factors deemed important by the different stakeholder groups (for example to show "safe spaces" as well as those areas with higher vulnerabilities).
Format: Different data inputs to ParisK are foreseen to be updated at different schedules:
Seasonal climate data will be updated monthly during the summer months to support short-term decision making.
Decadal climate data will be updated twice per year to support near-term decision making.
Socioeconomic data will be updated annually to reflect demographic changes and the implementation of adaptation interventions.
Scope: ParisK is envisaged to initially be an internal decision support tool, with the aim of eventually providing the information publicly once it could be assured that the data could not be mal-interpreted.

Territorial Scales
Targeted Scales: ParisK targets neighbourhood and municipality scales. A 1km grid of observations across Paris is available and would provide the basis for downscaling climate data to combine it with urban-scale flood, basin-scale drought, and neighbourhood-scale socioeconomic data.

Required Skills
Necessary Expertise: ParisK combines climate, earth systems and socioeconomic data, and thus requires a range of scientific/technical capacities alongside expert knowledge of municipal adaptation interventions.
Availability: The I4C team can provide the climate information, but the flood and drought mapping and socioeconomic data collection and manipulation would be provided by external stakeholders (the Paris Regional Authority and the Paris City Statistics team, respectively).

Challenges
Identified Obstacles: ParisK requires homogenisation of several data types to create two distinct outputs for different user groups (detailed data and accessible maps). This would require substantial co-construction and the need to build strong relationships to create the unified platform initially, and to sustain it as different data sources are updated. The initial obstacles are scientific and organisational (i.e. how to create a unified dataset), while the latter ones are organisational and financial (i.e. how to embed updating ParisK into different organisations' workflows).

Title of the poster: Multi-Adapt: Predictions for impacts across scales of Governance and Society

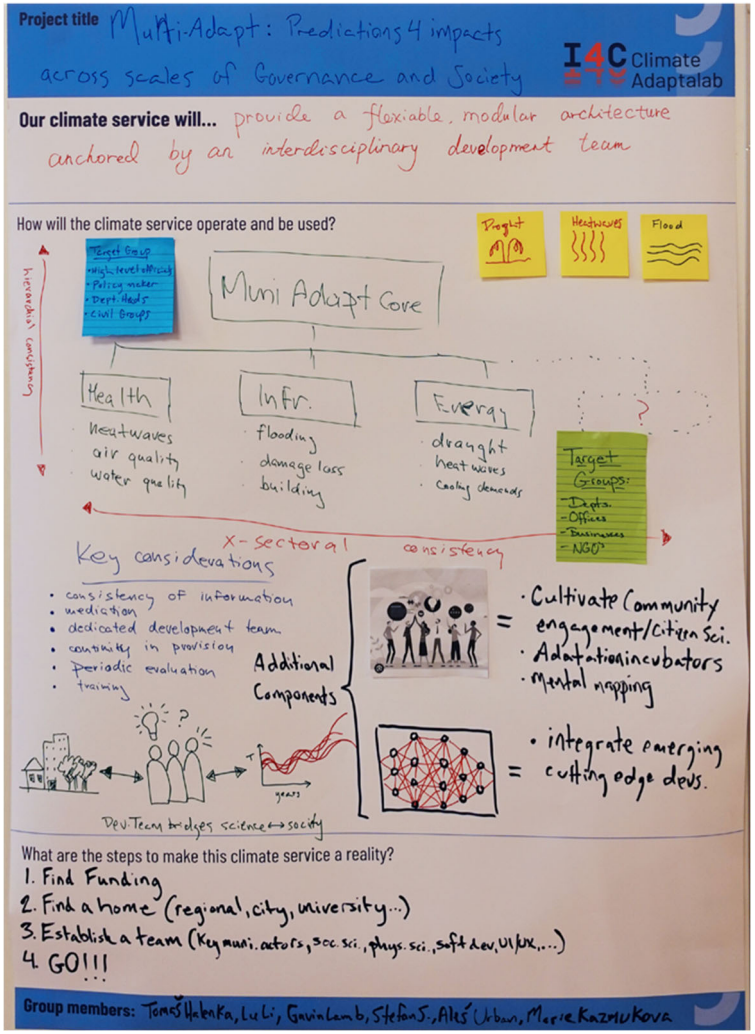
General Overview

an atmospheric scientist and expert in regional climate modelling (University in Prague, CU) representing I4C-WP6, an expert in modelling of relationships between climate and human health (Czech Academy of Sciences), a hydrologist and air quality specialist (Prague Institute of Planning and Development), a hydrologist and expert in hydrological modelling and extremes from NORCE working in I4C-WP6, an expert in how language and intercultural communication shape human relationships with the natural environment (NORCE) working in I4C-WP1, and an atmospheric scientist and expert in climate dynamics and regional climate modelling (NORCE)

Demonstrator city: Bergen and Prague

Poster Synopsis: The climate service aims to provide predictions for climate impacts across scales of governance and society. The service is characterized by a flexible, modular architecture and an interdisciplinary development team. It is specifically designed to be generalizable to diverse use-cases. Its aim is to foster consistency/continuity' in climate information hierarchically (in municipalities) and across sectors.

Keywords: health, infrastructures, energy, society, and governance, interdisciplinary.



Addressed Hazards

Heatwaves, water and air quality, floods, and energy-related challenges like drought and heatwave effects on e.g., cooling demands.

Target Audience

Intended Users: Municipalities, NGOs, and Businesses/Industries.

Purpose: It is intended to support various actions and decision-making processes such as urban and regional planning, building resilience against climate impacts, and community engagement in adaptation science.

Information Provided

Content: information on climate-related health issues, infrastructure vulnerabilities, and energy challenges.

Format: graphical/mapping representation and web interfaces.

Scope: it provides hazard diagnosis, impacts assessments, and possibly recommendations for adaptation.

Territorial Scales
Targeted Scales: it is a broad scope, potentially from local (municipality) to regional levels.

Required Skills
Necessary Expertise: Skills in climate science, hydrology and water resources management, energy system knowledge, data analysis, infrastructure and urban planning, public health expertise, software, and interface development, and possibly stakeholder engagement.
Availability: The skills are present in I4C except energy system knowledge and software engineer for software and interface development.

Challenges
Identified Obstacles: Challenges related to funding and finding a home for the project. Challenges related to building and maintaining the required multi-disciplinary team is required to underpin such an initiative.

Poster title: impACT

General Overview
one expert in meteorology and climate services (NORCE) working in I4C-WP6, one expert in modelling social systems (NORCE) working in I4C-WP1, an urban hydrologist (NORCE) working in I4C-WP6, a meteorologist and climate advisor (SWECO, Bergen), and one expert in medicine from the National Institute for Public Health, Prague.
Poster synopsis: Developing a website/application to warn citizens about near-term weather and climate-related hazards.
Keywords: climate hazards – impact warning – service – health

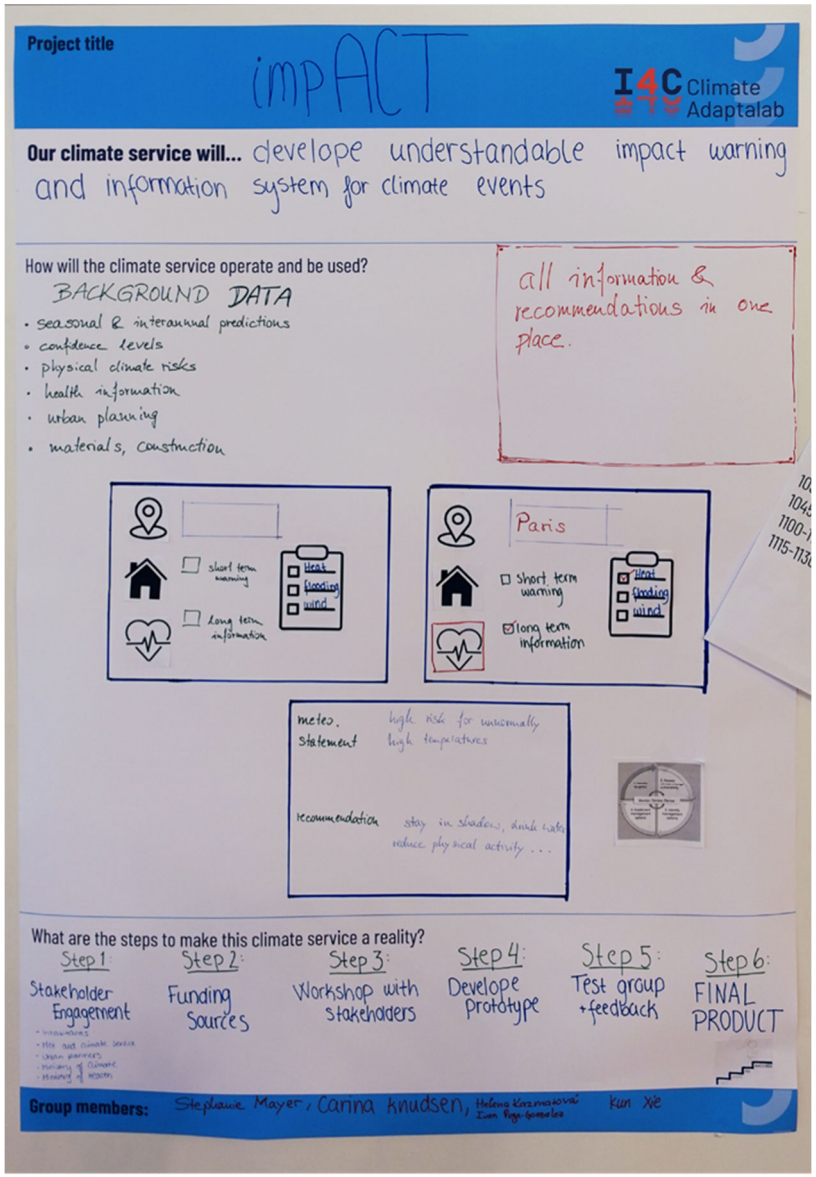
Addressed Hazards
heat – flooding – storms.

Target Audience
Intended users: all citizens.
Purpose: raising awareness, crisis management and reducing negative impacts

Information Provided
Content: impact warning and recommendations how to prepare and how to act
Format: graphics and text on website/app
Scope: not only hazard diagnosis but also recommendations how to adapt

Territorial Scales
Targeted scales: regional to urban areas. no discussion about spatial resolution

Required Skills



Necessary expertise: weather and seasonal prediction, expertise from medicine/biometeorology, architecture and building sector.
Availability: towards the end of I4C when new simulations are available.

Challenges
Identified obstacles: financing (time) and technical development (app/UX design?)

IMPETUS4CHANGE (I4C)

IMPROVING NEAR-TERM CLIMATE PREDICTIONS FOR SOCIETAL TRANSFORMATION

Grant agreement ID: 101081555

Call: HORIZON-CL5-2022-D1-02

Type of Action: HORIZON-RIA

Start date: 1 November 2022

Duration: 48 months

Website	impetus4change.eu
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