EVOKED

Enhancing the value of climate data

Deliverable 3.1

Field trial framework for the use of knowledge
concerning climate adaptation measures and their implementation

Work Package 3 – Co-Validate

Deliverable Work Package Leader:
Deltares

Revision: 0 – FINAL

23 April 2019

Project EVOKED is part of ERA4CS, an ERA-NET initiated by JPI Climate, and funded by RCN (NO), FORMAS (SE), NOW (NL), BMBF (DE) with co-funding by European Union (Grant 690462)

Note about contributors

Lead partner responsible for the deliverable:	Deltares
Deliverable prepared by:	Rutger van der Brugge, Gerald Jan Ellen, Gerben Koers, Kevin Raaphorst
Partner responsible for quality control:	NGI
Deliverable reviewed by:	Carl B. Harbitz
Other contributors:	All other projectpartners

Project information

Project period:	15. September 2017 – 14. September 2020
Duration (no. of months):	36
Web-site:	www.evoked.info
Project partners:	Norwegian Geotechnical Institute, Norway (p.nr. 20170408) Swedish Geotechnical Institute, Sweden Deltares, the Netherlands Christian-Albrechts University Kiel, Germany Larvik Municipality, Norway Värmland County Administrative Board, Sweden Province of North Brabant, the Netherlands Waterboard Drents Overijselse Delta, the Netherlands City of Flensburg, Germany

EVOKED

Acknowledgements

Research Funding organizations

Horizon 2020
European Union Funding
for Research & Innovation

This work is also supported by in-kind contribution from end-user partners:

Larvik Municipality, Norway

Värmland County Administrative Board, Sweden

Province of North Brabant, the Netherlands

Waterboard Drents Overijselse Delta, the Netherlands

City of Flensburg, Germany

Summary

This field trial framework aims to ensure that the various field trials at the EVOKED case study sites are carried out, as much as possible, in a consistent manner such that they may be cross compared, and lessons may be drawn. We do so by describing a framework using the key aspects of EVOKED:

- Climate services: the service of providing climate information in such a way that it supports decision-making, as well as benefiting society. Examples of such services are projections, trends, economic analysis
- Living Lab approach: an action-oriented research approach with committed stakeholders who actively participate in a real-life test and experimentation environment (i.e. laboratory) to test hypothesis, in this case hypotheses concerning climate services as well as coming up with solutions for complex problems such as climate adaptation or risk and uncertainty assessments.
- Information: the creation of information from climate data so that it becomes meaningful, useful for stakeholders and end-users in making decisions.

A series of hypotheses are formulated for each of these key aspects to translate the theoretical concepts into a field trial framework. Thus the goal of the field trials is to find ways in which climate information meets the needs of the end-users and to bridge the usability gap between the producers and users of information.

Contents

1 Introduction

The main objective of this field trial framework is to ensure that the various field trials at the EVOKED case study sites are carried out, as much as possible, in a consistent manner so that they may be cross compared, and lessons may be drawn. This comparison is not only important from a scientific perspective, but also from a practitioner's perspective as comparing also enables the case study sites to learn from each other. The application of the framework, however, should be flexible as each field trial has its own characteristics. To this end, deliverable D3.2 will include capacity building material including templates to be used during the field trials to guarantee this consistency.

2 Translating the theoretical concepts into a field trial framework

The overall objective of EVOKED is to reframe the risk and uncertainty associated with climate data into knowledge products more understandable and useful for end-users concerned with climate risk mitigation and adaptation. By doing so, EVOKED aims to enhance the value of the data that the scientific community produces for the end-users in decision making related to adaptive planning in relation to climate change.

To do so the EVOKED project focuses on three central elements:

- Climate services: A service that provides information about climate change, its impacts or adaptation measures for decision-makers as well as other stakeholders.
- Living Lab approach: an action-oriented research approach with committed stakeholders who actively participate in a real-life test and experimentation environment (i.e. laboratory) to test hypothesis, in this case hypotheses concerning climate services.
- Information: the creation of information from climate data so that it becomes meaningful, useful for stakeholders and end-users in making decisions.

In this chapter we outline these three concepts and how they will be used within the field trial framework.

2.1 Climate Services

Europe will be confronted increasingly with the effects of climate change in the future. In some regions this can lead to more droughts and heat stress, while in other areas increasing precipitation will become a leading problem (EEA, 2008; 2015). There is a need for climate adaptation to make sure that our contemporary society can endure these new challenges in the future. Decision-makers and other stakeholders need to understand their own responsibilities and obligations concerning climate change impacts and adaptation (Goosen et al., 2014).

Climate services offer information about climate change, its potential impacts and adaptation measures (Dutton, 2002; Visbeck, 2007; Hulme, 2009; Goosen et al., 2014; p.1036). The exact definition of climate services is still subject to debate. As a point of departure, EVOKED has looked to the European Commission's climate services initiative where it is recognized that the term **climate services** has a broad meaning (EC, 2015 in SGI, 2018). Further to this working definition, EVOKED has explored the subject in more detail to clearly illustrate how the concept can be used in EVOKED.

2.1.1 Climate services within EVOKED

Table 1 presents an overview of definitions. Based on these definitions, we distinguish the following shared elements. Climate services:

- provide useful information and knowledge related to climate change or climate change impacts.
- are used for (climate) informed decision-making by decision-makers, including non-governmental/private individuals and organisations.
- act as guidance and counselling in its use.
- are the transformation of climate data into customized products.
- encompass a variety of different tools, such as projections, scenarios, and assessments.
- support climate change adaptation, mitigation and disaster risk management.
- are produced as a result of a specific demand (user-driven).

Table 1 Overview of different definitions of climate services (Goosen et al., 2014, p.1036; Brasseur & Gallardo, 2016, p.80)

Definitions of Climate Services	**Sources**
"Offering information on climate change and its potential impacts in support of adaptation."	Dutton (2002); Visbeck (2007); Hulme (2009); Goosen et al. (2014)
"The timely production and delivery of useful climate data and knowledge to decision makers."	National Research Council (2001)
"Climate information provided in a way that assists decision making by individuals and organizations. Requires appropriate engagement along with an effective access mechanism and must respond to user needs."	Hewit et al. (2012)
"Transformation of climate-related data—together with other relevant information—into customized products such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessments), counselling on best practices, development and evaluation of solution, and other services in relation to climate that may be of use for society at large. Includes data, information, and knowledge that support adaptation, mitigation, and disaster risk management."	European Commission (2015)
"Production, translation, transfer, and use of climate knowledge and information in climate-informed decision making and climate-smart policy and planning."	Climate Services Partnership (2018)
"User-driven development and provision of knowledge for understanding the climate, climate change and its impacts, as well as guidance in its use to researchers and decision makers in policy and business."	Joint Programme Initiative (2015)

As such we can define climate services as:

> *'A service that provides information about climate change, its impacts or adaptation measures for decision-makers as well as other stakeholders.'*

These services can be tools, projections, scenarios, assessments or risk maps that support decision making, but also expert-advice, counselling or managing climate adaptation processes. The goal of climate services is to support decision-making and can be directed towards various end-users: politicians, managers, private enterprises, inhabitants etc. Climate services also play a role in education and awareness-raising (Medri et al., 2012).

Hamaker et al. (2017) distinguish between climate data services, adaptation services, mitigation services and disaster risk management (see Figure 1). According to Hamaker et al. (2017) climate services are based on observational data (satellite data, measurements). These data are used as input for climate data services (climate models, forecasting, maps) to assess useful information, often related to climate change impacts (Hamaker et al., 2017). Based on these insights, adaptation plans, mitigation plans, and disaster risk reduction plans are developed. These plans can then lead to the actual action: implementation of measures.

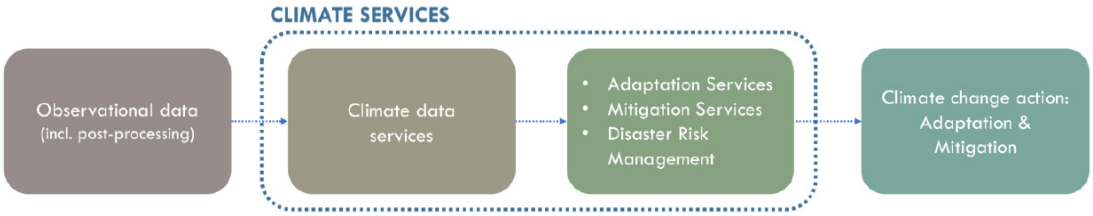

Figure 1: Categorization of climate services by Hamaker et al. (2017, p. 11).

In this model, the climate service is a combination of the information (often modelling output) and the response (a plan). In EVOKED, we put forward the view that the development process of climate services can be less linear, for example, by involving end-users in the design of the climate service. We will attempt to create a feedback loop between the produced climate services and the resulting climate change actions.

Living Labs (section 2.2) will be established at each of the case study sites and subsequently will establish such a feedback loop by articulating the needs of the end-users and invite them to co-create the climate service. This brings us to EVOKED's main research question: *how to reframe climate data into knowledge products more understandable and useful for end-users concerned with risk mitigation and adaptation?*

2.1.2 Hypotheses

Currently, we observe that there is not a wide variety of climate services available. A review of climate services available via the European climate adaptation platform presented in table 2 indicates that the majority of climate services are providing

information with regard to the planning phase and only a marginal number of tools focus on the acting phase. The current use of scientific knowledge within climate services is focused on providing, rather than communicating, climate information. Thus, the problem facing end-users is not a "lack of knowledge", but rather (i) knowing which knowledge to use and when, as well as (ii) knowing how to deal with risks and uncertainties related to different kinds of climate knowledge.

Tabel 2: Overview of existing climate adaptation support tools. Adapted from available tools via the European climate adaptation platform (http://climate-adapt.eea.europa.eu). The table gives an overview and some tools can adres multiple subjects.

Subject	Subdivision of subject	Number of tools
Challenge	Water management	32
	Disaster risk reduction	21
	Coastal management	26
Goal of the tool	Prepare/inform	41
	Predict	24
	Design to decide	14
	Dialogue	10
Techniques used	Mapping	27
	3D visualisation	2
	Tables/metrics	32
	Photos/visuals	6
At which stage	Plan	48
	Do	20
	Check	14
	Act	7
Scale	National	30
	Regional	24
	Local	29
Used elements of solutions	Participatory planning support tools on decision making	6
	User centred design of model	16
	Collaborative/Interactive modelling	5
	Visualisation	19

The observations in the table imply that there potentially exists a usability gap to which Lemos et al. (2012) are referring as there is a chance that these tools do not cover all information needs for climate impacts (e.g. lack of tools about heat stress or drought, etc.). This gap is also addressed by Weaver et al. (2013) who argue that the gap results from a mismatch between the delivered climate services, which are often projected on a large spatial scale and require technical expertise to understand, and the required

information for the local end-users to develop policies, allocate budgets, or implement measures (Harrison & Williams, 2007; Lemos et al., 2012; Weaver et al., 2013).

As a result, planners and policy makers perceive the information provided by these climate services as uncertain, too geographically and temporally distant, and to be solved elsewhere rather than at the municipal level. This perception is reinforced by a lack of knowledge of the precise impacts of climate effects at the local scale (Wilson, 2006; Goosen et al., 2014, p.1036). Weaver et al. (2013) point out that these problems with climate services' usability gaps can lead to a delay in decision making by end-users, which can consequently lead to a delay of taking climate adaptation and mitigation measures.

In EVOKED we are investigating the existence and characteristics of these usability gaps regarding climate services. Our first hypothesis is:

- 1a) A usability gap is present in the climate services that are used in the case study sites.
- 1b) This usability gap is caused by a missing feedback loop from the end-users to the producers of the climate service.

Our hypothesis is presented in Figure 2. The usability gap is located between the climate services and the climate change action. The arrows represent the missing feedback loops between the end-users and the producers of the climate services.

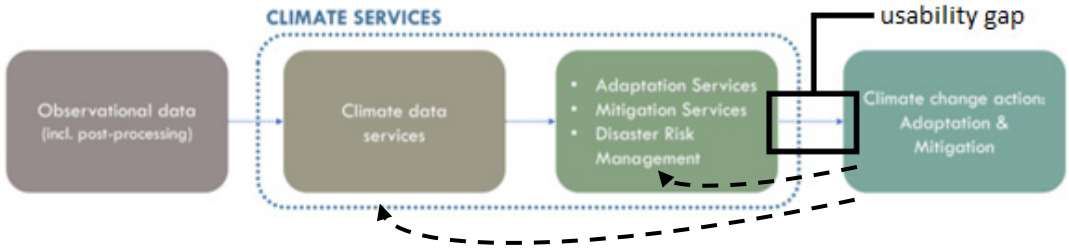

Figure 2: Climate services by Hamaker et al. (2017, p. 11) with the location of the usability gap (Lemos et al., 2012) and the necessary feedback loops.

In order to investigate how we can establish this feedback, EVOKED will be initiating Living Labs. In some of these Living Labs, existing climate services will be taken as point of departure while, in others, completely new climate services may need to be developed.

2.2 Living Labs

2.2.1 Living Labs within EVOKED

A second theoretical concept within EVOKED is the Living Lab. The Living Lab approach is thought to be a useful approach to establish a firm feedback loop between the end-users and the producers of the climate service. Hence, the Living Labs might help to bridge the usability gap. In the EVOKED project we test whether this approach is indeed useful.

Living Labs have been emerging as a form of collective governance and experimentation to address societal challenges and opportunities on many subjects, e.g. urbanization, climate change, and health. A Living Lab is an ongoing, iterative process. It is much more than just a workshop or observation of activities; it involves active participation of various stakeholders in a number of events and forums for testing and producing a climate service (SGI, 2018).

Each Living Lab within the EVOKED project will look slightly different depending on the climate service that will be produced, the climate issue at hand, the people involved and the context (geographical, social, and institutional). Each Living Lab will be composed of a collection of activities such as workshops, interviews, focus group activities, surveys, as well as policy studies (see Figure 3).

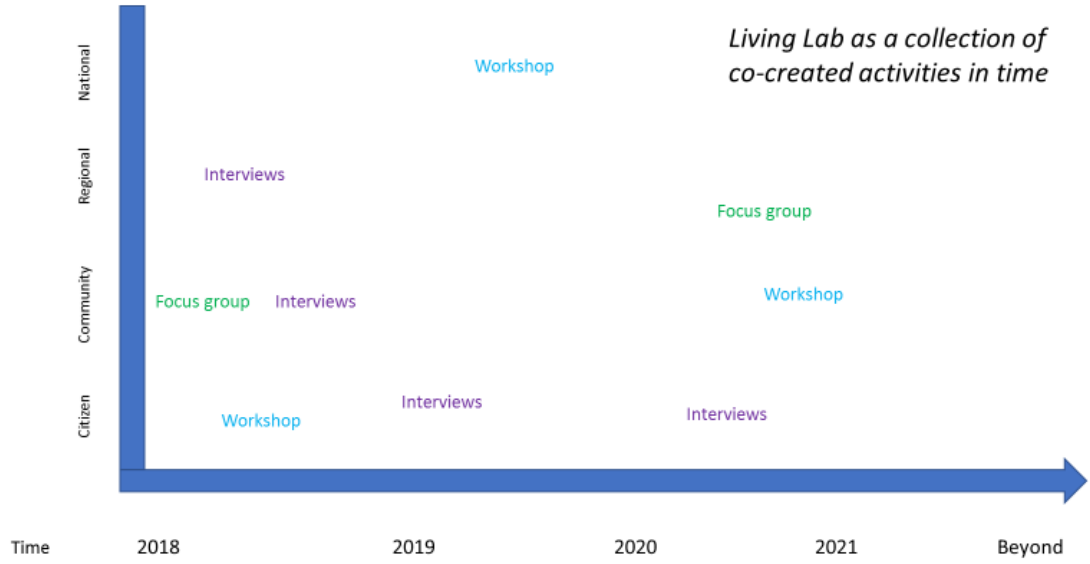

Figure 3: Example of Living Lab as a collection of co-crated activities in time (SGI, 2018).

2.2.2 Hypothesis

The principles of the EVOKED Living Labs approach are described in Deliverable 1.1 (SGI, 2018). The key principles of Living Labs that are incorporated within EVOKED are:

- Continuity;
- Openness;
- Realism;
- Influence;
- Value:
- Sustainability

Regarding the Living Labs as a theoretical concept, our second hypothesis is:

- 2a) Living labs are beneficial environments to create a feedback loop between the producer and user of the climate service.
- 2b) Each of these organisational principles of the Living Lab is necessary to establish this feedback loop.

Organising Living Labs according to the principles above can be accomplished in different ways. Each Living Lab will be unique at the case study sites and as such, these Living Lab principles will be applied in a slightly different way. These differences are useful and allow the EVOKED partners to cross compare the Living Labs with regard to the effectiveness of bridging the usability gap.

In the field trials we especially would like to rely on using the questionnaire that is developed for *Deliverable 4.1*. By using this questionnaire, the key principles of the living lab (as displayed above) can be evaluated by using a survey. This way the end-users at each meeting can assess the extent to which these principles were expressed during the meeting (e.g. perceived levels of experimentation, ownership). The usability gap can be measured by evaluating whether and why the end-users are going to actually use the climate service. In addition, the end-users' satisfaction can be evaluated as well. If their satisfaction of a modified climate service is high during a subsequent meeting, we may assume that the inclusion of a feedback loop from end users to the producers of climate services during the development can help to bridge the usability-gap mentioned by Lemos et al. (2012).

2.3 Climate information

Bridging the usability gap provides the right information to the right end-user; however, bridging this gap requires a deeper understanding of climate information. Thus, the third theoretical concept in EVOKED is that of climate information which is understood as the processed, organized, structured, and presented version of raw unorganized climate data in a given context (Hamaker et al., 2017).

2.3.1 Climate information within EVOKED

During the process of translating raw data into useful information, choices are made about the processing, organizing, structuring, and presenting data. Furthermore, choices are also made about the message that these data is intended to convey to a particular audience. These choices are often made implicitly.

In the EVOKED field trials, we want to experiment with climate information by involving the end-users in the information design (i.e. the way in which information is presented, Horn, 1999). Information design focuses on the communication of information to receivers. This process of visual communication consists of three stages: the i) production, the ii) image, and the iii) audience stage (see Figure 4). Information design can potentially serve as a bridge between science and policy since the form of (raw) research data is often inadequate for the communication of findings to policy-makers (Wurman, 1989). In other words: "*to make data valuable, it has to be structured, transformed and presented in a meaningful way*" (Kazmierczak, 2003; Goosen et al., 2014). This may be, for example, in the form of a report or a map, as well as many other ways of communicating information depending entirely on the message and the intended audience for this information.

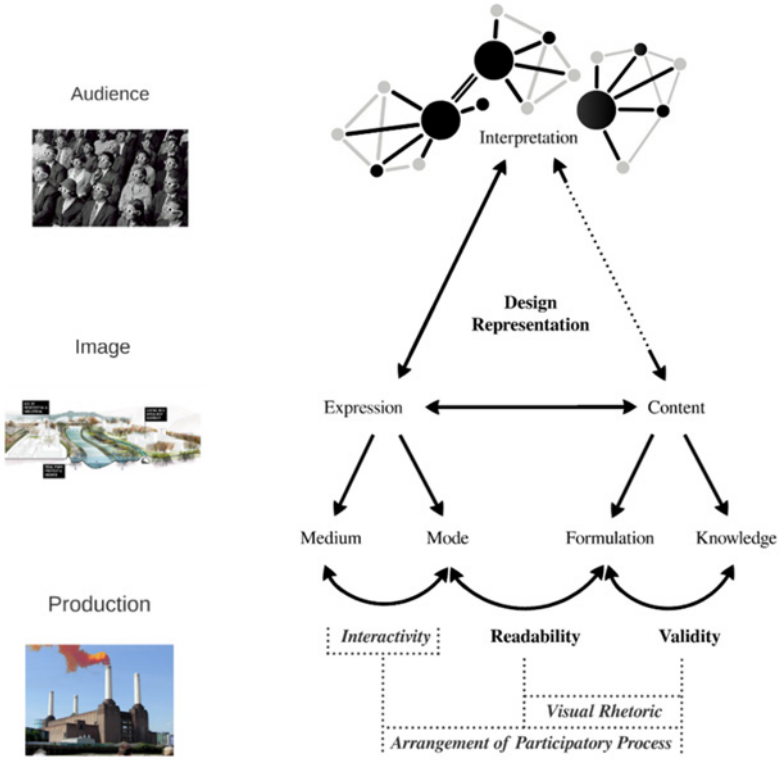

Figure 4: Critical visual research framework (Raaphorst et al., 2018)

This notion of visual communication in information design is important to guide the development of alternative climate information designs in the EVOKED field trials. For example, an extensive technical report may be of value for someone working in a government department who has an extensive background in his or her field, but it could also appear as a report full of difficult, technical language to citizens. On the other hand, showing photographs to citizens that illustrate the impact of urban flooding or property damage may communicate the same information much better.

The development of climate services with information design for different actor groups can be set up by using a methodology of climate information design (Figure 5, adapted from Raaphorst et al., 2018). This methodology assumes that climate service visualizations have an implicit or explicit goal, and that the quality of visualization depends on the extent to which that goal is achieved. Climate data visualizations that do not lead to the appropriate action by its targeted audience are therefore considered unsuccessful. Such miscommunication occurs due to inconsistency in any of the visual communication components: (1) the appropriate knowledge, (2) framed for a specific audience, (3) readable in its choice of visual expression, and (4) presented on an appropriate medium, leads to (5) the desired interpretation (and resulting action).

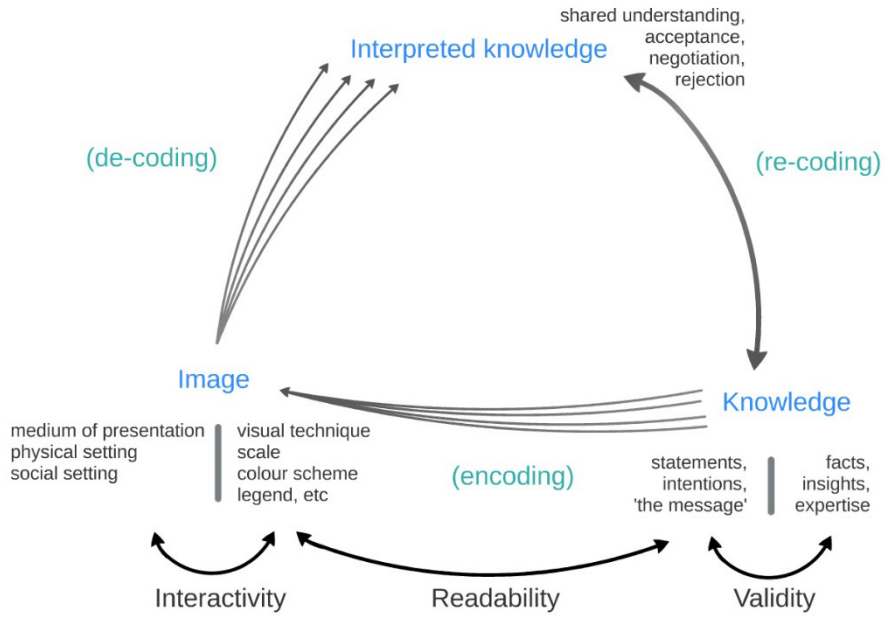

Figure 5: The methodology of climate information design. Adapted from Raaphorst et al. (2018)

Three important communicative qualities are distinguished within this methodology of climate information design: validity, readability, and interactivity. Validity entails whether the type of climate information presented is appropriate, and whether the message (or in the case of a climate service: implied levels of risk, responsibilities to act) are perceived as accurate or credible. Readability constitutes whether the climate information and the intended message of the content is visualized in a way that the

targeted audience understands. In this case, successful communication is not primarily dependent on the type of information, or credibility of risk calculations, but rather the visual language used. Finally, interactivity depends on both the physical medium on which the climate service is presented (printed poster, projector screen, web interface), and the social setting (desired level of participation) where the climate service is used.

2.3.2 Hypothesis

In the field trials, the goal is to find ways in which climate information meets the needs of the end-users and to bridge the usability gap between the producers and users of information. Experimenting with various components of information designs (e.g. type of climate information, framing, visual expression, medium, and type of audience) will help to determine the type of usability gap (i.e. validity, readability, and/or interactivity) and to improve the design of the climate service with each iteration. These field trials may result in climate services that are better attuned to the end-users' needs.

Our third hypothesis is:

- 3a) Information designs connect produced information to the end-user
- 3b Information designs are necessary tools to establish the feedback loops between the end-users and the producers of climate services.

How to conduct these field trials in the EVOKED Living Labs context is further discussed Section 3 in this document.

2.4 Overall objective of the field trials

During the policy cycle, the need for climate-related information changes (fig. 6). For example, during the agenda-setting phase this might be information concerning climate change impacts, whereas during the implementation phase information about climate policies and perceptions of stakeholders regarding climate change impacts are needed. Hence, there are many different types of climate information needed throughout the cycle, while most existing climate services focusses only on the first phases of the policy cycle and subsequently only a small audience is involved.

The overall objective is therefore to contribute to our understanding of what climate services are needed during the entire policy cycle and what they should look like. This will be investigated in the various case-studies.

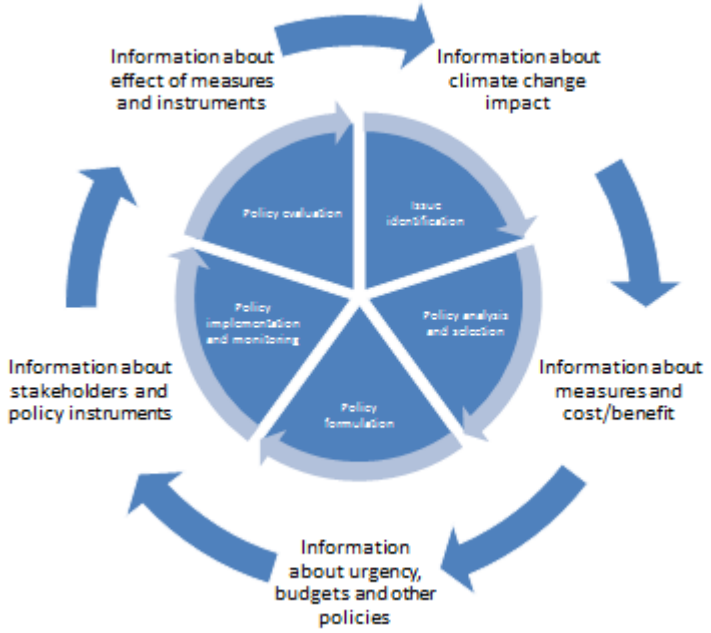

Figure 6: Climate information needs during the policy cycle

2.5 Cross comparison of the case study sites

The research results from the different Living Labs will be evaluated as part of the EVOKED project. As mentioned before, the case study sites will be different, but the methodology should be (more or less) similar to compare the results. In general, the evaluation could be a cross comparative analysis consisting of three steps:

1. Conducting an inventory of common practice: What kind of information design is currently applied in climate services? This means getting insight into visualization strategies and knowledge products that are currently used for communicating climate data, and into what their communicative qualities are.
2. Conducting an inventory of perception: What are the risks and uncertainties commonly associated with climate data by end-users, how do the end-users see their responsibilities and the urgency to act, and to what extent do the current interpretations lead to actions of climate adaptation?
3. Visualization of climate data: What appropriate climate information design, for the successful development of knowledge products/climate services, leads to the appropriate action by end-users?

This succession of steps will result in: a systematic evaluation of the climate information designs and thus of the communicative qualities of currently used climate services; insight into the different information needs, perceptions of risk and uncertainty, and the responsibilities and roles of different stakeholder groups; a set of visualization principles and visualization strategies for stakeholder specific climate services.

3 Method & practical guidelines and how to set up the Living Labs and field trials

This chapter translates the theoretical framework presented in Section 2 into activities and practical guidelines for the field trials in the Living Labs.

3.1 Research questions in the case study sites

Within EVOKED there are five case study sites (fig. 7), in which we attempt to verify or falsify the hypotheses described in Section 2 of this report:

- 1a) A usability gap is present in the climate services that are used in the case study sites.
- 1b) This usability gap is caused by a missing feedback loop from the end-users to the producers of the climate service.
- 2a) Living labs are beneficial environments to create this feedback loop between the producer and user of the climate service.
- 2b) Each of the organisational principles of the Living Lab is necessary to establish this feedback loop.
- 3a) Information designs convey produced information to the end-user
- 3b Information designs are necessary tools to establish the feedback loops between the end-users and the producers of climate services.

The following sections describe the general activities in the framework. In deliverable D3.2 the capacity building material supporting the methods will be provided (Deltares, 2019).

The activities mirror the general EVOKED methodology of (i) the co-design process in Work Package 1 (WP1); ii) the co-development of products in Work Package 2 (WP2); iii) co-validation of operational products in Work Package 3 (WP3); and subsequently iv) co-evaluate to assess the user experience in Work Package 4 (WP4). This general methodology is scaled down for application in the field trials as described in more detail in the following sections.

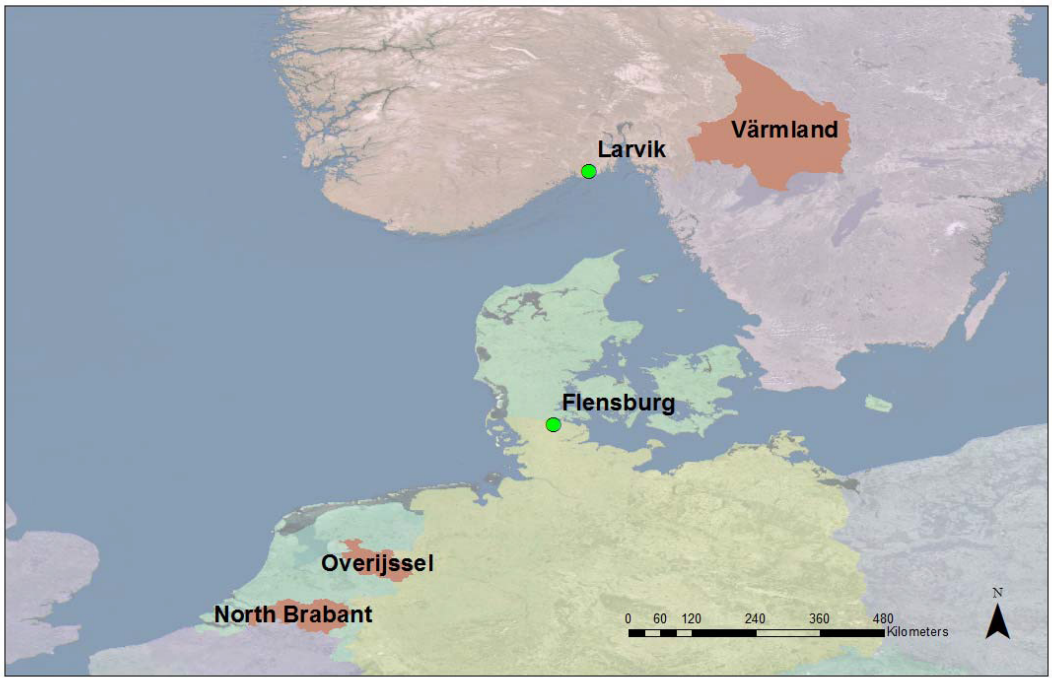

Figure 7. The five case-study sites focused upon in the EVOKED and their geographical location within the partner countries.

3.2 Co-design

The first step of the framework is the co-design phase consisting of five activities:

- Scoping
- Initiating the Living Lab
- Problem framing
- Design of the Living Lab
- Methods and tools

3.2.1 Scoping: stakeholders, physical and institutional context

The first activity is to scope the general context of the case study site in relation to climate change. The information gathered (as part of WP1) sets the context of the climate change problems, geographical boundaries and governance issues for the Living Lab and anchoring of the climate services to the end-users. This information already collected in WP1 subsequently provides a point of departure for the Field Trials, so although there may be overlap, this activity as part of WP3 is specific to the Field Trials. For this, the three scoping templates that were developed in WP1 (SGI, 2018) should be used.

- Stakeholder analyses;
- Territorial governance template;

- Needs and visions template;

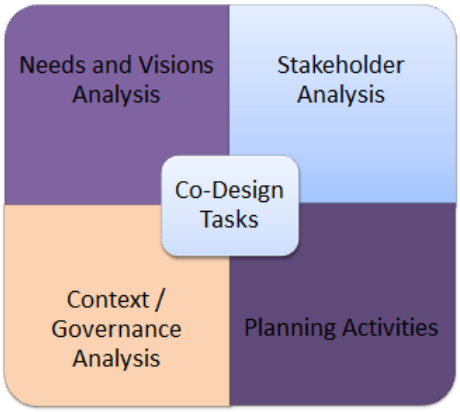

Figure 8. Templates of work package 1.

These templates help to understand the context in terms of climate impacts in the area and also in terms of governance, which again helps to identify the people who should participate in the Living Lab. At the same time, the scenario planning part of WP2 (University of Kiel, 2019) can be used to identify the most important climate effects for each case.

3.2.2 Initiating the Field Trial

Initiating the Living Lab means inviting people to participate in the field trial concerning the climate services for the most important/challenging effects of climate change. The aim is to verify the hypotheses posed in section 3.1. To be able to do so the scoping templates of WP1 (SGI, 2018) help to get a clearer understanding about:

- Key Partners
- Resources
- Time-span
- Frequency of meetings, discussions, events

When asking a person to participate, several things should be clear:

- What is the goal of the process?
- What is in it for the participant?
- How much time will it take?
- What is expected of him/her?

After participants are asked and agreed to participate, a kick-off meeting should be organized.

3.2.3 Problem framing

After the Living Lab is initiated, one or more field trials can be initiated. First activity is to specify which topics (problems or opportunities) related to climate change adaptation should be addressed in the field trial and which climate service(s) will be the main subject while addressing the hypotheses.

The climate service will be analysed through its information design (Figure 8). It helps to identify the stakeholder, the information's purpose, the presented information and the visual format.

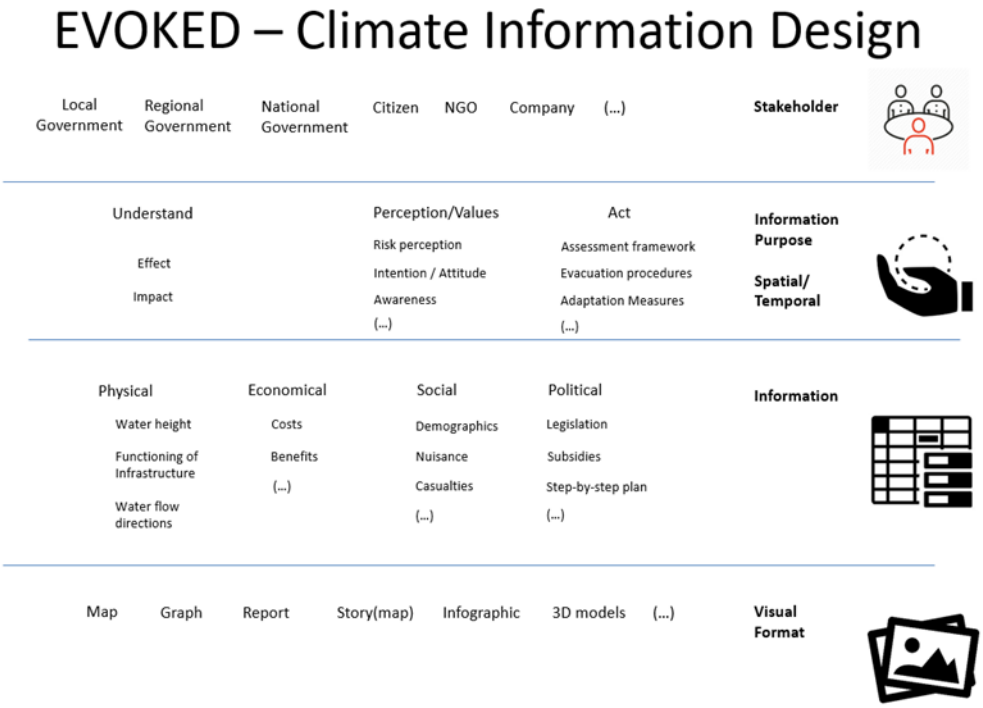

Figure 9: The Climate Information Design-framework that can be used for analysing existing climate services and the needs of users in order to identify potential usability gaps. Adapted from Raaphorst et al., 2018.

Figure 9 gives a visual representation of an inventory of current climate services in the Living Lab area. This will provide insight in a) audience b) information production, c) information carrier (visual format) and is based on the framework of climate information design.

Figure 9 furthermore helps to identify the usability gap by combining the needs with the information design of the climate service. For instance, one of the identified stakeholder groups are laymen residents, but if the existing climate service consists of risk maps designed for trained government officials, the climate service should be *reframed*, by altering its information design.

By experimenting in the field trial with different components of the information designs, the most useful frame can be found. For instance:

- One alternative might be to adjust the information on the map. Maybe it is more useful to project the highest possible damages per household rather than the risk.
- Another alternative could be altering the information carrier (format in figure 9), for example, by using illustrated narratives of personal experiences of the effects of climate change instead of a map. The fact that we are using the narratives of WP2 (University of Kiel, 2019) as a field trial in appropriate cases could already be an experiment. But then it is important to address how they are experienced by the end-users.

3.2.4 Design of the Field Trials

The goal of the field trial is to identify the information design of the climate service that fits best with the end-users needs, and as such will be bridging the usability gap. The number of field trials for each of the EVOKED Living Labs will vary and will depend on whether the Living Lab focuses on:

- new climate services, or on adjusting existing climate services
- awareness raising, or on measures
- multiple climate effects, or one a single climate effect

The overall goal for EVOKED is that at least each case study site completes (at least) one field trial including iterative co-evaluations activities.

3.2.5 Methods and tools: setting up a field trial project plan.

For each field trial, a plan should be formulated, which builds further on the results of as described in Deliverable 1.1 section 4 (SGI, 2018). Deliverable 3.2 (Deltares, 2019) will provide a more detailed workflow and capacity building materials to support the EVOKED partners with preparing their field trial(s). The field trial plan will elaborate on the following questions:

Inventory of climate services and end-user information needs

1. What are the biggest climate related problems for the end-user?
2. Which stakeholders are needed and what kind of climate information do they need?
3. Which climate services are currently available in the case study area?
   a. Validity: what kind of climate data are available and do we need to change/simplify available climate information?
   b. Readability: what visual language is used to communicate the climate data, and do we need to change/simplify the image?
   c. Interactivity: what type of medium of presentation is used in what kind of setting, and do we need to change/simplify the possibilities of interaction?

4. What problems are encountered in the current use of climate services?
5. Which climate service(s) is/are likely to give the highest added value in the case study area?

Developing an alternative climate information design

6. How can the existing climate service(s) be adapted in order to fulfil their information need(s)[see question 2]?
   d. Do we need to reach another audience?
   e. Do we need to adjust the (climate) information?
   f. Do we need to change the information carrier (map, infographic, impression, etc.)?

Based on the answers concerning question 6: create an information design that is assumed to address this.

Testing the alternative climate information design

7. Test this created alternative information design (based on one or more climate services) by:

g. Testing the climate service on another audience
h. Testing the climate service where additional (climate) information has been added.
i. Testing the new/adapted climate service by using a different information carrier (map, images, video, etc.)

3.3 Executing the field trial

During this phase the field trials are executed.

The first activity is to initiate the pilot. This may potentially require the inclusion of new stakeholders beyond the ones that are cooperated with during the setting up of the field trial. These people should be considered as the actual end-users. The needs of the end-users are made explicit. What kind of information would they like (to trigger them into action?) And how should this information be brought to them? The collection of these end-user needs is therefore an important second activity in this phase.

Finally, the third activity is the most crucial one as the collected data is turned into specific information designs, according to the user needs. These information designs are presented to the end-users. A number of information designs can be made and compared. In subsequent workshops adjusted information designs can be presented. The response of the end-users should be recorded in order to monitor progress.

3.4 Co-evaluate

Co-evaluation takes place repeatedly during the field trial Living Labs. Each time information design is used to develop or revise a climate service, the responses of the stakeholders participating in the Living Labs should be evaluated. The monitoring

method for the field trials is to use the questionnaire developed as part of EVOKED WP4. This assessment and the analysis of results at each case study site will help bridge the usability gap for the new climate services that are designed. After the field trials are completed, cross comparison between the case study sites will be an important aspect to study to assess overall lessons with regard to:

- Successes and failures
- Potential of extension
- Application elsewhere
- Policy recommendations

4 References

Bessembinder, J., Bley, D., Manez, M. & Zölch, T. (2013). The role of climate services in communication between science and policy - integrating knowledge across sectors and countries. Available: http://edepot.wur.nl/328554. Last accessed 25th Feb 2018.

Brasseur, G. & Gallardo, L. (2016). Climate services: Lessons learned and future prospects. Earth's Future. 4 (3), p. 79-89.

Climate-ADAPT (n.d.). The Adaptation Support Tool – Getting started. Available: http://climate-adapt.eea.europa.eu/knowledge/tools/adaptation-support-tool. Last accessed 26th Feb 2018.

Climate Services Partnerships. (n.d.). What are Climate Services?.Available: http://www.climate-services.org/about-us/what-are-climate-services/. Last accessed 8th Mar 2018.

Dutton, J. (2002). Opportunities and priorities in a new era for weather and climate services. American Meteorological Society. 83 (9), p. 1303-1311.

EEA. (2008). EEA Briefing: Impacts of Europe's changing climate.Available: https://www.eea.europa.eu/publications/briefing_2008_3/download. Last accessed 8th Feb 2018.

EEA. (2015). Climate change impacts and adaptation. Available: https://www.eea.europa.eu/soer-2015/europe/climate-change-impacts-and-adaptation. Last accessed 8th Feb 2018.

European Commission. (2015). A European research and innovation roadmap for climate services. Available: https://ec.europa.eu/programmes/horizon2020/en/news/european-research-and-innovation-roadmap-climate-services. Last accessed 6th Mar 2018.

Giorgi, F., Jones, C. & Asrar, G. (2009). Addressing climate information needs at the regional level: the CORDEX framework. Available: http://wcrp.ipsl.jussieu.fr/cordex/documents/CORDEX_giorgi_WMO.pdf. Last accessed 6th Feb 2018.

Goosen, H., De Groot-Reichwein, M., Masselink, L., Koekoek, A., Swart, R., Bessembinder, J., Witte, J., Stuyt, L., Blom-Zandstra, G. & Immerzeel, W. (2014). Climate Adaptation Services for the Netherlands: an operational approach to support spatial adaptation planning. Regional Environmental Change. 14 (3), p. 1035-1048.

Hamaker, R., Jiménez-Alonso, E., Rycerz, A., Baglee, A. & Stegmaier, P . (2017). Analysis of Existing Data Infrastructure for Climate Services. Available: http://eu-macs.eu/wp-content/uploads/2017/08/EU-MACS_D13_submitted_14072017.pdf. Last accessed 6th Feb 2018.

Harrison, M. & Williams, J. (2007). Communicating Seasonal Forecasts. In: Troccoli, A., Harrison, M., Anderson, D. & Mason, S. Seasonal Climate: Forecasting and Managing Risk. Dordrecht: Springer Academic Publishers. p. 299-322.

Hewitt, C., Mason, S. & Walland, D. (2012). The Global Framework for Climate Services. Nature Climate Change. 2 (12), p. 831-832.

Hulme, M (2009). Why we disagree about climate change: Understanding controversy, inaction and opportunity. Cambridge: Cambridge University Press. p. 1-432.

Joint Programme Initiative. (2015). Workshop Demand driven climate services in Europe, 11-12 June 2015, Brussels. Available: http://www.jpi-climate.eu/workshopdemanddrivenclimateservices inEurope2015. Last accessed 6th Mar 2018.

Lemos, M., Kirchhoff, C. & Ramprasad, V. (2012). Narrowing the climate information usability gap. Nature Climate Change. 2 (11), p. 789-794.

Measham, T., Preston, B., Smith, T., Brooke, C., Gorddard, R. & Withycombe, G. (2011). Adapting to climate change through local municipal planning: barriers and challenges. Mitigation and Adaptation Strategies for Global Change. 16 (8), p. 889-909.

Medri, S., Banos de Guisasola, E. & Gualdi, S. (2012). Overview of the Main International Climate Services. Available: https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID2194841_code1235432.pdf?abstractid=2194841&mirid=1&type=2. Last accessed 8th Mar 2018.

Miralles-Wilhelm, F. & Castillo, R. (2015). Climate services: a tool for adaptation to climate change in Latin America and the Caribbean - Action plan and case study applications. Available: https://publications.iadb.org/handle/11319/6845. Last accessed 26th Feb 2018.

Mols, J. & Schut, M. (2012). Gemeentelijke aansprakelijkheid bij wateroverlast - Wetgeving, rechtspraak en praktijkvoorbeelden. Available: http://edepot.wur.nl/196928. Last accessed 8th Mar 2018.

OECD. (2014). Water Governance in the Netherlands - Fit for the Future?. Available: http://www.oecd.org/gov/regional-policy/publicationsdocuments/BrochureWaterNL%20.pdf.. Last accessed 21th Dec 2017.

Raaphorst, K., Duchhart, I., Van der Knaap, W., Roeleveld, G. & Van den Brink, A. (2017). The semiotics of landscape design communication: towards a critical visual research approach in landscape architecture. Landscape Research. 42 (1), p. 120-133.

Raaphorst, K. (2018). Knowing your audience: the contingency of landscape design interpretations. Journal of Urban Design.

Raaphorst, K., Roeleveld, G., Duchhart, I., van der Knaap, W., & van den Brink, A. (forthcoming). Reading landscape design representations as an interplay of validity, readability, and interactivity: a framework for visual content analysis. Visual Communication.

SGI (2018). Living Lab Co-Design Requirements Guiding Paper. Deliverable D1.1 of the EVOKED (Enhancing the Value of Climate Data) Project. 16.05.2018, 22 pp.

University of Kiel (2019). Deliverable D2.1 of the EVOKED (Enhancing the Value of Climate Data)

Uittenbroek, C., Jansen-Jansen, L. & Runhaar, H. (2013). Mainstreaming climate adaptation into urban planning: overcoming barriers, seizing opportunities and evaluating the results in two Dutch case studies. Regional Environmental Change. 13 (2), p. 399-411.

Visbeck, M. (2007). From climate assessment to climate services. Nature Geoscience. 1 (1), p. 2-3.

Weaver, C., Lempert, R., Brown, C., Hall, J., Revell, D. & Sarewitz, D. (2013). Improving the contribution of climate model information to decision making: the value and demands of robust decision frameworks. WIREs Climate Change. 4 (1), p. 39-60.

Wilson, E. (2006). Adapting to Climate Change at the Local Level: The Spatial Planning Response. Local Environment. 11 (6), p. 609-625.

Review and reference page

Document information	
Deliverable title Field trials framework for the use of knowledge concerning climate adaptation measures and their implementation.	***Deliverable No.*** 3.1
Work package No. 3 ***Distribution*** Unlimited	***Date*** 23 April 2019 ***Rev. No and date*** 0
Client	
Keywords	

Geographical information	
Country, County	***Offshore area***
Municipality	***Field name***
Location	***Location***
Map	***Field, Block No.***
UTM-coordinates	

Document control

Quality assurance according to **NS-EN ISO9001**

Rev.	***Reason for revision***	***Self review by:***	***Colleague review by:***	***Independent review by:***	***Inter-disciplinary review by:***
0	Original document				