



Enabling Climate Information Services for Europe

Report

User evaluation document

Activity:	A catalogue of best practices in climate services in Europe
Activity number:	Task 1.5
Deliverable:	ECLISE user evaluation document
Deliverable number:	1.3
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The work leading to this publication has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 265240.



Summary

The aim of ECLISE was to develop and demonstrate local climate services to support the development of climate adaptation strategies. A climate service can be described as the provisions of information on climate change in such a way that decision making is supported. Important part of local climate services is the interaction with users. For the ECLISE project different users were identified in Europe in several climate vulnerable regions. The user communities varied in spatial scale and sector and were mainly determined by decision makers from businesses, local and regional authorities. Each user required different information about climate change. After an initial assessment of the user needs, the research institutes (providers) developed in cooperation with the users knowledge about climate change, adapted to the specifics of the case study. This report evaluates the experiences of providers and users within the ECLISE project. 'User interaction' and 'usability' are used as indicators to evaluate the success of the climate services. Within these indicators a specific focus is on knowledge sharing, guidance of users and dialogue between users and providers. The results of the evaluation show that both users and providers are dominantly positive about the interaction during the project, but also both would like more interaction in future projects. Users described the actuality of the subject, the need of information and personal interest as stimulants for their involvement. Institutional barriers and lack of funding, time or expertise were mentioned as barriers to involvement. Users rate climate impact analysis as most useful, but do not have very good access to these information sources. Uncertainty, temporal and spatial scale are mentioned as barriers to use the data from the ECLISE project for decision making. Recommendations for user and interaction and the development of local climate services are given at the end of the report. For future projects it is recommended to think about interaction and to involve users throughout the whole project. Also the communication about user needs in combination with the limitations of science is important. This would prevent unrealistic expectations about uncertainty or spatial or temporal scales.

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1 Introduction

Often the knowledge developed within climate science do not make into operational products that can be used for decision support or other practical applications (Brooks 2013). Addressing this issue is a major challenge for the climate science research community. The aim of ECLISE was to develop and demonstrate local climate services to support climate adaptation policies in close cooperation with the users. Within this project 26 case studies were identified, divided over the water, energy, coastal or urban sector in eight different European countries. For each case study, one of the partner research institutes was linked to a user. The user institutes were mainly local governments and water authorities, but also included an insurance-, electric-, and railway company. The overall objective of the ECLISE project was to take a first step towards a concept of how climate services could be provided at a pan European level from a research project perspective. Until now, this field is rather unexplored and much can be learned from research and hands-on experience. A climate service can be described as the provisions of information on climate change in such a way that decision making is supported (Hewitt et al. 2012). One of the main challenges of local climate services is to connect to local users, which often have other priorities or do not speak the 'same language' (Buizer et al. 2010; Kirchhoff 2013; McNie 2007). Therefore, a successful and close cooperation between user and provider (the research institute) of climate information is one of the most important conditions for the development of local climate services. Active involvement of both providers and users is needed to establish a two-way dialogue and to ensure that the knowledge provided by the research institute is usable for decision making; engagement is a core competency of climate services (Brooks 2013).

The landscape of climate services across Europe is heterogeneous and ECLISE is the first large scale effort to provide some conceptual terms on how climate services could be provided. Deducting general lessons for European climate services has not been an easy task as ECLISE had a large diversity of partner institutes, users and case studies. This was reflected by the many different experiences. The setup of ECLISE does, however, allowed for sharing and discussion of results amongst partners and this reports shares some generic best practices from the evaluation of the case studies. Based on the experience of users and partner research institutes this report reviews the involvement of and interaction between providers and users for the ECLISE project and evaluates the user experiences within the local case studies. Furthermore, this report summarizes the most important lessons for climate services and gives an outlook for future research on local climate services.

2 Approach

One of the first steps in the ECLISE projects was to identify initial user needs. For this purpose a workshop was organised by Wageningen University with contribution of the Climate Service Centre on 7 and 8 September 2011 in the Netherlands. The main objective of the workshop was to facilitate interaction between the research institutes and the users. In preparation of the workshop a form was developed to identify the user needs and to get an overview of how the interaction between user and provider would be organized for each case study. The form was filled out during or after the workshop for the majority of the case studies. This form and the results and discussion of this workshop can be found in Report 1.1 'Initial user requirements for climate services of the ECLISE cases'. These results will not be discussed in this report.

After the initial workshop, three surveys have been conducted to collect information on the experience of the user with the ECLISE project. The surveys can be found in Annex 1,2 and 3. The first survey was filled out by the research institutes (n=18), the second survey was sent out to the user community (n=14), which was followed up by a third survey, which was also sent to the user community (n=12). Users were contacted through the providers, which made it a bit more difficult to get replies on the user surveys. Even though some users or research institutes were involved in multiple cases, the surveys were filled out for each case separately. In a synthesis workshop in Brussels, some preliminary results of these surveys were discussed with both research institutes and users. The

results of the surveys are summarized in this document, together with information deduced from informal discussions on the cases.

3 How to evaluate local climate services

The production of useful information is warranted and asked for by policy makers around the world, however, often this results in an increased supply of information that can lack any correlation to the information needs of the decision maker (Kiem and Austin 2013b; McNie 2007; Meinke et al. 2006). Consequently, decision makers often lack the information that is needed for good decision making on climate change. Here, a distinction can be drawn between what providers of climate information consider 'useful' and what users of climate information perceive as 'usable' (Lemos et al. 2012). Providers may make the assumption that information is 'useful' when they engage in research they think users need, but because of a limited understanding of the decision making process and local context of a user, the knowledge is not applied by the user. Users in turn may have unrealistic expectations of what science can deliver or do not engage enough to be able to use it in the decision making process, despite its usefulness (Lemos et al. 2012). Efforts do exist to increase information uptake on climate change to support decision making. However, as the problems of climate change become more urgent across the world (IPCC 2013), the demand for usable science may quickly outstrip the ability of scientists to produce it (Kirchhoff et al. 2013). One of the methods employed to address this issue is the development of local climate services which aim to provide information on climate that is useful for decision making at the local scale.

An important challenge for local climate services is how to evaluate the usability of science in the context of decision making. In this report, usability is based on the experience of both research institutes and providers. To evaluate and compare these results, we use the criteria of usability and interaction as developed by Lemos and Morehouse (2005), but which also have been used in different ways in multiple other studies (e.g. Dilling and Lemos 2011; McNie 2007; Tribbia and Moser 2008; Buizer et al. 2010; Cash et al. 2006; Jacobs et al. 2010). Many studies on the use of knowledge based information focus on either science produced for policy, which is demand driven, or science grounded on research interest alone (Lemos and Morehouse 2005). A third approach has become more popular in recent years, in which science and policy are co-producing (Jasanoff 2004) science and the dichotomy between science and policy is blurred. Also other models like 'mode 1' and 'mode 2' (Gibbons et al. 1994) science have been introduced, which goes from knowledge driven, primarily disciplinary and cognitive, to interdisciplinary, interactive research involving different stakeholders. Most studies also emphasize that there is no single model of engagement, which is also shown by the diversity of the experiences within the ECLISE project. Also until now, limited empirical evidence exists of how interaction between scientists and stakeholders evolves within different local contexts. Some countries have well-developed services, whereas others have few or none (Hewitt et al. 2012).

Figure 1 shows the criteria on which we have based the evaluation of the ECLISE project. The large circles indicate which generic criteria are important for the creation of usable science, based on the co-production model of Lemos and Morehouse (2005). The white square in the middle shows the specifics of climate services for the ECLISE project as described in Report 7.1: "Report on a web-document presenting the different initiatives towards Climate Services in the world". These specifics fall within (and overlap with) the larger model, but contain a more specific description for the evaluation of local climate services. The first circle and indicator for providing climate information is '*interaction*'. This indicator refers to the interaction between the research institutes and the user institutes in each case study. Important for this indicator is the degree to which the users have been involved in the problem formulation and research design, but also in the analysis of the findings. The involvement of users in the research project may change their perception on the subject of climate change. Furthermore it is important that a relationship of trust develops between the research institute and the user and the interaction is regular. The final goal is that the interaction between research institutes and

users will improve the implementation of public policy or support the decision making process. This part is, however, hard to evaluate, as no decision making has occurred yet.

The second indicator of Figure 1 refers to the '*usability*' of produced knowledge. The usability refers to the degree to which the produced knowledge meets the user's needs. This also means that it should be understandable, available and accessible to the users (McNie, 2007). The usability of science is also discussed by Cash (2003) and it is argued in this paper that in order to connect knowledge to action information has to be sufficiently salient, credible and legitimate in the eyes of multiple audiences. Important for the perception of credible and legitimate science is the interaction between scientists and users, but also the way the data is presented and the guidance that is given in interpreting and understanding the data. Usable knowledge can be incorporated in the decision making process (Lemos and Morehouse 2005). The definition of usable science is, however, far from straightforward and more empirical evidence is needed. For the ECLISE project we focus on the view of the users, do they feel they learned from the information and knowledge they received through the ECLISE project, can they use this knowledge for decision making?

The paper of Lemos and Morehouse (2005) also describes a third aspect of the integration of science and policy, which is interdisciplinarity. They argue that interdisciplinarity is defined as the effort of scientists from different disciplines to work together. Which is important for complex topics as global climate change. Although we do not argue against interdisciplinarity being important, also for local climate services, we do not evaluate this aspect for the ECLISE project in detail, as it was not an explicit part of the project.

The centre of Figure 1 describes specific indicators of local climate services, which fall within the broader categories of interaction and usability. In the surveys that are conducted for this report, we focussed on the evaluation of these indicators.

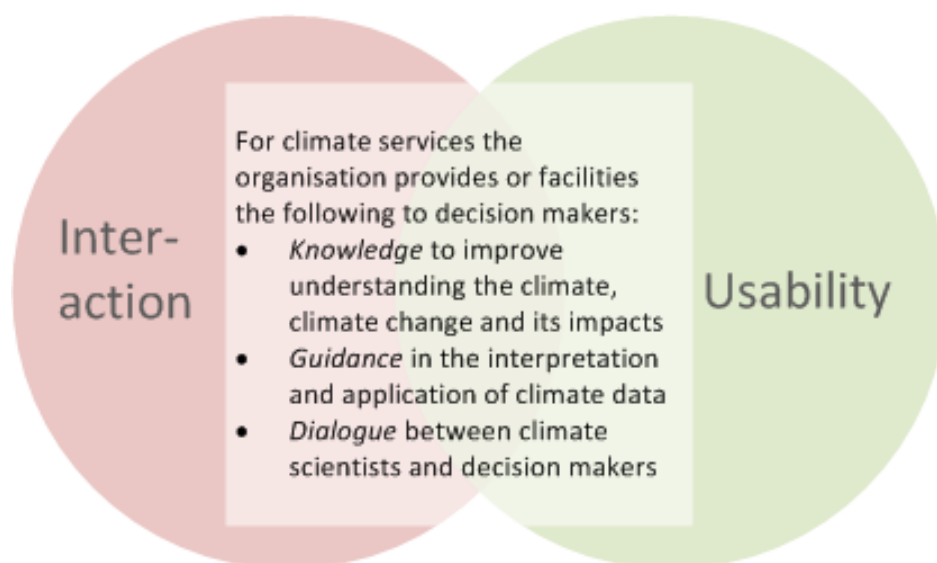


Figure 1: Evaluation of best practices, modified from Lemos and Morehouse (2005).

4 Evaluation of local climate services

In general the ECLISE project was evaluated positive by both providers (the research institutes) and users across the different case studies. In this section the evaluation of the interaction between providers and users and the opinion of the users regarding the usability of the information is discussed. The results are based on the provider and two user surveys (see Annex 1, 2 and 3).

4.1 Evaluation of the interaction between providers and users

The interaction between the providers and users will be evaluated for three key indicators, the first two are also mentioned in the white square of Figure 1. The first indicator is the dialogue between the providers and users during the research process. The evaluation is based on the frequency of the interaction, but also on the involvement of the process of both parties and the understanding of each other. The second indicator is the guidance in the interpretation and application of the data by the provider. This is often an important factor for data to be used in the decision making process (Gawith et al. 2009). The third indicator that influences both interaction and uptake of information is trust between the providers and users (Kirchhoff et al. 2013). Trust is a complex interpersonal and organization construct (Blind 2007), which needs thorough research and this in-depth analysis goes beyond the focus of this study. However, we do attempt to get a basic idea of the level of trust between providers and users based on the survey results.

Dialogue between the providers and users during the research process

The frequency of interaction between users and providers was usually a few times a year (Figure 2). Telephone and e-mail are used more often in some cases. Most providers (82%) indicated that the frequency of the interaction was sufficient, which is in agreement with the opinion of the users. They also indicated in most cases (79%) that the interaction was sufficient. In one case, the user indicated that the interaction was not sufficient due to interaction at the wrong level of the organisation. The interaction started at a high political level, which did not work. Later the interaction continued at a researcher/engineering level which improved the interaction. Providers presented data to the users a few times a year to once a year, mainly through documentation and presentations and to a lesser extent through workshops.

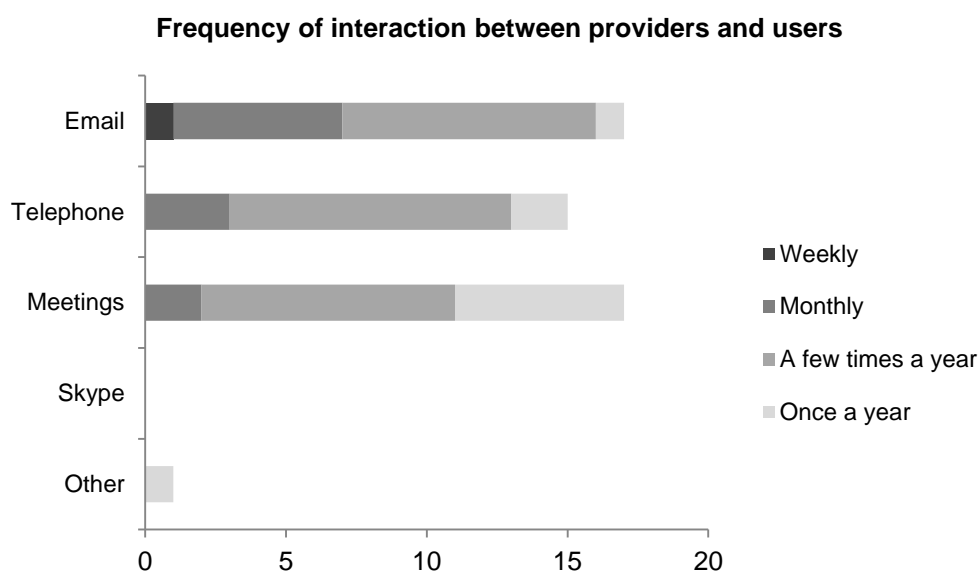


Figure 2: Frequency of interaction between providers and users. The numbers on the x-axis represent the number of respondents.

The providers mostly described the users as active or very active (67%), some users were described as limited (22%) or not (11%) involved. The active involvement of the user was explained by interest in the ECLISE project or a requirement for the data that was developed in the project. Also some difficulties were reported regarding the user involvement. For example, one of the providers stated: *“The user that signed at the proposal stage was completely inactive due to retirement of the user in charge and the merging of municipalities. Around the middle of the project a new user expressed their interest”*. Reasons for limited involvement of users were mostly lack of time and other priorities. The users stated mostly that they had a (more than) sufficient involvement (75%), which is in agreement with the description of the providers. Half of the users would like to be more involved if there would be a follow-up project, because, for example, this would improve the connection of the information to water management plans, or would improve the understanding of the results. One of the users states: *“We would like to be involved more intensively in order to gain knowledge about data handling and impact modelling and extend this knowledge to impact of extremes”*. The other half of the users would prefer a similar involvement, one of the reasons mentioned for this was that there were not enough resources or personnel for more involvement. In Table 1 the most important stimulants and barriers to user involvement are mentioned. Stimulants that are mentioned can be summarized as the actuality of the subject, the need for information on climate change (impacts) and personal interest. The most important barriers are the language that is too specific, institutional barriers, funding, lack of time or limited expertise.

Table 1: Response to the question: “*What were the most important stimulants or barriers to your involvement?*”

Stimulants	Barriers
<ul style="list-style-type: none"> • Actuality of the subject • The need of climate information for the development of water management plans • Understand future natural disasters and how we can handle them • It is an important part of my work on hazard/risk management • The topic is interesting for me personally • The topic is extremely important as my activity is influenced by climatic conditions • Provide high quality information to potential future customers • Getting information about available data useful for our activities • We were involved in data quality assessment in order to steer a correct homogenization activity, and in comparing data interpolation results • Comparing results of climatic analyses with previous studies of our service • We were involved in data retrieval, and the results of climatic analyses were submitted to us for a better interpretation • The analysis of the results obtained 	<ul style="list-style-type: none"> • The language is too specific • Some institutional barriers and limited national funding related to limited person • The involvement was moderately sufficient due to reforming of the public sector and personnel moving • Lack of time • Limited expertise in the topic • The topic is not under my area of expertise or a major issue of concern at work • We were invited to participate as users in the middle of the project • Limited time to spend for this activity • We could not take part directly to the analyses due to lack of human resources • The availability of time

More than half of the users was able to define their research needs supported by limited interaction with the research institutes. About a third of the users needed intensive interaction with the research institute and 15% of the users could only partly identify their research needs, they were mainly determined by the research institute. Almost all users (93%) state that the research institute had an understanding of their research needs. One of the users indicated that this was not the case in the beginning, but after collaboration the institute did understand their needs. Half of the users discussed with the provider the research steps within the project and the way the data would be analysed. About 40% of the users only discussed this partly and one of the users did not discuss this at all. A majority (58%) of the users indicated that they find the information process throughout the ECLISE project very or extremely transparent.

Guidance in the interpretation and application of data

A large majority (85%) of the providers plans to provide or has given training to the user with respect to the ECLISE project. The users appreciated this training by stating that they received enough guidance to understand the data. However, more guidance on uncertainty would be needed for about 40% of the users. Almost all users (93%) find the provided information clear. The providers mainly

received positive feedback (70%) from the users on the data they presented. In discussions with users feedback was given on the usability of the results and sometimes adjustments were made accordingly. On some occasions, the users demands could not be met mainly regarding the spatial scale or relevance of the data. One provider indicated: *“The user is interested in short-term climate information, mainly weather forecasts”*.

Trust between providers and users

To establish whether there was already a relationship between the providers of climate information and users, we asked if they worked together in previous projects. About 40% of the users did not work together with the research institute before ECLISE, a third of the users did work together and another 25% did not work together but have used information from this institute before. A majority (75%) of the users states that they would like to work together in future projects. Reasons for this is that they have a well-established partnership with the research institutes, the easy access to the research institute, and satisfaction about the results of and collaboration within the ECLISE project. Some users say that they are not sure yet if they want to work together in future projects. Most users that are not sure about working together in the future, also did not have a relationship with the providers from previous projects. Most users (66%) find the information they received through the ECLISE project very or even extremely credible. Some users (25%) indicate they find it somewhat credible, because of the spatial and temporal scale and large uncertainties.

4.2 Evaluation creating usable science

The results of the workshop on user needs showed the wide range of cases and diversity of user institutes. Some general patterns, however, emerged. For example, the majority of the cases focussed on either climate extremes, being mainly flood risk, or water availability. Furthermore most users showed awareness of climate change uncertainty, but it was not clear how to take that into account when using climate information. In this section, it is evaluated how well the user needs were addressed in the ECLISE project and if the information that is offered is relevant for the user or the decision making process. Four different indicators are included in the evaluation. First, the knowledge that the users had prior to the ECLISE project and whether this knowledge has changed during the ECLISE project. Second, the user needs regarding climate change in general will be addressed and the specific user needs for this project. Third, the accessibility of data will be addressed from a general perspective, but also within the ECLISE project. Fourth and final the potential support that the information from ECLISE gives for actual decision making will be evaluated.

Knowledge to improve understanding of climate change and impacts

The providers were asked to assess the experience of their users with climate change. Half of the users had experience with climate change through the observation of the effects of climate change. A third of the users was experienced by using climate change scenario's or other climate data. A few users had developed adaptation strategies and one user did not have any experience with climate change. The providers described most (65%) users as having a little experience with climate change and about a third of the users as having a lot of experience with climate change. In 44% of the cases, this experience affected the interaction between provider and users. For example, one provider stated: *“Their experience with climate change helped us to better identify the climate information they need”*. In this case, the experience of the user had a positive influence on the interaction. There was also one provider stating: *“Because of the little experience of the end user with climate change science and impact modelling, the research institute had to start the interaction with some form of introductory information explaining some basic concepts”*. The users were asked whether they perceived climate change as a risk for their organisation of activities. Half of the users responded positive to this questions, about a third of the users responded with “maybe”. Two users indicated that they did not perceive climate change as a risk. Surprisingly, one of those users indicated that they did address

climate change within their organisation a lot. Most other users (67%) addressed climate change a little within their organisation and 25% of the users did not address climate change at all.

One of the indicators for the success of the ECLISE project is whether ECLISE influenced the knowledge level of the users. To assess this the users were asked whether the ECLISE project influenced their perception of the risk of climate change. Half of the users indicated that now they perceive climate change more of a risk than before the project, the other half indicated no change in their perception. The users were also asked whether the information that has been provided within the ECLISE project helped them to better understand the impacts of climate change. Half of the users responded positive, while two users indicated that it did help them to better understand the impacts, but that they still have a lot of questions. A third of the users responded with “maybe”. Because uncertainty of climate change was also an important topic within this project, the users were asked whether they feel they have enough understanding of the uncertainty of the provided information. None of the users indicated that they understand it completely, but a large majority (83%) indicated that they do understand it, although not everything. Two users state that they are not sure if they understand the uncertainty.

User needs

The users were asked about different types of information about climate change and how they perceived the usefulness. The results are shown in Figure 3.

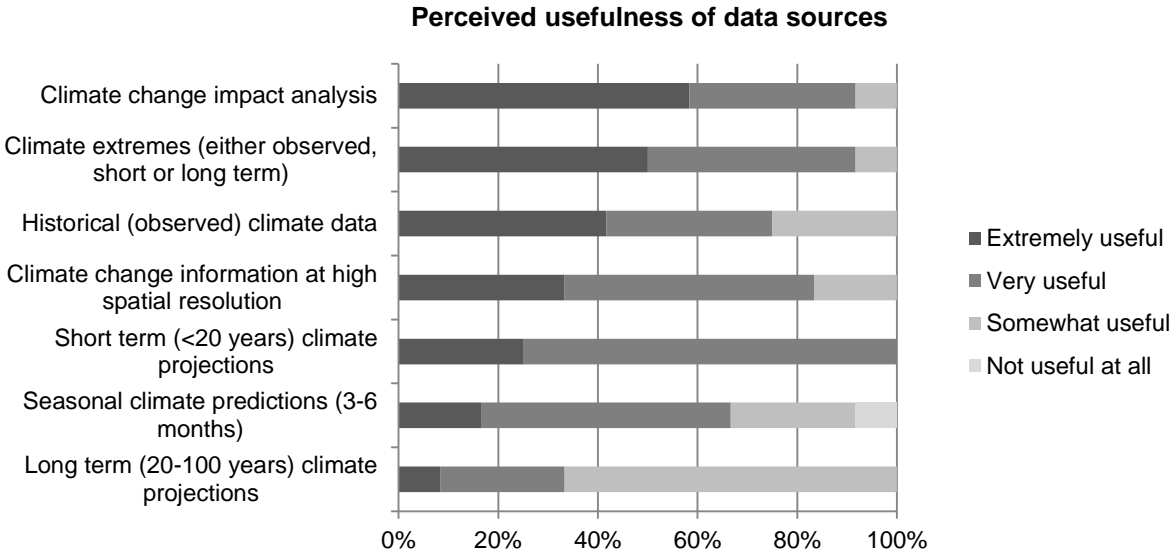


Figure 3: Response of the users to the question: “How would you describe the usefulness of the following information regarding climate (change)?”

Especially climate change impact analysis and information about climate extremes is valued by the users as extremely useful (Figure 3). But, also short term climate projections are important, as a lot of users value this as very useful. Long term climate projections are valued least useful. The users were also asked which way of learning about the impact of climate change they perceive as useful (Figure 4).

Perceived usefulness of opportunities to learn about CC

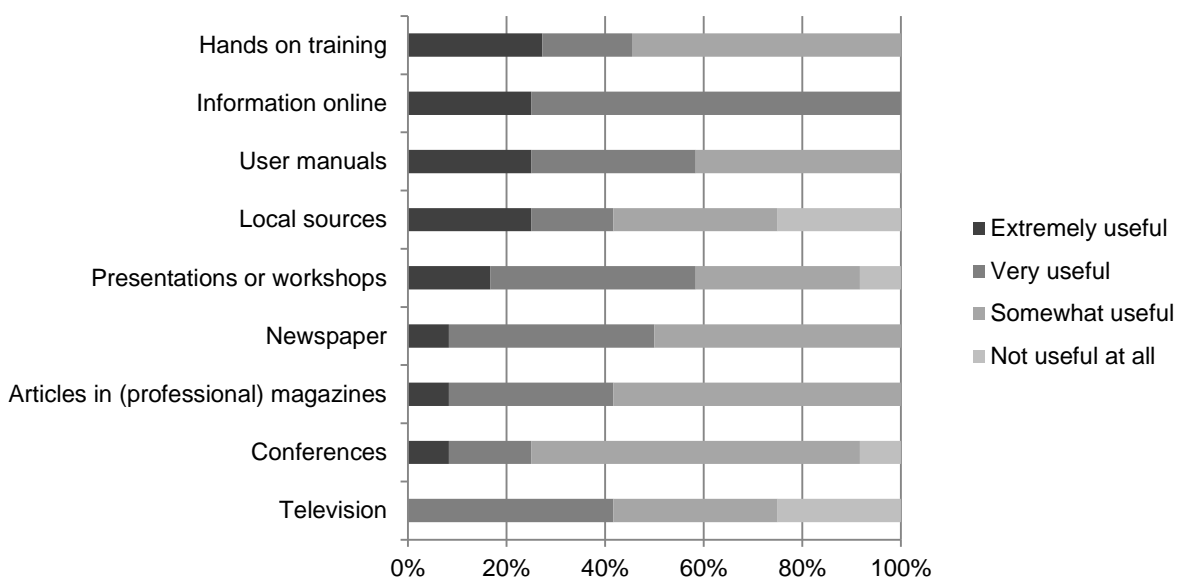


Figure 4: Response of users to the question: “How would you describe the usefulness of the following opportunities to learn about the impacts of climate change for your organisation or activities?”

Figure 4 shows that direct contact with providers of information is perceived useful through, for example, hands on training or presentations and workshops. Also information that can be found online is appreciated as extremely or very useful by all users. Information shared through newspapers, articles, conferences or television is considered to be least useful. These information sources are also most generic, while the other sources are more specific and personal.

Most providers (80%) think they were able to address all user needs as formulated at the start of the project. These user needs matched the scientific interest of the provider in most cases (67%), or partly in some cases (33%). Reasons for providers that were not able to address all user needs varied from practical reasons, e.g. the user needs were identified very late in the project to unrealistic user demands regarding spatial resolution. A large majority (73%) of the providers stated that the time frame of their research matched the user needs and 71% of the providers states this is also true for the spatial scale. 57 % of the users state that the providers have met their expectations, 36% thinks this is only partly true and one users states ‘other; and describes it as: “We developed the curves ourselves, but the climate institute will do a check with their climate models to see if the curves can be generated with their climate models”. The users which expectations were only partly met indicate that spatial or temporal scale of the results is the reason.

Data access

An important aspect of data being relevant for a user is whether the data they need is accessible using the resources and knowledge of the user. A general assessment of the access of user to climate information is shown in Figure 5.

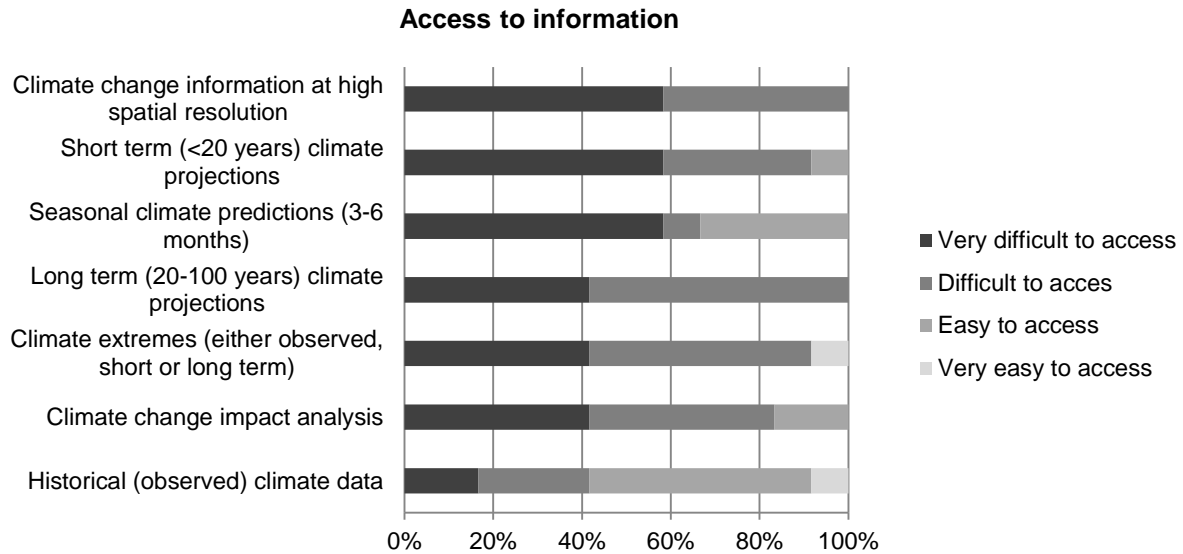


Figure 5: Response of users to the question: “How would you describe the possibilities to access or obtain information for your region?”

It is very difficult for users to get access to climate change information at a high spatial resolution. This could, however, also be due to the fact that it is not available (Figure 5). Short term, seasonal and long term predictions are also difficult to access for users. Historical or observed climate data are most easily accessed by users. Overall, Figure 5 shows that users find it difficult to access information about climate change.

Within the ECLISE project one of the users indicates that the access to information is ‘very easy’, while the majority (58%) of the users describe the access to information as ‘easy’. Two users had difficulties to access information from this project. One of these users explains that there is not a lot of information available on the project website, while the other users states that they received data in raw form and that it is difficult to analyse this data.

Also providers need to be able to access data they need for their research. The survey results showed that 50% of the providers were able to collect the data they needed, but 39 % could not access all the data they needed. This was mainly related to CORDEX data being not available yet, but also because of missing observational data or the availability of bias corrected data. The ECLISE project can help with these issues as 50% of the users indicate that they received information through the ECLISE project which would otherwise be difficult to obtain. A lot of providers (69%) worked together with one or more of the other ECLISE research institutes. The providers were also asked what European resources they would need to provide local climate services, the results are shown in Table 2.

Table 2: Response of providers to the questions: “Which European resources would you need to provider (local) climate services?”

Resource	Respondents
Online data portal with regional climate model data	79%
Online data portal with observations of climate variables	74%
Exchange of methods to improve user interactions	68%
Online data portal with global climate model data	58%
Exchange of methods to analyse climate change impacts	37%
Exchange of methods to analyse climate model data	32%

Online data portal with impact model data	26%
Exchange of climate or impact models	21%

The providers mostly need data of regional and global climate models and observations (Table 2). The resources that providers need are different from the user needs of Figure 3. Users mainly need information about climate change impacts, while only 37% of the providers indicate they need exchange of the methods to analyse impacts and even less providers (26%) would like a data portal with impact model data. It could be that providers do not think there is any benefit in sharing climate impact model data or methods for analysis on a European level, because, for example, the focus for this type of research is local. Another reason could be that providers are less focused on climate impact analyses in general. If this is the case, there is a gap between the user needs and what providers are delivering.

The exchange of methods to improve user interactions is needed by most providers. The methods used or developed within the ECLISE case studies can often (83%) be used in other regions and are sometimes (17%) valid for other regions.

Support for decision making

One of the indicators to evaluate if information is useful is when it is relevant or used in the decision making process. One user described the information received through the ECLISE project as extremely relevant for decision making within his or her organisation. The other users indicated that the information was very relevant, or somewhat relevant. This division was also present when users were directly asked whether the information would support their decision making. Half of the users responded with “yes”, the other half with “maybe”. Examples of decisions that could be made based on the ECLISE project are shown in box 1. Users were also asked if they received enough information to take uncertainty into account for their decision making. For 27 % of the users the information was enough, 27% of the users were not sure and 45% of the users stated that they would need more information.

Box 1. Examples of how decision making is or will be affected by information from the ECLISE project

- *Sicily has a semi-arid climate, where drought is a frequent event. A better analysis of drought periods allows to assess whether a drought event is extreme.*
- *The results from the ECLISE project will support the analysis of heavy rain and flood events and their impact on agriculture*
- *The climate information that the region of Crete obtained will be used as guidance for the upcoming decisions that will be taken regarding new infrastructure design*
- *The provided information will be used to disseminate our capabilities to cope with future precipitation and temperature extreme events in local cities and raise public awareness*
- *Future emergency planning activities would better consider the connection with potential climate change impacts*
- *There is a need for farmers to use irrigation systems, but there might be shortages of water in the future, therefore they need to look at more resistant seeds*
- *Investments related to building insulation or energy efficiency might consider the evolution of main climate parameters in the future*
- *The results of the project may be used to improve water management activities, e.g. the way reservoirs are operated*
- *The provided information will affect the spatial positioning of new PV plants and provide information to potential future customers.*

The users were also asked what would be a barrier for using information from the ECLISE project for decision making. The responses to this question are summarized in Table 3.

Table 3: Response of the users to the question: “What would be a barrier for using the information from the ECLISE project for decision making?” Users could give multiple answers.

Barrier	Respondents
The information is too uncertain	75%
The information is not at the right spatial scale	50%
The information is about a time period too far in the future	33%
The information does not warrant action right now	33%
We do not have the (financial) resources to make any decisions based on this information	33%
The information needs to be checked with other sources	25%
We prefer using other sources of information for decision making	25%
It is not possible to incorporate this information in our existing decision making process or infrastructure	17%
The information given is not complete enough to base decisions on	17%
Other *	8%
The information is not transparent	0%
The information is too difficult to understand	0%

*Other was described as: “It is difficult to explain inside our enterprise the importance of this type of data”

Table 3 shows that uncertainty is an important issue for users. Also spatial and temporal scale are mentioned often. Some users also do not have the (financial) resources to make decisions based on the information from the ECLISE project. Some users indicate that the information needs to be checked with other sources, which might indicate a low level of trust in the information. Other users indicate they prefer using other sources of information. Half of the providers stated that it would be essential to also use other sources of information for decision making, in addition to the ECLISE project. Examples of these other sources are local or specific knowledge for the application, documentation from the national meteorological service, impacts models that link agricultural productivity with climate, information on changes in other variables like demography, ensemble predictions and longer observational time series.

To assess the usability and relevance of the information of the ECLISE project, the users were asked if they were willing to pay for information from a similar (follow-up) project. None of the users answered ‘yes’ to this question, 58% answered ‘maybe’ and 42% of the users said ‘no’.

5 Best practices and recommendations for future research

The aim of ECLISE was to develop and demonstrate local climate services to support the development of climate adaptation strategies. Climate services provide decision support with, amongst other things, climate data, future projections, applied research and integration with other environmental data sets or socioeconomic datasets or models (Brooks 2013). An important part of local climate services is the interaction with users. For the ECLISE project different users were identified in Europe in several climate vulnerable regions. The user communities varied in spatial scale and sector and were mainly determined by decision makers from businesses, local and regional authorities. Each user required different information about climate change. After an initial assessment of the user needs, the research institutes (providers) developed in cooperation with the users knowledge about climate change, adapted to the specifics of the case study. Successful local climate

services are for an important part dependent on the cooperation of or interaction between the providers and users. This report discusses the experiences of both providers and users. The results will be discussed in this section, based on the results, first some recommendations regarding user interaction will be formulated, followed by recommendations for local climate services.

5.1 Recommendations on user interaction

Within the ECLISE project both the experience of users and providers where evaluated using three surveys. The evaluation was based on the dialogue between providers and users during the research process, the guidance from providers to users in the interpretation and application of data and trust between providers and users. The results of the surveys show that overall most users were actively involved in the projects. This involvement was experienced mostly as sufficient by both providers and users. However, half of the users would like more involvement in future project and also providers indicated that this would benefit future research. Also, 57% of the users indicated that they think that an increased number of meetings would improve the interaction with the user institute. Our results show that most barriers are related to lack of time or resources or limited expertise in the topic. The stimulants for being involved in the ECLISE project related to gaining knowledge about climate change, either for the user itself, or for the services the user provides to others. The providers were also asked to comment on how user interaction can be improved (Box 2). The recommendations of the providers show that frequent contact and an active involvement of the user from the beginning of the project is very important. One provider indicated that the user interaction developed very late in the project, because the research was delayed. In order to improve user interaction, this provider therefore recommend to finish the research in time.

In Section 3 different models for knowledge production were listed among which the ‘mode 1’ and ‘mode 2’ (Gibbons et al. 1994). The results from this project show that user interaction is very important for the success of local climate services and that users need to be engaged from the beginning of the project. Figure 6 shows the two modes of knowledge production, with at the bottom of the figure the different stages of a research project. Mode 1 is the more traditional form were providers mainly determine the research process and communicate with users at the beginning and the end of the project. Scientists studying how research results get used or ignored in policy systematically come to the conclusion that this linear process does not work (Ison et al. 2011).

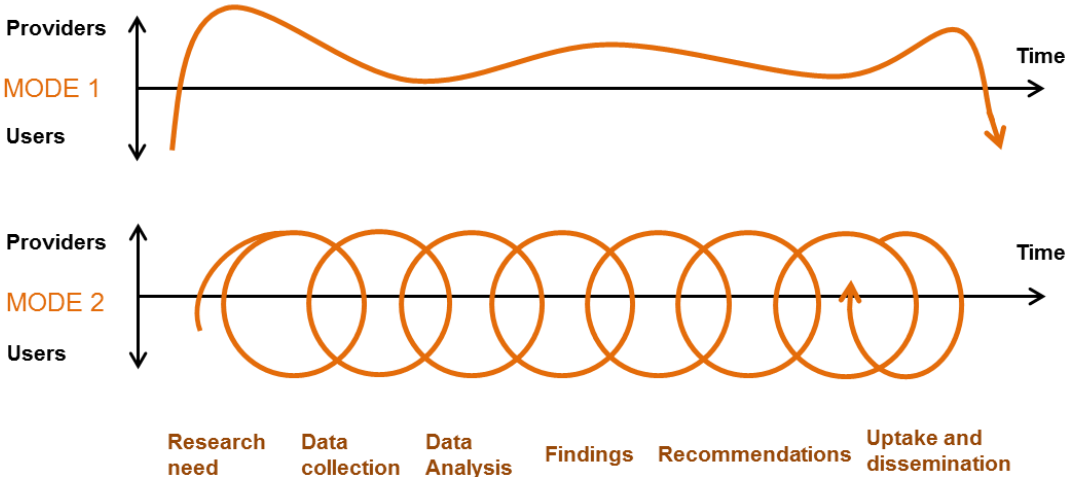


Figure 6: Mode 1 and Mode 2 communication (adapted from Ison et al. (2011)).

In Mode 2 there is a continuous interaction between users and providers throughout the research project. The ECLISE survey results show that even though there was an effort to engage users in the

different case studies, both users and providers think this could be improved and more interaction would be preferred for future projects.

Most providers have given guidance to the user with respect to using data from the ECLISE project and they have received mainly positive feedback on this guidance. More guidance or training would be needed for 40% of the users, this will be also important for future projects because if the users cannot apply the data, it will probably not be used.

Box 2: Summary of recommendations of providers to improve user interaction in future projects.

- *A strict interaction with the user is necessary. The interaction should be established with people who actually work with the climate data that will be provided by the provider.*
- *An important improvement will be to interact with a wider range of sectors of the user.*
- *More interaction with the people who work with the data that is provided.*
- *To have ongoing discussions and frequent personal contact*
- *Develop the project together, involve users as partners in the project from the beginning*
- *More interaction with the user to identify needs*
- *The communication of the limitations and uncertainties of the information is of crucial importance*
- *Make sure users have some skin in the projects.*
- *We need to finish our research earlier.*

Trust was mentioned during the workshop as an important aspect of successful interaction. The results of the survey show that long-term relationships can be important for developing a high level of trust. Most users that indicated they wanted to work together again in future projects, also worked together in previous projects.

Overall user interaction was evaluated quite positive by users and providers, but there are also improvements that can be made. Although 93% of the users indicated that the providers had an understanding of their research needs and the interaction was sufficient, only half of the users discussed the research steps of the project and about 58% found the information process transparent. The recommendations from both users and providers evolve mainly around getting the users more involved and having more interaction.

Recommendations for future projects:

- Limited expertise of the user can be a barrier for interaction or user involvement. Providers and users need to discuss the level of expertise on both sides and if there is no match either (if possible) search for another expert within the user institute or the provider should provide basic knowledge on the subject to create some level of climate science literacy.
- Understand user needs. Within ECLISE this worked well and users were very positive about this. The main stimulants for user engagement were gaining knowledge on climate change, so it is important to involve the users by understanding what they would like to know about this topic.
- Interact with the users from the beginning and develop the project together. This is mentioned by both users and providers a lot. Involve users throughout the project. It is likely that this will also increase the legitimacy and credibility of a project.
- Think about user guidance throughout the project, but also after the project. The user must have the skills to actually implement the knowledge.
- Trust is an important key for success. This project only briefly touched upon this subject, for future research it would be interesting to address this issue more.

5.2 Recommendations local climate services

The success of local climate services depends on user interaction and the usability of science (Figure 1). In the previous section the user interaction was evaluated. In this section, first the usability of the knowledge delivered through the ECLISE project will be evaluated, then the main benefits of ECLISE and finally general recommendations for local climate service in Europe will be given.

Creation of information relating to climate change impacts, although scientifically sound, can lack relevance (McNie 2007; Meinke et al. 2006). This disconnect often prevents effective exchange of information between providers and users (Dilling and Lemos 2011; Kiem and Austin 2013a; Lemos et al. 2012). For this report we asked the users how useful they perceive different data sources. Results showed that climate change impact analysis, information on climate extremes, observed (historical) time series and climate change information at high spatial resolution are among the most valued data sources (Figure 3). Providers, however, do not need the exchange of methods or data on climate change impact analysis on European level. This could indicate a gap between user needs and the type of research providers prefer to do. On the other hand the providers did indicate that their scientific interest matched the user need (67%) or partly matched the need (33%).

Short term climate change projections are also valued by the users, but seasonal and long term projections are indicated to have the lowest value for users. This also shows one of the problems of delivering useful information about climate change. Short term climate change projections at high spatial resolutions often also have high uncertainty levels. However, uncertainty is mentioned as the main barrier for using information about climate change in decision making. Managing the expectations from the user side is important to address this issue. In the ECLISE project most user needs were addressed by the providers, however, when it was not the case this was mainly related to spatial or temporal scale issues. One of the providers mentioned that the user was mainly interested in weather forecasts. In those cases it can be questioned whether (long term) climate services are what a user needs. It might also be a matter of 'marketing' of the climate services, do users know what value they can have to them (see also Bolson et al. 2013)? And coupling to other models, like agricultural productivity models as mentioned by one of the users can make the products more relevant.

An important aspect for usability of data is having access to the data. Access can be limited for a number of reasons: (1) geographical sparseness of data, e.g. historic observations are missing. This is often the case in remote areas, (2) temporal limitations of data series, e.g. lengths of measurements are different for different sites, (3) limited access of researchers to numerical models, (4) institutional barriers to data access, e.g. no centralised data bases and (5) financial obstacles to data access (Beniston et al. 2012). For this report we did not analyse the reasons for (limited) access to data but we did assess if the users had easy or limited access to information on climate change and data from the ECLISE project. Our results showed that users have very difficult or difficult access to information about climate change (Figure 5). This was also reported in other studies (e.g. Bolson et al. 2013). This is an important issue that can be addressed through local climate services. The ECLISE project contributed to this issue, as a lot of users (58%) described that they had easy access to the data. However, there were also users who had some problems accessing the data, continuous improvements on this issue are therefore needed in future projects. For knowledge to be usable it is not only important that users have access to data, but also providers need to be able to access data they need for research. Almost half of the providers could not access all the data they needed, although some of the issues were related to data not being available yet. Projects like ECLISE can be beneficial for sharing data, as half of the providers gained data through ECLISE partners which they would otherwise could not have accessed.

One of the indicators for defining information as usable is when it can support decision making. About half of the users indicated that the information they got through the ECLISE project could support decision making. Also half of the users stated that they would need additional information for decision

making. It could be interesting to assess whether this information could be delivered through research projects like ECLISE.

Barriers for using information about climate change were mostly related to uncertainty and temporal and spatial scale of the delivered information (see also Bolson et al. 2013; Miles et al. 2006; Archie et al. 2014). Some barriers were also related to (financial) resources, which is depend on the local context and economy. The uncertainty barrier and competition between social, economic and political drivers are also found in a number of other scientific studies (Amundsen et al. 2010; Bierbaum et al. 2013; Biesbroek et al. 2013; McNeeley 2012; Moser and Ekstrom 2010). Uncertainty in scientific output and decision making is currently topic of international scientific debate. The results of this evaluation show that this is justified, as users identify it as an important barrier. More research and case studies are needed to deal with this issue and to find ways to address uncertainty in a way that able users to include the scientific knowledge with uncertainties in their decision making process.

This results also shows that communication about what science can deliver is very important. Users need to communicate about what information they need to support decision making, but providers also need to communicate about what they can deliver and what is realistic.

Both providers and users indicated that gaining knowledge is one of the main benefits of ECLISE. A summary of the benefits mentioned, including a comparison can be found in Annex 4. The benefits described in Box 3 are very knowledge oriented. Some survey results also showed that the knowledge gained through the ECLISE project influenced the perception of users on climate change. About half of the users perceived climate change more of a risk than before the project.

In Box 3 a summary of recommendations for local climate services is given, based on the experiences of the providers. Some recommendations regard the access of data, like setting up a national climate contact point, or the putting the data in an accessible format. Other recommendations are about user interaction, or the presentation of uncertainties.

Box 3: Summary of recommendations of providers to improve local climate services in future projects.

- *In our opinion records that represent cooling and heating degree-days and solar radiation at National and Regional level are very useful for a lot of energy related applications, especially if they are provided together with models relating the demand for electricity and heating. In this context we think that the case study we developed in cooperation with RSE can provide useful information to better understand the dynamics of electricity demand, allowing a better management of the energy sector.*
- *In our opinion the case study represents a good example of an activity which should be performed by a local climate service*
- *To present uncertainties in a good way.*
- *Set up a monitoring system.*
- *Interaction with local authorities and institutions managing hydro-geomorphic hazards in the area*
- *Interaction with local authorities and institutions managing agricultural activity in the area*
- *Higher model data resolution at local scale (e.g. 1 km)*
- *The data provided by local climate services must be into an accessible format.*
- *Local services need to be very specific for the impact considered and only provide relevant and refined products.*
- *A national Climate contact point (NCCPs) for could be the best practice of local climate services by providing a general briefing and further channels of communication with local climate information providers. A protocol can be formed to ensure the standardization of the climate service provided, regarding the most commonly requested information.*
- *More meetings*

The users were also asked to give recommendations for future local climate services, these results are summarized in Box 4.

The results of Box 3 and 4 show that although formulated differently, the recommendations of users and providers are quite similar. Both mention more or better interaction between users and providers, improving the uncertainty range and higher resolution of data. Also the access of data and availability of data is important for both parties.

Box 4: Summary of recommendations of users to improve local climate services in future projects.

- *By establishing partnerships with stakeholders.*
- *I consider the evaluation of impacts of climate changes on ecosystems and human activities to be very important*
- *For a better quantification of landslide/flash-flood risk in terms of management at regional scale, climate services would have to focus more on developing regional models with a higher temporal and spatial accuracy that might be considered in spatial decision support systems.*
- *Climate services for agricultural practices must provide reliable information to help farmers making better use of new seeds and technologies and also, to increase the efficiency of farm labour and resource allocation in respect to near-term climate projections.*
- *More interaction to precisely define the needs and what information can be realistically provided*
- *Refining research in order to fit smaller, particular areas, especially those which are more sensitive to climate changes*
- *Since the water management plan (according to European Water Framework Directive) has a time horizon of 6 years and then it will be reconsidered, there are limits in information to be included in water management plan. This information could be provided by decadal predictions of appropriate spatial scale over the region. Moreover the size of the study area impose to use higher resolution modelling results in order to evaluate the effects of climate change on the island*
- *The climate service uncertainty range (different scenarios/ models) is a point that improvements could be made on.*
- *Collecting data - Making these (raw but quality controlled) data available on their website to be used by third parties. - work together with users, not only communicate with politicians*

For the success of local climate services it is important that user needs are addressed and that they are given information that they can use in their decision making processes. There is, however, still insufficient understanding of the mechanisms that promote information uptake and use in decision making processes (Kirchhoff 2013). In this project it also shows that the users are not sure if they can use the information in the decision making process. Moreover, there was no willingness to pay for this type of knowledge, which is an indication for the relevance of the information for the users. These issues need to be addressed. How to create knowledge that is relevant for users and will be used in decision making processes? An important question here is who is responsible for the interaction with users. Boundary organizations can bridge the divide between scientists (information providers) and policy and decision-makers (users). Boundary organizations can improve the communication and translate technical scientific information into more usable forms and mediate conflicts that arise in the process (Cash et al. 2003; Guston 2001; Sarewitz and Pielke 2007). The study of Kirchoff et al. (2013) suggests that interaction in the context of an integrated boundary organization predicts higher use of climate information by water managers. Examples like that show the potential of boundary organizations for local climate services.

Recommendations for future projects:

- At the start of a project it is important to communicate about user needs, but also about what science can deliver. Users and providers should have a realistic expectations about the final product.
- Users report having problems accessing data on climate change. This relates to both actual data access as the format of the data that is delivered. It could be interesting to research the

main problems for data access, which will also depend on the context of the case study, and it is important to consider this issue for future projects.

- Users state they need additional information for decision making, but it is not yet clear what type of information they need. It would be interesting to analyse this and assess where research institutes can contribute to delivering this information.
- ECLISE proves to be beneficial for data sharing of providers, experiences regarding user access to data should also be shared on a European level.
- Developing climate services is often hampered by a lack of institutional, financial or human resources. Also within the ECLISE projects users indicate this as a barrier and the willingness to pay for services like delivered in ECLISE is low. Future research could help identify the reasons behind these barriers and how to address this.
- Within the ECLISE project there was some discussion on how to evaluate the climate services. There is a lack of existing metrics for evaluation of climate services. Developing metrics can help to track performance, identify and evaluate processes that need refining, measure impacts, set goals and inform stakeholders (see also Brooks 2013).
- For engagement to be successful each party must have a stake in the development of knowledge. In the ECLISE project this was also stated as “the user should have some skin in the game”.
- When a project starts it is important to define different roles. Who is responsible for what? It can be beneficial to add a boundary organization which can facilitate the interaction between users and providers and enhance the possibility of information uptake.

Acknowledgements

We would like to thank all the research institutes and users as defined in the ECLISE case studies for helping us creating this document.

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Annex 1 Provider survey



ECLISE questionnaire for the Best Practices Catalogue

The aim of this questionnaire is to gain insight in the interaction between users and providers within the ECLISE project. These results will be used to make a catalogue of best practices of climate services provision. In addition, this questionnaire will support the preparation for the joint synthesis workshop in Brussels. The results will not be used to value or compare individual institutes or researchers, but to determine (generic) best practices based on all cases. We would appreciate it if you would take some time to answer the questions for each case separately. The questionnaire is split up in 7 parts and contains 31 questions. Answering all the questions of this questionnaire will take about 30 minutes.

User characteristics and experience

Name of case study:

Is there a clearly defined user, including a contact person?

- Yes, the user is clearly defined including one or more contact persons
- Yes, the user is clearly defined, but there is no contact person
- No, the user is not clearly defined and there is no contact person
- Not applicable

Which (previous) experience did the user have with climate change? (multiple answers are possible)

- Observations of the effects of climate change
- Use of climate change scenarios, models or other climate data
- Development of adaptation strategies
- No experience with climate change
- Other
- Not applicable

How would you describe the level of experience of the user with climate change?

- No experience
- A little experience
- A lot of experience
- Not applicable

Did the experience of the user with climate change influence the interaction with the research institute?

- Yes
- No
- Other
- Not applicable

Can you please explain your answer to the previous question?

Communication between user and provider

Please indicate which communication channels you have used to communicate with the user and the frequency of the use of these channels

	Weekly	Monthly	A few times a year	Once a year	Not applicable
E-mail Telephone Skype Meetings Other					

Was the frequency of this interaction in your opinion sufficient?

- Yes
- No
- Not applicable

Can you please explain why?

How often have you presented your data to the user?

	Weekly	Monthly	A few times per year	Once a year	Not applicable
Documentation Presentation Workshop Other					

Did you, or do you plan to provide guidance or training for the user with respect to the ECLISE case study? (multiple answers possible)

- Yes, we are planning to provide guidance or training
- Yes, we have given guidance or training
- No
- Not applicable

Did your received feedback on your data from the user? (multiple answers possible)

- Yes, positive feedback
- Yes, negative feedback
- No feedback
- Not applicable

Please shortly describe the feedback

How would you describe the user involvement?

- Very active
- Active
- Limited
- No user involvement
- Not applicable

Please explain why the user was active or inactive

Analysis of uncertainty

Did you provide an uncertainty range for your data?

- Yes
- No
- Not applicable

How did you present your uncertainty range? (e.g. through an ensemble)

Which of the following data sources did you use in your case study?

	One	Multiple	Not applicable
Observations data set			
Emission scenario			
GCM			
RCM			
Impact model			

Which uncertainties did you take into account in your analysis?

Which uncertainties did you not take into account? Please explain why not.

Have you received user feedback on the uncertainties as presented in your case study?

- Yes, positive feedback
- Yes, negative feedback
- No feedback
- Not applicable

Please shortly describe the user feedback

Which guidance have you provided (or will you provide) on explaining uncertainties?

Addressing user needs

Were you able to address all user needs as they were formulated at the start of this project?

- Yes
- No
- Not applicable

Can you please explain why you were not able to address all user needs?

Does the time frame of your research match the users need?

- Yes
- No
- Not applicable

Does the spatial scale of your research match the users need?

- Yes
- No
- Not applicable

In your opinion would it be essential for the user to use other sources of information for decision making?

- Yes
- No
- Not applicable

Can you please mention which sources of information would be needed?

Does the scientific interest of your research institute match the users need?

- Yes
- Partly
- No
- Not applicable

Collaboration with other ECLISE partners

With which ECLISE partners have you collaborated for your own case? (multiple answers possible)

- CNR-ISAC
- GKSS
- IGAR
- KNMI
- Met No.
- NIHWM
- SMHI
- TUC
- UNEW
- Uni Research
- WUR
- None of the above
- Not applicable

Did you receive data or other information through the ECLISE partners, which would otherwise be difficult or impossible to obtain?

- Yes
- No
- Not applicable

Were you able to collect all the data or information that you needed?

- Yes
- No
- Not applicable

Can you explain why you were not able to collect all the data or information that you needed?

Upscale to European level

Providers of (local) climate services are intermediars between the research institutes (that develop knowledge on climate change using for example observations and climate models) and the end users.

Which European resources would you need to provide (local) climate services? (multiple answers possible)

- Online data portal with observations of climate variables
- Online data portal with global climate model data
- Online data portal with regional climate model data
- Online data portal with impact model data
- Exchange of climate or impact models between countries
- Exchange of methods to analyse climate model data
- Exchange of methods to analyse climate change impacts
- Exchange of methods to improve interaction with users
- Other
- Not applicable

Please explain 'other'

Are the methods or results from your ECLISE case study applicable for other European regions?

- Yes, methods can be used in other regions
- Yes, results are valid for similar regions
- No
- Not applicable

Please describe what would be needed to make te results applicable to other European regions

Best practices from the ECLISE project

Please describe the main benefits for the user of your ECLISE case study.

Please formulate some best practices and possible improvements regarding user interaction based on your experience with the ECLISE case study.

Please formulate some best practices and possible improvements regarding the development of local climate services based on your experience with the ECLISE case study.

Do you have any other comments?

Annex 2 User survey part 1



User questionnaire - Best Practices

The aim of this questionnaire is to gain insight in the interaction between users and providers within the ECLISE project. These results will be used to make a catalogue of best practices of climate services provision. In addition, this questionnaire will support the preparation for the joint synthesis workshop in Brussels. The results will not be used to value or compare individual organizations, but to determine (generic) best practices based on all cases. We would appreciate it, if you could try answering all questions, there are no wrong or right answers. If you are part of multiple case studies, please answer the questionnaire separately for each case study. The questionnaire is split up in 3 parts and contains 13 questions. Answering all the questions of this questionnaire will take about 10-15 minutes.

Research needs

Name of case study:

Were you able to clearly define your research needs?

- Yes, it required limited interaction with the research institute
- Yes, but it required intensive interaction with the research institute
- Partly, the needs were mainly defined by the research institute
- No, the topic was defined by the research institute
- Other
- No opinion

In your opinion did the research institute that you worked with understand your research needs?

- Yes
- Partly
- No
- Other

- No opinion

Please formulate your research needs for the ECLISE project

Did the research institute (until now) meet your expectations?

- Yes
- Partly
- No
- Other
- No opinion

Please explain your answer

Interaction with research institute

How would you describe the frequency of interaction with the research institute?

- Sufficient
- We would have preferred more interaction
- Other
- No opinion

Was all the information that has been provided until now clear to you ?

- Yes
- Partly
- No
- Other
- No opinion

In your opinion have you received enough guidance from the research institute to understand the information?

- Yes
- No, I would prefer more guidance
- Other
- No opinion

**Which options would you recommend to improve the interaction with the research institute?
(multiple answers possible)**

- Increase number of meetings

- Increase number of updates by telephone/e-mail/skype
- More guidance from the research institute to support the use of the information
- Other channels of communication
- Include other organizations
- Other
- No opinion

Use of information for decision making

Does the information that has been provided until now, or that will be provided within the ECLISE project help you to better understand the impacts of climate change?

- Yes
- Yes, but I still have a lot of questions
- Maybe
- No
- No opinion

Will the information that is provided until now, or that will be provided within the ECLISE project support your decision making?

- Yes
- Maybe
- No
- No opinion

Can you give an example of how your decision making is or will be affected?

Please describe the main benefit of the ECLISE project for your organisation

Please describe how climate services in your opinion could be improved

Do you have any additional comments?

Annex 3 - User survey part 2



User questionnaire - Part 2

The aim of this follow-up questionnaire is to finalize our findings for the Best Practices document within the ECLISE project. This document will synthesize the experience within each case study regarding the interaction between research institutes and its users. The results will guide further local climate service (research) projects. The results will not be used to value or compare individual organizations. We would appreciate it if you could try to answer all the questions, there are no right or wrong answers. If you are part of multiple case studies, please answer the questionnaire for each case study separately. The questionnaire is split-up in 2 parts and contains X questions. Answering all the questions will take 10-15 minutes. Your participation in taking this survey is very much appreciated!

Interaction

Name of case study:

Did you work together with the research institute in earlier projects (before ECLISE)?

- Yes
- No, we have not worked together, but we have used information from this institute
- No
- I do not know
- Other

Did you discuss how the research would be conducted with the research institute? This means, for example, discussion of the research steps within the project, or the way the information would be analysed.

- Yes
- Partly
- No
- Other

How would you describe your involvement throughout the whole project?

- More than sufficient
- Sufficient
- Less than sufficient
- Other

Can you explain your answer to the previous question, what were the most important stimulants to your involvement?

And what were the most important barriers to your involvement?

Would you like to be involved more or less in similar projects?

- I would like to be more involved than I was in this project
- I would like a similar involvement as to this project
- I would like to be less involved
- Other

Can you explain your answer to the previous question? Why would you like to be more, similar or less involved?

Would you work together with the research institute in follow up projects?

- Yes
- Maybe
- No

Can you explain your answer to the previous question? Why would you (not) work together with the institute again?

Knowledge

Do you perceive climate change as a risk for your organisation or activities?

- Yes
- Maybe
- No
- I do not know

Did you address climate change before the ECLISE project?

- Yes, we addressed this issue a lot
- Yes, we addressed this issue a bit
- No, we did not address this issue
- I do not know

Did the ECLISE project change your perception on the risk of climate change?

- Yes, I perceive climate change more of a risk than before this project
- Yes, I perceive climate change less as a risk than before this project
- No, my perception did not change because of this project
- I do not know
- Other

How would you describe the usefulness of the following information regarding climate (change)?

	Not useful at all	Somewhat useful	Very useful	Extremely useful	I do not know
Historical (observed) climate data Seasonal climate predictions (3-6 months) Short term (< 20 years) climate projections Long term (20-100 years) climate projections Climate extremes (either observed, short or long term) Climate change impact analysis Climate change information on high spatial resolution Other					

How would you describe the possibilities to access or obtain this kind of information for your region?

	Very difficult to access	Difficult to access	Easy to access	Very easy to access	I do not know
Historical (observed) climate data Seasonal climate predictions Short term (<20 years) climate projections Long term (20-100 years) climate projections Climate extremes (either observed, short or long term) Climate change impact analysis Climate change information on high spatial resolution					

How would you describe the usefulness about the following opportunities to learn about the impacts of climate change for your organisation or activities

	Not useful at all	Somewhat useful	Very useful	Extremely useful	I do not know
Hands on training					
User manuals					
Conferences					
Presentations or workshops					
Information online					
Newspaper					
Local sources					
Television					
Articles in (professional) magazines					
Other					

ECLISE was an EU funded project and therefore the information delivered is free of charge. Would you be willing to pay for information from a similar (follow-up) project?

- Yes
- Maybe
- No
- Other

How would you describe the relevance of the ECLISE project for decision making within your organisation?

- Extremely relevant
- Very relevant
- Somewhat relevant
- Not relevant at all
- Not applicable
- I do not know

What would be a barrier for using the information from the ECLISE project for decision making? (multiple answers possible)

- The information is not at the right spatial scale
- The information is about a time period too far in the future
- The information is not transparent
- The information is too difficult to understand
- The information is too uncertain
- The information needs to be checked with other sources

- We prefer using other sources of information for decision making
- It is not possible to incorporate this information in our existing decision making process or infrastructure
- The information given is not complete enough to base decisions on
- The information does not warrant action right now
- We do not have the (financial) resources to make any decisions based on this information
- Other

Do you feel you have enough understanding of the uncertainty of the provided information?

- Yes, I understand completely
- Yes, but I do not understand everything
- Maybe, I am not sure if I understand it
- No, I do not understand everything
- No, I do not understand it at all
- Not applicable
- Other

Do you feel you have received enough guidance on how to deal with the uncertainty of the provided information?

- Yes
- No, I did receive some guidance, but not enough
- No I did not receive any guidance
- No, but I do not need guidance
- Not applicable
- Other

Do you think you have enough information to take uncertainty into account in the decision making process?

- Yes
- Maybe
- No, I will need additional information
- Not applicable
- Other

How would you rate the accessibility of the information from the ECLISE project?

- Very easy access
- Easy access
- Not so easy access
- No easy access at all
- Not applicable
- I do not know

How would you rate the transparency of the information from the ECLISE project? In this case information is transparent when you know how the information is obtained and all the steps in the research process are clear to you.

- Extremely transparent
- Very transparent
- Somewhat transparent
- Not transparent at all
- I do not know

How would you rate the credibility of the information from the ECLISE project? In this case information is credible when you have trust in the quality of the information, technical evidence, argumentation and the work of the research institute.

- Extremely credible
- Very credible
- Somewhat credible
- Not credible at all
- I do not know

Annex 4 – Main benefits ECLISE project

Table A1: Summary of description of main benefits of the ECLISE project for users and providers. The left and right column correspond to the same case study.

Users	Providers
Improve knowledge about the effects of climate change on the electricity sector	High resolution quality checked and homogenized data.
The evaluation of drought scenarios and their impacts on agriculture in the next decades	The study will support the user in better managing Sicily region
To better know the climate of the region and to evaluate extreme events in their relationship with climate change	The study will support the user in better managing Sicily region agriculture
The available information from the ECLISE project concerning the expected changes in the precipitation regime until 2050, would allow us to reduce the uncertainty in landslide/ flash-flood risk management under future climate conditions.	The available information from the ECLISE project concerning the expected changes in the precipitation regime until 2050, would allow us to reduce the uncertainty in landslide/ flash-flood risk management under future climate conditions; hazard and risk maps at regional/local level are an important tool in the user activity to support the decision making
As farmers, we are already aware of climate change and we are adapting our practices to the observed change patterns in the temperature and precipitation regimes. The results of the ECLISE project might prove useful for outlining the future adaptation measures in respect to the challenges posed by the projected climate change and extremes for agriculture.	The results of the ECLISE project might prove useful for outlining the future adaptation measures in respect to the challenges posed by the projected climate change and extremes for agriculture
The results of the ECLISE project might prove useful for outlining the necessary adaptation measures in respect to the projected change of the urban climate and expected temperature and precipitation extremes and might support the decision making process for urban planning.	The results of the ECLISE project might prove useful for outlining the necessary adaptation measures in respect to the projected change of the urban climate and expected temperature and precipitation extremes and might support the decision making process for urban
The project will give a prevision for the evolution of water resources in the following 40 years.	Estimation of future water resources
Our organization gained knowledge about how climate may affect the “water future” of the study region. Climate change impacts on hydrological regime of the island of Crete, in the context of precipitation and temperature change is considered as crucial importance.	The user was informed in detail regarding the proofs and concept of climate change, the ways of handling climate information and interpreting uncertainty and its propagation. User realized that climate change (anthropogenic or not) is a fact and extremely important for planning at a global, national or local level
Our organization was provided quantitative information of climate extremes projections under various climate scenarios. Moreover our organization will benefit from the provided climate information for strategic planning of handling future natural disasters.	The user was informed in detail regarding the proofs and concept of climate change, the ways of handling climate information and interpreting uncertainty and its propagation. User realized that climate change (anthropogenic or not) is a fact and extremely important for planning at a global, national or local level
Scientific background as a confirmation of our practical approach.	can know the amount of electricity provide by the hydro power station that goes into the national power system - can set the price of electricity
	idea on future regional sea level change in comparison to the global mean
	The study will support the user in better managing Sicily region agriculture
	availability of high resolution temperature and

	precipitation data sets for past and future to better evaluate the relationship between plant productivity and meteorological variables
	Local results
	Climate change impact assessment based on stae-of-the-art climate model data, post-processing and impact model simulation
	The user was informed in detail regarding the proofs and concept of climate change, the ways of handling climate information and interpreting uncertainty and its propagation. User realized that climate change (anthropogenic or not) is a fact and extremely important for planning at a global, national or local level
	Understanding of likely damage due to wind