Collaborative Project

CLIM-RUN

Climate Local Information in the Mediterranean region Responding to User Needs

WP 1 – Climate Services Analysis and Support
Task 1.1 CLIM-RUN Protocol Development

D 1.1: Report on the CLIM-RUN Protocol

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1 - INTRODUCTION

The Clim-Run project aims at developing a protocol for applying new methodologies and improved modeling and downscaling tools for the provision of adequate climate information at regional to local scale that is relevant to and usable by different sectors of society (policymakers, industry, cities, etc). Differently from current approaches, Clim-Run has developed a bottom-up protocol directly involving stakeholders early in the process with the aim of identifying well defined needs at the regional and local scale. The improved modeling and downscaling tools will then be used to optimally respond to these sector-specific climate information needs.

In this context, the main objective of the Clim-Run protocol is to support the envisioned bottom-up approach for the development of climate services and the transfer of improved climate information to stakeholders. More precisely, the protocol is intended to support this bottom-up approach at two main levels. The first aim of the protocol is to propose some methods and tools to be used to involve and communicate with stakeholders at the Clim-Run project level. The second aim of the protocol is to propose a business model for the development of climate services at the Mediterranean level, based on the results of the bottom-up approach of the project.

In this way the protocol proposed here has three main parts that are quite independent. The first part of the protocol is intended to answer to what is asked in the Description of Work of the project in terms of methods and tools to be used to involve and communicate with stakeholders in the case studies of the Clim-Run project. A detailed proposition of what should be a stakeholder analysis in the context of a participatory bottom-up approach for the development and the delivering of tailored climate information in the Clim-Run project is proposed. This general framework is followed by a deep analysis of the methods and tools available (and generally used in participatory project) for the identification and the selection of stakeholders to be involved at the case study level of the project, and by a description of the methods and tools for the analysis of stakeholder characteristics and their interrelations. It should be noted that these methods and tools were not seen as mandatory and that each work package case study was led free to choose the best suited approach (depending on sectoral particularities but also on scientific background of work package leaders, from social science to climatology).

On the contrary of the two following parts of the protocol, this first part has mainly be defined in the first period of the project and has to be considered as the general methodological background intended to support the participatory bottom-up approach of the project.

The second part of the protocol is intended to describe the iterative process regarding the development of tailored climate information and products that took place during the Clim-Run project. Thus, the ways of communication with stakeholders, the processes used for the identification, the translation of user needs, and the production of climate products are analyzed and assessed.

The third part of the protocol is quite different in his nature as it is intended to build on the experience of Clim-Run and its innovative participatory bottom-up approach to envision a business model for the development of a wider Mediterranean climate services. The strong involvement of stakeholders in the Clim-Run project, to address stakeholder climate information needs in an iterative process, has generated many results and insights regarding the ways to develop effective climate services at the Mediterranean level. The most prominent one is the idea that climate services need to be developed on the basis of a Three Tier Business Model that adds an interface layer between the climate tier and the stakeholder tier. In this way, this part describes the composition, the role and the main tasks of the climate tier, the interface tier and the stakeholder tier. After having defined the interactions between these three tiers, three main topics or issues of importance for the effectiveness of the proposed climate services business model are analyzed: the need for capacity-building and training, the issue of certification and the need for finance and support of climate services and climate research. This third part of the Protocol has been used as the general background for the definition of recommendations and “good-practices” to international stakeholders and policy-makers for the development of a wider Mediterranean climate service.

2 - METHODS AND TOOLS FOR THE INVOLVEMENT OF STAKEHOLDERS IN THE CLIM-RUN PROJECT

2.1 - Stakeholder Analysis in the Context of a Participatory Bottom-up Approach

2.1.1 - Stakeholder Analysis

Many projects in development, natural resource management or technology development fields fail because they pay inadequate attention to the needs and characteristics of stakeholders [Grimble and Wellard, 1997]. As a consequence, stakeholder analysis has gained increasing attention and is now an integral part of project development and implementation initiatives.

The main objective of CLIM-RUN is to provide the seeds for the development of Climate Services for Mediterranean stakeholders. Climate Services can be defined as a "*timely production and delivery of useful climate data, information and knowledge to decision makers*" [NAS, 2001: 2]. In that way, conduct a stakeholder analysis appears to be an approach particularly useful for the project.

Stakeholder analysis can be defined as an approach for understanding a system by identifying the key actors or stakeholders in the system, and assessing their respective interests in that system. In the context of the CLIM-RUN project, stakeholder analysis is a process for (i) identifying and collecting information about groups or individuals who are relevant for CLIM-RUN project, in the sense that they need climate services, (ii) categorizing that information, (iii) explaining the possible interrelations that may exist between important groups, and (iv) prioritizing these individuals and groups for involvement in the decision-making process. It can be undertaken simply to identify stakeholders or to explore opportunities for getting groups or individuals to work together [Brown et al., 2001; Reed et al., 2009].

Stakeholders here include all those who are affected by climate change and extremes and who need better climate information in their decision-making process in order to better adapt to climate variability and change. They can be individuals, communities, social groups, organizations or institutions of any size, aggregation or level in society. The term includes policy-makers, planners and administrators in government and other organizations, as well as producer, commercial and user groups. The key objectives of stakeholders analysis is to improve the effectiveness of policies and projects on the ground, by explicitly considering stakeholders' interests and the challenges they may present [Grimble, 1998; Grimble et al., 1994].

Within policy, development and natural resource management, stakeholder analysis was increasingly seen as an approach that could empower stakeholders, and particularly marginal stakeholders, to influence decision-making processes. In policy research, stakeholder analysis has been seen as a way of generating information on the "relevant actors" to understand their behavior, interests, agendas and influence on decision-making processes [Reed et al., 2009; Brugha and Varvasovsky, 2000].

2.1.2 - A Participatory Bottom-up Approach

In the context of CLIMRUN project, stakeholder analysis might be understood and undertook within the framework of Participatory research or more precisely *Participatory Technology Development* approach (PTD). Participatory research is an approach which argues that research has greater relevance when representatives of the targeted beneficiary groups actively participate in the research process [Sutherland, 1998], and the PTD can be seen as a type of participatory research. CLIMRUN project has typically adopted this perspective for the development of Climate Services.

Initially, Participatory Technology Development approach has been developed in the context of agriculture development and natural resources management. Indeed, it would be an interesting entry point for the development of the CLIM-RUN Protocol and of Climate Services.

PTD is defined as a creative process of joint experimentation and research by farmers and development agents in discovering ways of improving farmers' livelihoods. It has been recognized that research is more effective in improving farmers' livelihoods if farmers play a vital role in the process. PTD is an approach to learning and innovation that is used in international development as part of projects and programmes relating to sustainable agriculture. This approach involves collaboration between researchers and farmers in the analysis of agricultural problems and testing of alternative farming practices. PTD is a practical process where farmers, as "insiders" bring their knowledge and practical abilities to test technologies, and interact with researchers, the "outsiders". In this way, farmers and researchers are able to identify, develop, test and apply new technologies and practices.

This framework appears to be fully in accordance with the approach supported by the bottom-up iterative process of CLIM-RUN for the development of a Regional Climate Services Network for Mediterranean stakeholders.

In this context, the objective of CLIM-RUN and of this supportive protocol methodology is two-fold. It has to understand stakeholders' needs in terms of climate information to sustain rational and well-informed decision-making in the context of climate variability and change. In that way, participatory methods to identify, engage and involve stakeholders in order to make the information to emerge have to be developed. Secondly, it aims to find a consensus between stakeholders and climate sciences researcher team on priorities to adopt about climate services to be developed (utility of data *vs.* capacities to provide these data). This has to be done through an iterative process of participation and discussion between stakeholders selected in each case studies and WP2 and WP3 teams *via* WP5-8 teams. A major issue is to define the modalities and characteristics of this iterative process, and more particularly the type of interaction we expected in CLIM-RUN and the involvement methods we have to select or develop. An essential step in the CLIM-RUN protocol development would thus be to define the participatory process to be developed.

An important part of the participatory research literature is concerned with how researchers and farmers manage their interaction. Various typology of interaction have been developed [Selener, 1998; Martin and Sherrington, 1997; Pretty, 1995; Okali et al., 1994; Biggs, 1989; Ashby, 1997; Ashby, 1986]. However, the classification of Biggs, which is based on the different relationships between researcher and farmers, and their decision-making roles at various stages of the research process, is probably the most used. In this way, the classification can be elaborated according to the institutional context and whether participatory research is "research driven", that is primarily intended to advance research objectives, here it would be intended to provide insights for a wider development of Climate Services; or "development driven" with socioeconomic development and in our case reduction of risks of climate variability and change objectives. The four types of participatory research are: *contractual, consultative, collaborative, and collegiate* (Table 1). One can make the hypothesis that different types of participation occur at different stages in the process of technology development and implementation.

TABLE 1: Definition of four types of interaction between stakeholders and researchers

INTERACTION TYPES	DEFINITION
CONTRACTUAL	Scientists make all the decisions alone without organized communication with farmers, usually contracting farmers to provide land, labour and other services needed for on-farm research, without being involved in decision-making
CONSULTATIVE	Scientists make the decisions alone but with organized communication with farmers. Scientists consult farmers about their problems, opinions, preferences and priorities through organized one-way communication, but the decisions are not made with farmers nor are there delegated to farmers
COLLABORATIVE	Decisions are made jointly by farmers and scientists through two-way, organized communication and continuous interaction between researchers and farmers who are seen as partners in the research process, not merely beneficiaries or sources of information. They are involved in making key decisions on the design, planning, monitoring, and management of experiments as well as analyzing data and using results. Their opinions and preferences are as important as the experimental results
COLLEGIATE	Decisions are made by farmers collectively in a group process or by individual farmers who are involved in organized communication with scientists. Farmers have the major say in running the experiment but may seek advice from scientists who play more of a catalyst and facilitator role. The major emphasis here is on activities designed to increase farmers' ability to do research and request information and services from formal research and extension organizations.

Sources: Sanginga [2001]; Biggs [1989]

For the development of Climate Services for Mediterranean stakeholders in CLIM-RUN, it would be an essential issue to well define (i) the objectives of participation, (ii) the different stages of the project and the types of participation and interaction with stakeholder we aim to develop, (iii) the degree or strength of participation, (iv) who participates, and (v) how do the participants evaluate the process of participation and the results.

2.2 - Methods and Tools for the Identification and Selection of Stakeholders

CLIM-RUN involves an instrumental approach of stakeholder analysis (as opposed to a normative approach). Instrumental stakeholder research is pragmatic and largely devoted to understanding how organizations, projects and policy-makers can identify, explain and manage the behavior of stakeholders to achieve the desired outcome [Reed et al., 2009].

In the development and natural resource management literature, stakeholder analysis has been used instrumentally to overcome obstacles to the adoption of new technologies, adapt technologies to relevant user groups, or to disseminate the same technologies in different ways to different groups [Johnson et al., 2004]. It has been demonstrated that stakeholder analysis can enable information and perspectives to be sought from a far wider range of sources, providing a more robust knowledge base from which to build development or natural resource management project [Olsson et al., 2004; Woodhill and Röling, 1998].

The stakeholder analysis encompasses 3 major steps: The first step involves the identification of stakeholders and their classification by types. The second step aims at categorizing stakeholders into priority groups in order to determine who to involve in the participatory processes of CLIM-RUN. The third step implies a careful analysis of stakeholders' characteristics (from both a socioeconomic and climate change points of view) and interrelations between stakeholders.

2.2.1 - Identification and classification of stakeholders

Identifying and grouping stakeholders marks the beginning of the formal stakeholder analysis process. Identifying stakeholders that may be relevant to CLIM-RUN project and the Mediterranean Climate Services would start the stakeholder analysis. This identification would be followed with a classification of individuals, groups, organizations and institutions by types. This would be done at

the sectoral level. From this basis, a typology based on a continuum of stakeholders from the macro to the micro level would be developed.

Much of stakeholder analysis presumed that stakeholders are self-evident and self-constructed, and focused on categorizing pre-identified stakeholders to understand their interests and relationships. However, before this can be done, it is necessary to identify who holds a stake with the project, i.e. the development of a Climate Service for Mediterranean stakeholders at the case study level. This in itself necessitates a clear understanding of the issue under investigation so that the boundaries of the social and ecological phenomenon can be established. Here it would be necessary to define clearly the boundaries of the CLIM-RUN project that aim to develop a prototype of Mediterranean Climate Services that have to provide insights for the development of a wider climate service for Mediterranean stakeholders. It would also be important to define precisely spatial and temporal scales of the analysis of climate variability and change at the case study level.

Several methods are available for identifying stakeholders. Identifying stakeholders is usually an iterative process, during which additional stakeholders are added as the analysis continues, for example, using expert opinion, focus groups, semi-structured interviews, snow-ball sampling[1], or a combination of these [Dougill et al., 2006; Prell et al., 2008]. If the boundaries of the project are clearly defined, then stakeholders can be relatively easily identified.

Stakeholders identified can then be classified according to organization type (Table 2). It is important for the project to identify some specific stakeholder groups representative of each institution or organization type that can be identified in each case study. One can note that this classification is general and would be probably refined according to the specificities of sector or case studies (some organization type would not be useful for some sector but would have to be more detailed for another one).

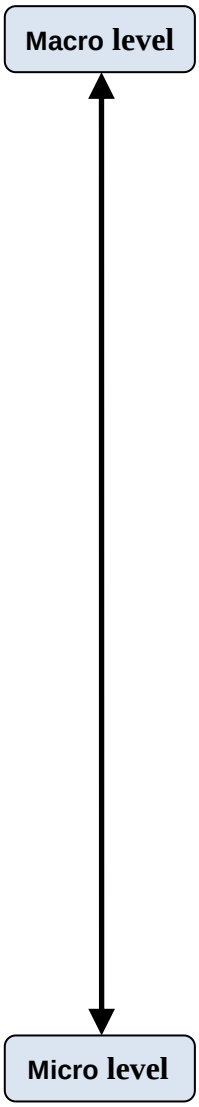
[1] The snow-ball sampling method can be summarized as follow: Individuals from initial stakeholders categories are interviewed, identifying new stakeholder categories and contacts.

TABLE 2: Organization types which may have relevance for CLIMRUN project and Mediterranean Climate Service Network

Organizations	Other Institutions
- Private sector	- Informal networks and conventions
- User organizations	- Legislation and policy
- Producer organizations	
- National administrations	
- Local administrations	
- Local NGOs	
- National or international NGOs	
- Executive agencies (e.g. public sector research and extension organizations)	
- Financial institutions	
- Multilateral and bilateral projects	
- Donors	
- International research organizations	

One method which can be used to classify resource stakeholders is to develop a typology based on a continuum of stakeholders from the macro to the micro level. This typology is general and so can be applied to a variety of context and settings. It may be a useful reminder about stakeholders at different levels who may be important to the decision-makers, or who are influential over the outcome of the decision. This provides a useful checklist to the many different levels at which stakeholders may be found. This approach would be complementary to the classification of stakeholders according to institution/organization types. The assumption made here is that climate services needs would probably be different according to the continuum level.

TABLE 3: Typology of stakeholders on a macro to micro continuum



Continuum level	Stakeholder groups	Interest in Climate Services
Global and international wider society	-	-
	-	-
	-	-
National	-	-
	-	-
	-	-
Regional	-	-
	-	-
	-	
	-	
Local off-site	-	
	-	
	-	
	-	
Local on-site	-	
	-	
	-	
	-	

Source: Grimble et *al.*, 1994

This step offers a first categorization of stakeholders as part of the identification process. Analytical categorization of stakeholder groups according to their characteristics, interrelations and attitude toward climate change (Step 3) will be complementary and particularly useful to define and choose the more promising engagement and involvement methods.

2.2.2 - Categorization and selection of stakeholders

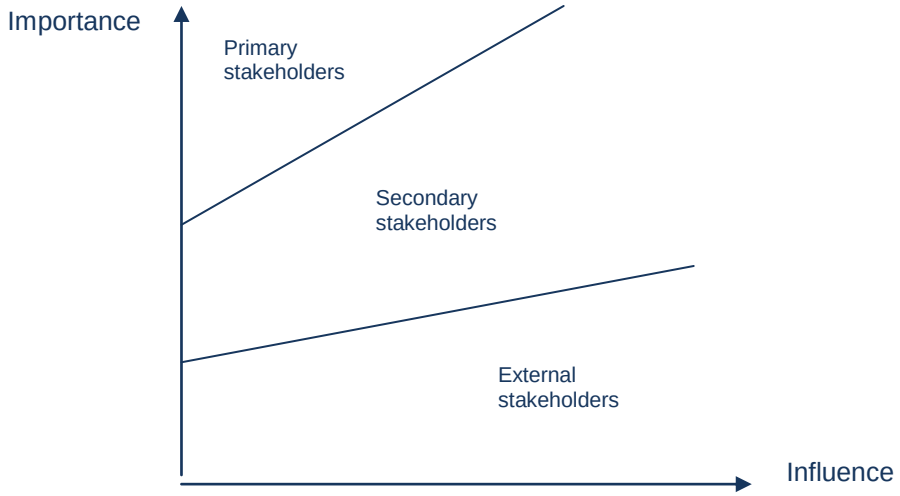
At this stage there is likely to be a long list of possible stakeholders under consideration. The list need to be prioritized to identify those who will be engaged actively in the participatory bottom-up process for the development of the Mediterranean Climate Services, those who will be consulted, and those who will be kept informed of actions or events. In other word, stakeholders need to be grouped into *primary*, *secondary* and *external* stakeholders.

Stakeholders can be categorized according their level of *influence* and their degree of *importance*. Broadly speaking, *importance* refers to the degree to which the stakeholder is considered a focus of a decision to be made. In the CLIM-RUN project, importance can represent the degree of susceptibility of the stakeholder to climate change and extreme and reflecting the importance of climate information and service in the stakeholder decision making-process. Thus, importance would be determined by the results of the analysis of stakeholder characteristics, and more specifically by the "climate change analysis" that would be done in the following step.

Influence refers to the level of power a stakeholder has to control the outcome of a decision. Influence can be determined by the stakeholders themselves, or though assessment of independent reports on the stakeholders groups' access to power and resources. In the CLIM-RUN project influence of stakeholders might be determined through an analysis of the degree of linkages between stakeholders and meteorological and climate research institutes.

Such an *importance/influence matrix* is useful to help to categorize and map the relative importance and influence of key stakeholders and to assist project in deciding who should be involved in the CLIM-RUN participatory bottom-up process, who should be consulted and who should be kept informed.

FIGURE 1: The relative importance and influence of the different stakeholders



Source: Brown et *al.*, 2001

Self-exclusion by stakeholders themselves and self-selection biases should be avoided. Groups who perceive that they may lose from the process, because it is time consuming for example, may not feel inclined to engage at all. Also, stakeholders who don't perceive themselves vulnerable to climate change or who don't perceive how climate information might be useful for their activities may be reluctant to engage in the participatory process. Characterizing attitudes of stakeholders toward climate change issues, that have to be investigated in the following step, would be particularly important in the involvement process. If a primary stakeholder group is resistant to engage, the project team must exhibit perseverance and some creativity to keep that group interested, engaged and participating in the process. This might be done by engaging particular efforts to demonstrate and characterize the importance of climate change vulnerabilities of the group and how a timely production and delivery of useful climate data, information and knowledge would deliver valuable benefits to the stakeholder in question. Even if a primary stakeholder group will not engage immediately, the team must continue to invite them to participate.

2.3 - Methods and Tools for the Analysis of Stakeholders' Characteristics and Interrelations

2.3.1 - Stakeholders' characteristics: socioeconomic and climate change analysis

A careful analysis of stakeholders' characteristics needs to be engaged. It would include a deep analysis of stakeholders' socioeconomic characteristics and a more specifically study of the relevance and the nature of climate change issues for each stakeholder.

Socioeconomic analysis: Stakeholder groups are often described by socioeconomic classifications such as income level, occupational group and employment status, or by degree of formal involvement in the decision-making processes, degree of group cohesion, formal or informal structures. This analysis would also include power and knowledge.

Climate change analysis: The objective here is three-fold. Firstly, it aims to analyze the effects of climate change on stakeholders groups in order to specify the extent and the nature of climate change issues for each stakeholder groups. These results would be particularly important for the selection of stakeholders to be involved in the participatory process according to their need of climate information for adaptation and the relative importance of the development of Climate Services. Secondly, it would analyze how climate, changes in climate and climate-related environmental parameters intervene in the decision-making process or function. This step appears particularly important for the development of the Climate Services. This aspect of the stakeholder characterization would be an essential input for the definition of stakeholder groups in the communication strategy. In fact, it may be useful to consult together stakeholders that faced the same types of issues. Thirdly, it would be interesting to characterize attitude of stakeholders toward climate change issue. Communication methods to be adopted would be different according to their degree of comprehension of climate change issues for their activities. This analyze would also be an important input to avoid self-exclusion of stakeholders that don't perceive them as vulnerable to climate change.

2.3.2 - Stakeholders' interrelation analysis

Finally, interrelations between stakeholders need to be investigated. This would be done by developing an *actor linkage matrix* and/or a *conflict/complementarity matrix*. An interesting alternative might be found in developing a *system diagram approach*.

The *conflict/complementarity matrix* is a framework to map areas of cooperation and conflict between key stakeholders. This step would be important for the organization of workshop and for the choice of involvement methods. For example, the presence of some stakeholder groups may inhibit discussion and open revelation of preference and can jeopardize the possibility of other stakeholder groups to work together at a later stage [Matsaert, 2002]. This kind of conflict/complementarity matrix might also be realized in a more specific way in the context of the CLIM-RUN project by mapping areas of consensual and conflicting needs in terms of climate information needs between stakeholders. This would be useful for the organization of workshop and the prioritization of the types of climatic data to be discussed and developed.

The *actor linkage matrix* is an approach that uses a matrix to map linkages and flows of information between key stakeholders. It can be used to gain an understanding of the key institutional linkages with which the project should work, or strengthen, to achieve its aims. To do it, stakeholders are tabulated in two-dimensional matrix and their relationships are described using codes (types and importance of linkages). For example, each cell in the matrix can show the depth of the relationship using symbols (x, xx, xxx for example), and be linked to a piece of text describing the linkage and explaining the ranking given. Each cell in the matrix represents the flow of information from the actor on the horizontal axis to the actor on the vertical [Matsaert et al., 2004; Reed et al., 2009].

The *systems diagrams approach* is useful for mapping linkages between stakeholders and for planning integrated approaches. Systems diagrams which visually map organizations, their linkages and flows of information and resources provide an additional framework of analysis of stakeholders interrelationship to the matrices described above. It might be particularly relevant approach for the CLIM-RUN project.

3 - DEFINING THE ITERATIVE PROCESS REGARDING THE DEVELOPMENT OF CLIMATE PRODUCTS IN THE CLIM-RUN PROJECT

3.1 - Introduction

The CLIM-RUN case studies were essential in implementing and evaluating the bottom-up approach to the development of Mediterranean climate services pioneered in CLIM-RUN. The case studies focused on tourism (Savoie, Tunisia, Croatia, Cyprus – co-ordinated by WP5), wild fires (Greece – co-ordinated by WP6) and renewable energy (Morocco, Spain, Croatia, Cyprus – co-ordinated by WP7) as well as one cross-cutting case study (North Adriatic – co-ordinated by WP8). The case studies were each led by locally-based teams with overall co-ordination provided by WP4. WP4 was responsible for defining the five key stages (see Table 3.1) early on in the project. The common methodological steps (also listed in Table 3.1) were identified and defined in greater detail as work progressed. The decision to produce information sheets, for example, was made following the first round of workshops during the process of translating user needs. This reflects the fact that implementation of the case studies was essentially a process of 'learning by doing'.

Since CLIM-RUN was a fixed-term project the key stages were implemented as an 'end-to-end' process over the three years of the project. They could, however, be readily implemented as an iterative, rolling process within an operational climate service.

Table 3.1 indicates the WP4 deliverables which describe the key stages and methodological steps in greater detail and which also provide an overall assessment of what worked well, what didn't work so well and what could be improved. These WP4 deliverables include links to the case-study deliverables including workshop reports and cross-cutting conclusions reports which provide much more detailed information relating to the individual case studies.

The first step was the identification and selection of stakeholders. This was supported by the theoretical and methodological review of stakeholder categorisation and analysis undertaken by CLIM-RUN social scientists (see Section 2). For the North Adriatic case study, the typological analysis approach proposed by WP1 (see Section 2) was used in which stakeholders were placed on a macro (national level) to micro (municipalities) continuum and then ranked using a score from 1 to 5 considering five specific attributes (i.e., importance, influence, effects, relevance and attitude) (see D7.4). A systematic ranking of stakeholders was also undertaken for the Savoie and Tunisia tourism case studies (see D5.4). The value of undertaking this type of analysis or mapping was not recognised by all case-study partners at the outset but, in general, appreciation of the

utility of such a step increased over the course of the project as discussed further in Section 2.2 of D4.4.

In the following sections, a brief commentary is provided on a number of issues that are particularly relevant to the CLIM-RUN protocol. Communication with stakeholders is discussed in Section 3.2, while Section 3.3 considers the identification of user needs, and Section 3.4 outlines the process of translating these needs. Section 3.5 addresses the production of products and Section 3.6 the process of reviewing and assessing them.

TABLE 4: The five key stages for implementation of the CLIM-RUN case studies and the common methodological steps associated with each key stage

Key stage *WP4 deliverable(s) providing further details and assessment*	***Common methodological steps***

Stage setting
 	
See D4.1 and D4.2
	• Identification and selection of stakeholders
	• First formal stakeholder contact
	• First stakeholder workshops and interviews (May-Dec 2011)
	• Beginning to define the 'who' and the 'what'
	  ○ Who are the climate service stakeholders?
	  ▪ Why is climate variability and change relevant to you?
	  ▪ How do climate issues fit within your decision making mechanisms and your perception of risk?
	  ○ What do you need/want from climate services?
	  ▪ Specific data
	  ▪ Analysis tools
	  ▪ Guidance and training
	  ▪ Other things…..

Mapping the issues
 	
See D4.2 and D4.4
	• Undertaken prior to/during/after first stakeholder workshops and interviews
	• Perception and data needs questionnaires covering:
	  ○ Who?
	  ▪ Your institution/organization
	  ▪ Risk perception and current use of climate and weather information
	  ▪ Your perspective on climate services

	○ What? ▪ Data requirements ▪ Handling uncertainties • Identification of user needs for each case study ○ Synthesis of information from: ▪ Hard copy/online questionnaires ▪ Stakeholder interviews ▪ Workshop discussions
Iterative consultation and collaboration *See D4.2 and D4.4*	• Translation of needs for each case study ○ Production of new examples of products and outputs ▪ What specific variables, indices and/or transfer functions to be used? ▪ What specific data sets (observed/simulated) to be used? ▪ Which climate experts to develop the product? ○ Identification of key data/output gaps and strategies for tackling them ○ Identification of priorities ○ Identification of requests which are 'out of 'scope' of CLIM-RUN or impossible to meet ○ Definition of new modelling tools required • Categorisation of needs (observations/simulations) ○ 0 not possible to provide; 1 already available; 2 easy to provide; 3 able to provide, but with a lot of work • Development of two-page product information sheets (following a standard format) ○ Sections on: Relevance to the case-study requirements; The approach; Product example; and, Making the product usable ○ Addressing the following questions: ▪ What is the target group? ▪ What problem is it for? ▪ What is the underlying approach? ▪ How reliable are the results?
Consolidation and collective review and assessment *See D4.3 and D4.4*	• Second stakeholder workshops and interviews (May-Oct 2013) • Review both the process of interaction between CLIM-RUN and case-study stakeholders, as well as the utility of the products and information developed in CLIM-RUN ○ How far have we got and how successful have we been? ○ What are the remaining problems and/or gaps? ○ How to sustain and extend the interactions? • Presentation of the product information sheets • Feedback on the product information sheets ○ Is the information clearly presented – in language that is

	meaningful and understandable for you? ○ Could the presentation/description be improved? ▪ If so, how? ○ Is the information relevant (and useful and/or usable) for you? ▪ If so, how might you use it? ▪ If not, why not? ○ What additional information would you like to have? • Further refinement and revision based on feedback, and then publication of the final information sheets on the CLIM-RUN case-studies web portal
Going forward: synthesis and recommendations *See D4.4*	• Review and synthesis of the case-study cross-cutting conclusions (D5.4, D7.4 and D8.4) and second round workshop reports in order to identify key common messages for input to D4.4 (Synthesis of common messages from the case studies) • Final meeting and end of project (Feb 2014) ○ Carousel discussions on: ▪ What is the role of climate translators? ▪ How to involve users on a more permanent and sustainable basis? ▪ How to deliver climate products efficiently?

3.2 - Communication with stakeholders

Communication with stakeholders has been fundamental to the success of CLIM-RUN throughout all the key stages, as has communication between project partners.

For each case study, communication with stakeholders was led by a specific stakeholder expert. Members of the CLIM-RUN research team were allocated to the Climate Expert Team (CET) or the Stakeholder Expert Team (SET) – with specific experts named for each case study. With the exception of some of the renewable energy case studies, the named SET experts were locally-based in the case-study locations. The role of these individuals was also to facilitate communication between the local stakeholders and the relevant CET member. The latter person was responsible for wider communication with other CLIM-RUN experts on climate modeling and observations.

A number of different communication methods were used, all of which were considered to have a useful role:

- Email (particularly for inviting stakeholders to workshops and events)

- Telephone for reminders about workshops and events, and setting up interviews)
- Newsletters (circulated electronically – including the general CLIM-RUN newsletter and tailored newsletters produced for the renewable energy sector)
- Project workshops
- Presentations during sectoral conferences
- Face-to-face interviews
- Hard copy questionnaires (and in a few cases, electronic versions)
- Shared wiki space
- Project web site (www.climrun.eu)
- Videos (available from the CLIM-RUN web site)

As part of the process of communication, issues such as barriers to engagement were considered and where possible common language used, for example in distinguishing information on different timeframes. CLIM-RUN has tried to consistently refer to seasonal forecasts (for next few months), decadal predictions (for next 10/20/30 years) and climate change projections (next 10-100 years). Building trust has also been an important consideration in communication with stakeholders. In this context, it has been important to clearly define the scope of CLIM-RUN and to ensure that, having been raised, expectations were, so far as possible, met.

One major conclusion from the case studies is that communication would have been improved by the involvement of experts in communication, visualization and participatory methods, together with social scientists particularly those expert in decision making. Another major conclusion is that effective communication requires an understanding of the specific stakeholder sector.

3.3 - Identification of needs

One of the main mechanisms for identifying user needs was the perception and data needs questionnaire produced by WP4 (the full questionnaire is reproduced in Appendix 3 of D4.4). The questionnaire was designed to be used flexibly, e.g., different parts could be completed at different times. The information sought through the questionnaire was considered important for both climate and stakeholder experts to have, with all the questions having some utility. However, it was concluded that the optimal method for seeking the information from stakeholders was using the questionnaire as the basis for semi-structured interviews – rather than circulating hard copies or online versions.

A critical feature of the CLIM-RUN process of identifying user needs is that background information about the stakeholders organization and decision making context (the 'who') was sought as well as asking about specific climate information needs (the 'what'). It is noted that the decision context may be different for the same stakeholder organization depending on the timeframe of information sought, i.e., seasonal forecasts are useful for operational decision making, while decadal predictions and climate change projections are more useful for strategic decision making.

As anticipated, user needs varied widely, depending on the particular sector, case study and user considered. Nonetheless some common needs were identified, for example with respect to extreme temperature and rainfall events.

One important key message is that it should not be assumed that users know their needs *a priori* – or at least that they can express them in a technical way. Even if stakeholders know that they are vulnerable to climate change and variability, it can be difficult for them to specify their needs without some awareness or knowledge of climate science – or there may be a danger of them being unrealistic in their requests.

3.4 - Translation of needs

The process of translating needs into specific products, information and tools was led by the CET members assigned to each case study in consultation with the climate modelling partners (WP2) and experts in climate observations (WP3) and with the relevant SET member. Initially a summary of user needs and how these could be met was produced for each case study. For each identified product, the underlying data set (e.g., ENSEMBLES RCM output, SAFRAN high-resolution observed data), variables (e.g., temperature, precipitation, wind, radiation, sea surface temperature) or indices (e.g., indices of extremes, Tourism Comfort Index, Fire Weather Index) and climate group responsible were identified. Many of the products identified required input data from major European and international project databases (such as ENSEMBLES and MED-CORDEX for downscaled climate change projections, COMBINE for decadal predictions and the ECMWF S4 system for seasonal forecasts) as well as local observed datasets for model validation and in some cases for development of indices and transfer functions (or as predictands in the case of the University of Cantabria downscaling portal). The relevant national meteorological services and local stakeholders were able to help in providing local data in some cases, but in general access to

local data at the required high spatial and temporal resolutions was more difficult than access to climate modelling output.

As indicated in Table 3.1, requests were categorized and prioritized, before arriving at the list of products that it was considered feasible to produce within the scope of CLIM-RUN. This process recognized that there are needs that can be met in the short-term, while others require longer-term research and development. The major constraints in terms of meeting needs within CLIM-RUN were both scientific and logistical:

- Availability of appropriate simulated and observed data (particularly in terms of variables and spatial resolution)
- Lack of or low predictability (particularly in the context of seasonal forecasting)
- Human resources
- Time

3.5 - Producing the products

The aim in CLIM-RUN was to produce a number of demonstration products for the case studies, rather than attempting to meet all expressed needs within the project timeframe. As noted in Section 3.1, it was decided to present these products in the form of two-page information sheets (see Table 3.1). The climate input for these information sheets was provided by WP2 (climate modelling) and WP3 (observed climate) partners. While most of them were also written by the climate experts providing the input data, perhaps the most successful or accessible ones are those written by stakeholder experts or jointly by stakeholder and climate experts. It was envisioned that the information sheets would be supported by additional material and data on the CLIM-RUN case-study and data portals whilst being 'free-standing' for those who don't want or need lots of technical details and data.

Most of the products are primarily based on climate model output (from seasonal forecast global model runs, decadal prediction global model runs and climate change projection regional model runs) and observations (for calibration and validation purposes), with only a few based on observations only. Most focus on specific case-study locations though a few are Mediterranean wide or use common methodologies applied to a number of case-study locations. While most of the products are forecasts, predictions or projections, a number of tools are also presented (e.g.,

interactive applications for fire risk and a statistical downscaling portal). All of the information sheets approved by the internal review panel are being made publically available.

A key feature of the production process used in CLIM-RUN is the network approach. While the climate expert allocated to each case study had the main responsibility for translating user needs, they were able to draw on the wider expertise of the project partners when it came to developing and providing individual products. A register of skills held by the climate experts (including their familiarity with specific observational and model datasets) facilitated this process.

3.6 - Feedback on the products

Whatever the nature or format of the products, the job of climate services does not end when the first draft product is handed over to users. Thus within CLIM-RUN, feedback was sought from stakeholders during the second round of workshops and interviews. This was primarily done through discussion of the questions listed in Table 3.1, but in some cases using brief questionnaires and additional, standard sets of questions. Ideally there would have been more time for several iterations of products and more discussion – nonetheless a number of the products were revised in the light of stakeholder feedback.

Although the stakeholders generally considered the products useful, it is difficult to identify examples of them actually being used as part of the decision making process (though this may be a matter of time). Demonstrating the value of climate services through such practical examples of usability is considered important both by CLIM-RUN partners and stakeholders. Such examples will be particularly valuable for future training and capacity building activities which are also seen as vital by all those involved in the CLIM-RUN case studies. Thus exploring the practical usefulness and usability of information could be added as another methodological step in Table 3.1. Though it is an open question as to whether developing an understanding of how to use the products for decision making should be led by the climate and stakeholder experts (i.e., the providers) or by the stakeholders (i.e., the users). Ultimately such activities could help in the assessment of the economic value of climate services though work undertaken in CLIM-RUN (see D4.5) indicates that this is difficult to do particularly for longer-term climate change projections which cannot be verified in the same way as weather and seasonal forecasts.

4 - THE BUSINESS MODEL FOR CLIMATE SERVICES: A THREE TIERS MODEL

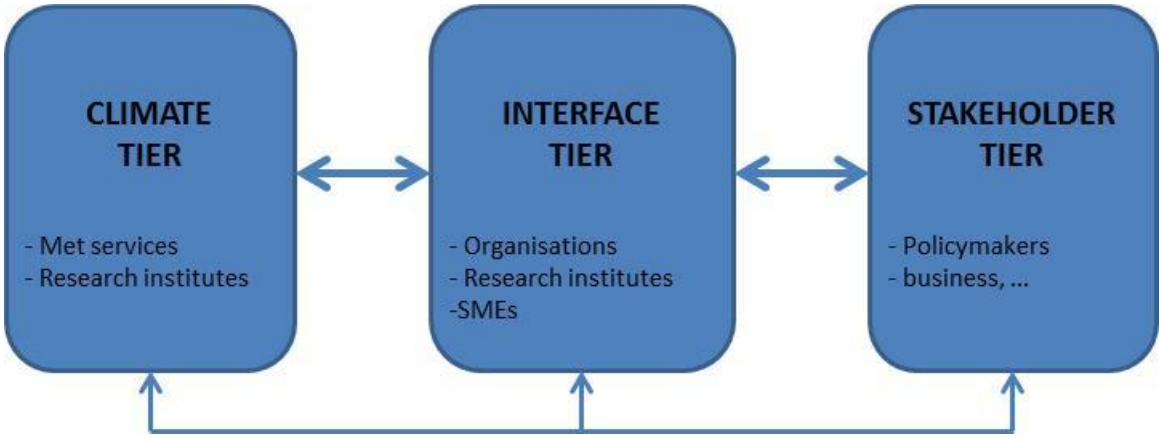
The CLIM-RUN experience has led us to envision the development of climate services on the basis of a Three Tier Business Model.

The main innovation or added-value of CLIM-RUN project is to have developed a bottom-up approach, by involving and communicating directly with stakeholders, from the start of the project, and throughout all the process of development and refinement of climate products. This innovative approach was thought as an effective way to provide adequate climate information at regional and local scale that is relevant to and usable by different sectors of the society. Based on this deep participation of climate services end-users, improved modeling and downscaling tools have been used to optimally respond to these specific needs, by enable relevant science to address stakeholder climate information needs in an iterative process.

This strong involvement of stakeholders, early and throughout the project, is a central aspect of the CLIM-RUN project. It has thus generated many results and insights regarding the ways to develop effective climate services at the Mediterranean level. The most prominent one is the idea that climate services need to be developed on the basis of a Three Tier Business Model.

Climate services have been defined as "*timely production and delivery of useful climate data, information and knowledge to decision makers*" [NAS, 2001: 2]. A climate service thus aims to make available a range of resources (data, products, decision supports, ...) directly usable by stakeholders that have to make climate variability and change-related decisions. It plays the role of an interface and coordination tool between needs (user area) and available information and resource (climate research area). But the main idea developed here is that to be effective, climate services should not be limited to a bilateral relationship between climate information providers (National Meteorological Services, climate research institutes, and climate impacts and adaptation research institutes) and users (stakeholders), but need to incorporate a third interface level, constituted by some organizations and group of individuals based for example in National Meteorological Services or research institutions, but also by a myriad of Small and Medium Enterprises (SMEs) that would have to perform this interface role. In this way, the main proposal made here is to develop climate services based on a three tier business model composed by a climate tier, an interface tier, and a stakeholder tier (see Figure 1).

FIGURE 2: A three tiers business model for the development of climate services



4.1 - The Three Tier Model

4.1.1 - The climate tier

The first component of the three tier business model for climate services is constituted by what have been named the “climate tier”. The general objective of this tier is to perform the role of “climate information providers”. In addition to this general role, the climate tier would also have to perform some certification and training tasks.

In this framework, National Meteorological Services (NMSs) of Mediterranean countries would have a central place and role to play in the climate tier. As a matter of fact, NMSs have a long history of, and experience in the provision weather, climate and hydrological information. Moreover, in the context of WMO, a mechanism of regional coordination and cooperation between NMSs has already been established. The WMO claims also for a “single windows” as a more efficient way to meet climate information and that single window can and have to be NMSs [Lucio, 2011]. But, in the same time, the climate tier would not be only composed by the NMS. In addition to NMS, climate research institutes but also climate impacts research institutes may have an important role to play in the climate tier. It is clear that climate products needed by the stakeholders are in many cases directly related to the effects of climate variability and change on natural

resources/assets and economic sectors (water, costal zones, marine resources, …). Thus, these research institutes may have a major role, along NMS, in providing climate related information to support adaptation to climate variability and change.

The climate tier would be in charge of four main tasks. Firstly, it would have to share climate expertise (teaching, training, identification of skills). Secondly, the climate tier would be in charge of some labeling or certification tasks on the ways to produce climate products or services. The third task would be accomplished jointly by the climate tier and the interface tier as it concerns the preparation of climate products. And last, but not least, this tier will have to work on data collection and processing as well as to perform new climate research on the basis of stakeholders needs.

It is important to note that to perform their role as component of the climate tier and provide climate services, NMSs and research institutes related to climate and climate impacts would have to define dedicated research cells that would actively participate in this business model for climate services and interact with the other tiers.

More precisely, one can distinguish two main levels in the composition and the functioning of the climate tier. The first level can be understood as the formal research component of the climate tier. This component is mainly in charge of developing and running new models, and establishing new reference datasets. The main idea here is that most of the research efforts regarding the development of climate and climate impacts observations and forecasts would not been undertaken to directly and specifically answer to information user needs, but to respond to research needs. In the same time, this formal research would be an essential input for providing dedicated climate services. The main implication is that even if most of the work performed by these institutes would contribute to the development of climate products that would answer to user needs, this would not implicate that all this work would be dedicated to this issue. Thus, at a second level, there is a need to define, inside the NMS and research institutes, more dedicated research cells that would interact directly with the other tiers (mainly the interface tier) to translate this formal research and meet the products needed by stakeholders.

In this framework, to be effective, the general functioning of the climate tier would need for national but also regional coordination between NMS and research institutes related to climate and climate impacts. Moreover at the Mediterranean level, there is a need of coordination of NMS of the region I and VI of the WMO.

4.1.2 - The stakeholder tier

The stakeholder tier is constituted by all the actors and/or sectors whose activities are sensitive to climate variables and that want to make informed adaptation to climate variability and change planning and decision making. More precisely, this tier would be composed by all the actors and/or sectors that want to take management and investment decision resilient to climate variability and change based on tailored climate products.

The Mediterranean region is considered as a “hot spot” of climate change and is already highly vulnerable to climate variability. Thus, theoretically almost all economic sectors of the region would be part of the stakeholder tier and be interested by climate services. In the same time, all levels of actors, from the micro the macro level, would have to make adaptation to climate variability and change decisions and would be interested in the availability of tailored climate information and services. It should be noted that climate services need would be different regarding socioeconomic sector and actor types.

As the stakeholder tier potentially represent a large group, it would be probably necessary to organize the interaction at a more formal and structural level. This could be done on a sectoral basis, at the national and/or the regional level, with key organizations.

The main activity of the stakeholder tier would be to define their climate product needs with the support of the interface tier. They would have to understand how climate variability and change can influence the profitability of their investments and the way they manage their activity. On this basis they would be able to define, with the support of the interface tier, what kind of climate information and products they would need to be better adapted and prepared to climate variability and change.

The main risk here would probably be that the stakeholder would maybe expect too much from the possibility to have tailored climate product that answer to their specific needs. From the experience it is clear that climate science and the climate tier would not be able to deliver climate products with

a too high geographic and time resolution for example. The same is true for the degree of confidence of some results. Thus there is a risk that stakeholders ask for too ambitious requests and thus to be disappointed by climate services. There is also an important risk that the climate products delivered by the climate tier would not be used on a proper way by stakeholders, even if guidance and training would help to prevent it.

In this way, there is an important need of capacity-building of the stakeholder tier by the interface and the climate tier. On one hand, depending on sector but also on actor type, there would be a need of capacity-building of stakeholder to support them in better understanding how climate variability and change influence their activities and their decision-making processes, but also to help them in the process of definition of their tailored climate products and services needs to be developed by the climate tier. One the other hand, stakeholder needs to be trained on the way they can use properly the climate products developed for them. It is noticeable that this training by the interface and the climate tier can be understood as climate services.

Moreover a process of certification of the climate products development process will have to be developed in order to create a climate of confidence in the use of the climate products.

4.1.3 - The interface tier

The interface tier would be constituted by a myriad of Small and Medium Enterprises (SMEs) specialized in climate consultancy, but also by some “boundary” organizations that are already used to play this interface role. For example, with the main objective of supporting organizations, sectors and governments to adapt to the changing climate through practice-based research, and by providing support and advice, the UKCIP can be considered as part of the interface tier in the United Kingdom.

The interface tier is a central piece of the three tier business model for climate services as it would play a key role of an intermediary, to assist in identification of needs, translate needs and make the climate products accessible to stakeholders. In this way, the interface tier would have the key role of bridging the gap between the important climate data and knowledge developed by climate research and climate information needs of various stakeholders to adapt to climate variability and change.

Thus, the main task of the interface tier will be to act as the catalyst between climate scientist (the climate tier) and the end-users of climate services (the stakeholder tier). More precisely, the interface tier would be in charge of raising the awareness on climate services of potential end-user. Moreover, even if it depends on sectors and stakeholders, end-users often do not know why they need climate services and so what kind of climate services they need. Therefore, an important task of the interface tier would be to create need by explaining how it can benefit the decision-maker. This can be done by using case studies and by a deep understanding of the specific decision-making processes of stakeholders. As climate products needs will be well understood, the interface tier would have to liaise with climatologists in order to create and develop these specific products. As mentioned before, the preparation of climate products will be conducted jointly by the interface and the climate tier. The burden sharing of this task will probably depend on the specific types of climate product needs. An important task of the interface tier would be then the tailoring of climate products, providing useful visualization tools, with a true sense of communication. This will help to make the product useful and useable to end-users. In this way, the interface tier would have to provide guidance to the end-user for use of the products in specific decisions, and help them to get the most from the service, for example by explaining the nature of probabilistic information. In order to perform these tasks the interface layer needs some understanding (though not detailed expert knowledge) of both the climate and the particular sector at stake.

4.2 - Some Topic of Importance for the Effectiveness of the Three Tiers Climate Services Business Model

By explaining the different tasks of the three tiers of this climate service business model, the previous sections have defined the interactions between them. But it is important to underline some other specific topics that would be essential for the development and the effectiveness of this climate services model.

4.2.1 - The need for capacity-building and training

One of the most important issues to deal with to develop an effective Climate Service concerns the need for capacity-building and training. This need is threefold.

First of all, depending on the socioeconomic sector and their relative knowledge regarding climate variability and change and the way that they will affect their activities, it would be essential that stakeholders would be trained by representative of the interface tier and the climate tier. In fact, they would help them to better define their needs in terms of climate products but also the way to effectively use them.

Secondly, the experience of Clim-Run deeply shows that it would be necessary that the climate tier trains the interface tier on the way to use the climate data to develop trustable climate products and on some important aspects of the climate science, for example the uncertainty surrounding climate projections.

One can note that these two first types of capacity-building and training might be considered as climate services.

Thirdly, the Clim-Run project revealed that it would also be important that the interface tier trains the climate tier in order to help them to better understand the ways of thinking and the needs of sectoral stakeholders.

4.2.2 - The Issue of certification

Building a climate of confidence and trust between the climate tier and the interface tier, and between the stakeholder tier and the interface tier would be a pre-requisite for the development and the effectiveness of Climate Services. A high level of transparency in the development process of the products that would be delivered, and thus of confidence in the climate services production, underpins the three tier model.

In this way, the issue of certification of the institutes and the companies that would compound the climate and the interface tier and the products they would develop is a major challenge. More precisely, this could be done indirectly by certifying the generation processes used by the climate and the interface tier to produce the climatic products than by certifying directly the products or the institutes or companies per se. A methodological charter that will specify and characterize the methods and procedure to be used to develop trustable products could have to be defined regarding for example the number of model that have to be used and on the representation of uncertainty, etc. It should be noted that identifying such defined criteria could not be straightforward and there is not a real consensus on this issue that probably need more discussion.

International groups such TGICA (Task Group on Scenarios for Climate and Impact Assessment of the IPCC) and WCRP (World Climate Research Programme) Working Group on Regional Climate will produce some guidance on these issues, and could be an important input to make progress on this important issue of certification.

It would also be important that the products delivered reflect the true spatial scale of the information provided by the underlying data/model. It should be noted that beyond a too prescriptive definition of the procedures to be followed to produce climate services, the probably most important issue to build trust in climate services would be the transparency of production process. This implies also to provide information about the model evaluation and validation, and on the sources of the information. In this way, one can note that if some climate information providers may want to share some experimental model or products at an early stage, it should be not a problem to provide it as it is clearly labelled as such.

4.2.3 - Financing and supporting Climate Services and climate research

Climate services have to be seen as an important tool to promote adaptation to climate variability and change for a large variety of socio-economic sectors and of actors. Climate Services will have an important economic value as they will support actively actors and socioeconomic sectors to make more informed choices in terms of management and investment decision regarding climate variability and change based as they will be in part based on tailored climate products. In this way, institutional actors would have an important role to play in promoting the reinforcement of the adaptation to climate variability and change capacities of socio-economic sectors and actors by supporting the creation and the development of Climate Services. Thus governments, but also international organizations would have the major responsibility of facilitating and supporting the emerging market of Climate Services by financing the dedicated research cells of the climate tier. This kind of support will help the climate tier to allocate time to develop some tailored climate information that would be asked by the interface tier but also to train effectively the stakeholder and the interface tier on the way to use climate products. On the other hand, the public financing of part of this emerging market will encourage the creation of small and medium enterprises that will composed the interface tier, but also will encourage stakeholders to try to use tailored climate data in their decision making process at not a too expensive cost and see the economic value of Climate Services.

The development of climate services will increasingly include a demand-driven climatology research that will have to be financed in part. This issue is twofold. On the one hand, on the basis of feedbacks delivered by stakeholders to the Interface Tier, then to the Climate Tier, and at the end, to national institutions in charge of research, the functioning of this climate service model would help to define new climatic research orientations based on important stakeholders needs. According to priorities, this upstream research would have to be funded to allow the climate tier to better answer to user climate information needs.

On the other hand, it is important to note that beyond the need of financial support for this focused research, it would be essential to finance long term climate research and to support large coordinated project as large ensemble of simulation or decadal exercises, as they would be an important basis for future climate services. In this context, there is an important need for financing of proactive long term research activity. Some stakeholder needs are not addressable with current research and knowledge, for example regarding aerosol issues. By supporting research in these fields, it would be possible to fulfill these kinds of needs in few years. In this way, in order to be able to deliver the next generation of climate services, some long-term research activities should start now.

The main point here is that it would be necessary to finance and support focused but also long term climate research as the climate services they will generate have an important socioeconomic value for numbers of socioeconomic sectors by supporting them to adapt to climate variability and change.

The issue of private payment for climate services has also to be raised. Are and when stakeholders expected to pay to have access to tailored climate products? No clear statement can be made here as no clear consensus emerged from the discussion. Nevertheless, it seems clear that that if a user requests something that they are not prepared to be made publically available, then they should pay directly as this would be essentially a consultancy service.

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