Indecis
Sectorial Climate Services

Integrated approach for the **d**evelopment across **E**urope of user oriented **c**limate **i**ndicators for GFCS high-priority **s**ectors: Agriculture, disaster risk reduction, energy, health, water and tourism

Work Package 7

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Demand for climate services in the French agricultural sector

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1 Context and objectives of this study

The INDECIS project has developed a portal to diffuse observational meteorological data from the E-obs database. 125 sector-oriented (Agriculture and Food Security, Disaster Risk Reduction, Energy, Health, Water and Tourism) climate indices are computed and made available in a gridded format (0.25°x0.25°) through the INDECIS portal (http://www.indecis.eu/indices.php). The overall aim of the work described in this report was to contribute to identifying the potential use of INDECIS indices in the French agricultural sector. The scope of the work was expanded to position INDECIS in the landscape of existing climate services in agriculture, analyse other climate services for agriculture and to draw lessons on the demand for climate services in this sector.

2 Performed work and results

We first describe the landscape of existing climate services and position the INDECIS portal within this landscape. We then carried out key informant interviews to describe the offer and demand for climate services in the agricultural sector. We finally carried out a survey with Climate Change (CC) Focal Points in Chambers of Agriculture[1] in order identify the need for water related climate services.

2.1 *Positioning of the INDECIS portal in climate services in France*

Climate services have been defined in France as the information and services for the qualification and evaluation of past, present and future climate, the evaluation of the impacts of climate change on economic activities, the society and the environment and the provision of elements to facilitate adaptation measures (Allenvi 2014). While other definitions exist, climate services do cover a broad spectrum of portals, decision support tools and models aiming at bridging the gap between science and users, to facilitate adaptation (and possibly mitigation) of climate change.

Different typologies of services have been elaborated. Swart et al (2017) distinguish climate indicators in three tiers. Tier 1 indicators gathers meteorological data derived from observations, climate models or their reanalysis. Tier 2 indicators consider in biophysical terms the impact of climate change on the sector considered such as the impact on water resources or the impact the agronomy of plants. Tier 3 indicators provide information on the social and economic impact resulting from the other indicators. There is a gradient in terms of the direct support to decision making, with tier 3 having the highest direct relevance for turning knowledge into decisions. Damm et al. (2019) includes a time gradient among services: past observational indicators, present indicators (weather forecast), close future indicators (seasonal forecast) and long term climate projections. We have combined these two typology in order to present an inventory of existing climate services available and position the indecis portal.

[1] Chambers of Agricultural chambers are self-governing public bodies representing French farmers and the rural world. They provide a wide range of services to the farmers and to other rural stakeholders. There are organized at the departmental and the regional level.

Other criteria such as the spatial resolution and the regularity of update of information (real-time or periodic) are other important characteristics of climate services.

The Indecis portal presently provides past observational data on indicators that are directly derived from meteorological data (Tier 1). An important effort has nevertheless been done to find indices that may be of interest for different sectors. The resolution is 0.25°x0.25° and data is periodically updated.

Table 1 presents a set of climate services available in the French agricultural according to a combination of the typologies presented above. We add the category "Climate indices relevant for specific sectors" as an intermediate category between tier 1 and tier 2 services.

	Past observational	Present	Close future	Climate projection
Meteorological data	INDECIS Climat-HD			DRIAS portal Climat-HD
Climate indices relevant for specific sectors	Oracle, INDECIS, MeteEau Nappes	MeteEau Nappes	MeteEau Nappes	Clima-XXI DRIAS
Impact of climate on agriculture in terms of agronomy	Oracle	AgrometInfo		Getari Clima XXI
Economic and social impact of climate on agriculture				Garonne 2050

Table 1: Some climate services available for the agricultural sector in France

Drias (http://www.drias-climat.fr/) is a portal that aims at providing the results of climatic projections implemented in French scientific labs. It also provides projections for a few indicators relevant for agriculture, tourism and the water sector.

Climat-HD (http://www.meteofrance.fr/climat-passe-et-futur/climathd), provided by Meteo France, present an integrated vision of past and future climate at the French and Regional level. A few national level indicators, relevant for agriculture, are presented such as drought indicators

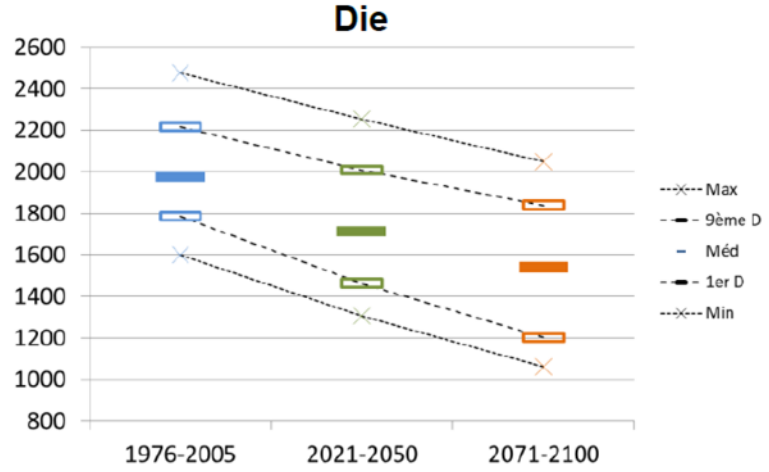
AgroMetInfo (https://www.agrometinfo.fr/), developed by the National Institute for Agriculture and Environment Research (INRAE) provides agro-climatic indicators and crop indicators for maize and winter wheat in real time based on the STICS model. It is calculated based on the reanalysis of SAFRAN climate data (resolution : 8x8km). It provides an opportunity to see trends in agro-climatic indicators, see their impact on crops and identify potential anomalies of the current year. The tool is opened to any user through the on-line portal

Getari (https://w3.avignon.inrae.fr/getari/) is a tool that allows to predict the impact of climate on crops, including in future climate. It is built to be used by scientist or trained crop experts. It's access is restricted on authorization.

MeteEau Nappes is a draft portal developed to provide real-time information on the state of underground water and seasonal probability of their evolution. It provides an opportunity to predict the probability to reach limits that may lead to water use restrictions, especially for irrigation.

Garonne 2050 is a an example of research study on the impact of climate change on water resources. It includes scenarios for the evolution of water use on the agricultural sector and resulting impacts on this sector. Many other study of the kind have been implemented in recent years: Explore 2070, Adour 2050…

Oracle and Clima-XXI are tools developed by the Chambers of Agriculture to foster climate adaptation in the agricultural sector. Oracle compiles observational meteorogical data from Meteo France over the last 50 years (Resolution 8x8km). A publication is produced by each participating regional Chamber of Agriculture on the evolution of climate indicators. A set of agro-climatic indicators, relevant for the different crops of the region as well as potential adaptation strategies elaborated with agricultural experts are also compiled in this publication. A similar approach is followed for the Clima-XXI tool that is however implemented at the provincial level (Département) and focused on future climate. Agro-climatic indicators are selected by CC focal points in discussion with agricultural advisors. Clima-XXI uses data from one model of the Drias portal to produce projections of the evolution of these indicators for two time-periods: 2021-2050 and 2071-2100. Each CC focal point is trained to compute directly the projections of these indicators for the selected locations of the province (resolution 8x8km). Focal points can therefore produce an infinity of indicators based on local needs. The results are therefore analysed and potential adaptation strategies are identified in discussion with crop experts. Both tools are used for advocacy activities on CC adaptation, training of farmers, and diagnosis of vulnerability of farms to CC.



Number of hours with T<7,2°C between 01/10 and 31/01

Figure 1: Example of a graph produces with Clima XXI for the location "Die" in the Drôme province for the (CNRM 2014, Aladin Climate model, RCP4.5)

This inventory, which presents only a subset of climate services available for the French agricultural sector, reveals the wealth of services available. These provide meteorological indices, agroclimate indices, as well as elements of impacts on agriculture and adaptation strategies. Both past observational and climate projections are available. Some climate services present a higher resolution than the INDECIS data portal and are often updated in real-time. This wealth of services represent a constraint for the positioning for the use of the INDECIS portal in the French Agricultural sector. The main comparative advantage of the INDECIS portal appeared to lie in its European scale. We therefore decided to explore further the demand for agricultural service, including for European scale services, through key informant interviews and a survey with CC focal points in Chambers of Agriculture.

2.2 *Key informant interviews and survey with CC focal points in Chambers of Agriculture*

Two methods were mobilized with different objects:

1. Interviews with key informants: 2 agro-climate scientists, 2 private grain traders, 1 technical institute expert and 2 climate change experts in Chambers of Agriculture. We explored the potential use of the Indecis portal, elements of the inventory of climate services and general lessons learnt on climate services.
2. A survey with 7 CC focal points on the clima-XXI tool and a need assessment for underground water climate services.

2.2.1 Key informant interviews

The interviews with grain traders aimed at testing the potential interest of the European dimension of the Indecis portal for the prediction of grain harvest and the prospects for future business operation. The interviews revealed that traders generally do not have the skills to process the type of raw data provided in the INDECIS portal. They indeed look for information to predict grain harvest in the different areas of Europe. They are nevertheless rather looking for expert analysis of meteorological data providing direct insights on future harvests in the different areas of Europe. They are currently paying consulting companies to provide this expertise. They also highlighted that the type of data produced in the INDECIS Portal may be nevertheless potentially useful if updated in real-time.

Interviews with agro-climate scientists, technical institute expert and CC experts in the Chambers of Agriculture highlighted the wealth of existing climate services available in agriculture presented above. However, one key lesson learnt is the general feeling that the promise of « climate services » has not been fulfilled yet. Farmers and agriculture technicians, although the main targeted users of these initiatives, rarely in effect use existing portals and climate services. They identified the need to create an institutional continuum between climate science and sectorial users, in addition to existing services, in order to translate climate data in operational sector specific services, which would include expert interpretations of climate change impact and adaptation options. Producing data, tools and portals is therefore not sufficient if the capacity of intermediary institution, such as the Chambers of Agriculture, is not strengthened to effectively tailor information to end-users needs and play as a sustainable bridge in the information chain. The

Oracle/Clima XXI tools were perceived as exemplary climate services in this perspective and were therefore investigated more in detail.

2.2.2 Qualitative survey with CC focal points of the Chambers of Agriculture

The aim of this qualitative survey was to explore further in detail the demand for agricultural climate services in France. Considering the exemplarity of the Climate-XXI tool in bridging the gap between science and farmers, this tool was particularly investigated. Interviews explored the following aspects:

- The main use of the Clima XXI tool and the targeted users
- The impact of Clima XXI on the agricultural sector
- The perceived strengths and weaknesses of the tool

During these interviews, we also investigated the need to enrich climate services with information on underground water, perceived as a gap in agricultural climate services. The interviews were carried out using the questionnaire presented in annex/

a) The Clima-XXI tool

The Clima-XXI tool is firstly used for the advocacy on the impact of climate change on agriculture. This advocacy approach targets a diversity of users, from key decision makers in the agriculture value chain to farmers. The perception is that the indicators produced and the fact that messages are delivered directly by farming experts, and not climate scientists, increases the impact and leads to a greater acceptance by the farming community. The second type of use is the training of farmers, through the inclusion of climate change modules in existing farmers training curricula. Finally, in some provinces, there is an ambition to turn this tool into a diagnosis method to evaluate the vulnerability to climate change of farms. This type of approach is nevertheless only envisaged for perennial crops for which CC needs to be already taken into account in present decisions, such as varietal choice. Some Chambers of Agriculture envisage turning this into a commercial service.

This tool presents two main strengths. First, the high resolution of the climate projections helps convincing farmers of the reality of the upcoming CC. Second, the flexibility of the tool, with the possibility to tailor climate indices to local needs, increases the impact on farmers. The indicators are defined either with crop experts in the Chambers of Agriculture or with direct interviews with farmers. This approach therefore facilitates the blending of climate information with agronomic expertise and increase its potential impact.

The main weakness of this tool is that a strong simplification of CC information needs to be operated, in order for non-climate experts to produce the agro-climate indices. In the Clima-XXI tool, only one model is used (DRIAS, CRM 2014) and two emission scenarios RCP 4.5 and RCP 8.5. In addition, the tool is developed in Excel and prone to errors with very limited quality control. This simplification may represent a tradeoff for ensuring the transfer of climate information to farmers. Although this may generate some errors, highlighted trends are probably accurate and may be sufficient to raise awareness on CC impacts and the need for farmers to anticipate climate adaptation measures.

This evaluation of the Clima-XXI tool provides also some lessons on how to develop climate services such as the one envisaged in INDECIS. First, the resolution of climate information is a key aspect for actual users to be convinced of the usefulness of climate services and that they are directly involved. Second, instead of

producing large number of indices that may nevertheless not be the one required by specific sectors/crops, efforts should be put on strengthening the capacity of potential users to generate themselves climate indices relevant for their sector/locations (indices calculator, simple training modules…). To achieve this objective, there is a need to collaborate directly with intermediate institutions in the construction of climate service, in order to blend sectorial expertise in climate services and ensure direct access to users through their network. This is in line with findings of Damm et al. (2019) for the touristic sector with the "applicability" and the "ease of use" criteria highlighted by stakeholders.

During these interviews, we also investigated the need to enrich climate services with information on underground water. Questions covered:

- The perceived importance of climate change issues on water resources and more specifically underground water.
- Do farmers start modifying their agricultural practices to adapt to the impact of climate change on water resources?
- What information is available to farmers on the impact of CC on underground water? What is lacking?
- What could be the adequate way to communicate CC information on underground water to farmers?

The interviews revealed that the use of alternatives water resources is perceived as the first adaptation measure by farmers. In areas with no history of irrigation, the development of irrigation facilities is therefore considered as an adaptation to future water scarcity. There is however a lack of knowledge on the availability of underground water in these areas. Simple information on the nature of the underground water and their potential to cover agricultural needs would therefore be the priority in these areas.

In other contexts where underground water is used for irrigation, information is more largely communicated to farmers through existing institutions such as water syndicates. There is however more limited knowledge on the impact of CC on these resources. In order, to have an impact on farmers, information should follow the same principles as highlighted above. For example, the impact of CC on water recharge, which is a very useful information for experts, may not be directly usable. Information such as the impact of climate change on the level of the water table or on the number of days of irrigation restrictions may be more easily understood and used by farmers.

Existing media such as "irrigation bulletins" which are technical letters sent by Chambers of Agriculture proving information on the state of water resources and technical advice on irrigation, which already has a large audience, may be an adequate media to convey this information to farmers.

Data on underground water, provided by the MétéEAU Nappes tool (deliverable 4.4) is considered particularly useful as seasonal "forecasts" of the state of water resources and the probability of water restriction. This could allow farmers to adapt their cropping system and/or their irrigation management according to prospects of water availability. The update in real time of forecasts and a large number of points are considered as a condition for the effective use of this tool.

3 Concluding remarks

The overall aim of the work described in this report was to contribute to position the INDECIS climate service in the landscape of existing climate services in agriculture, analyse other climate services for agriculture and to draw lessons on the demand for climate services in this sector.

A brief inventory, which presents only a subset of climate services available for the French agricultural sector, reveals the wealth of services available, which represents a constraint for the positioning for the use of the INDECIS portal in the French Agricultural sector. The main comparative advantage of the INDECIS portal appeared to lie in its European scale and its main limitation lies in its logically coarse spatial resolution, that raise the need to downscale the data information provided in the Indecis portal to more local scales.

The exploration of the demand for agricultural services to explore the future situations, including for European scale services, through key informant of the agricultural sector interviews and a survey with CC focal points in Chambers of Agriculture shown that more detailed climate services such as Clima-XXI were perceived as exemplary climate services.

Interviews also revealed that farmers perceive the use of alternatives water resources (such as irrigation in areas with no history of irrigation) as the first adaptation to climate change measure. Groundwater would be interesting as an alternative, but there is often a lack of knowledge on the availability of underground water. Simple information on the nature of the underground water and their potential to cover agricultural needs would therefore be the priority in these areas.

In other contexts where groundwater is used for irrigation, information is more largely communicated to farmers through existing institutions such as water syndicates. There is nonetheless a more limited knowledge on the impact of CC on these resources. In order, to have an impact on farmers, information provided should focus on specific indices used locally (information on the impact of climate change on water table level or on the number of days of irrigation restrictions rather on groundwater recharge for example). Following this idea, data provided by the MétéEAU Nappes tool (deliverable 4.4) is considered particularly useful, as it provides locally seasonal “forecasts” of the state of water resources and could help to forecast the probability of water restriction.

Finally, existing media such as “irrigation bulletins” providing information on the state of water resources and technical advice on irrigation, which already has a large audience, may be an adequate media to convey this information to farmers.

4 References

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Annex A: Interview Guide with CC focal points of Chanbers of Agriculture

GENERAL INFORMATION

Name :

First name :

Institution :

Function :

Date of interview :

ASSESSMENT OF THE CLIMA XXI TOOL

1. Can you describe the history of the deployment of the ClimaXXI tool on your territory?
2. What does ClimaXXI mean to you (an approach, a tool...)?
3. What developments of the tool have been made in your territory? How was the choice of the agro-climatic indicators analysed carried out?
4. What are the main uses of climate XXI in your region?
    - Training. Number of training courses: ..... Number of people reached :....
    - Production of prospective studies :
      Type of study :
      Number of studies/reports carried out :
      Communication :
    - Farmers advise
    - Other:...
5. Who are the main actors targeted by ClimaXXI (coop manager, coop technicians, large farmers, all farmers...)?
6. What do you think are the effects of ClimaXXI on the awareness of agricultural actors of the effects of CC and on farmers' adaptation strategies?
   Do you have concrete examples of impacts?
7. What are the strengths and weaknesses/improvement points of Clima XXI?
8. How do you monitor the activities associated with Clima XXI and could this monitoring be improved?
9. Are the skills you have developed in ClimaXXI valued within the Chamber of Agriculture?
10. Did Clima XXI generate income for the Chamber of Agriculture? If yes, what financial volume was generated by ClimaXXI related activities?
11. How does Clima XXI fit into the more global strategy of adaptation to CC implemented by the Regional Chamber?

STUDY OF THE NEEDS FOR CLIMATE SERVICES RELATED TO GROUNDWATER

BRGM is specialized in generating knowledge on groundwater, in particular by characterising the available resources and studying the impact of climate change on this resource. We believe it is important to explore how to make this knowledge available to meet the needs of the agricultural sector. The purpose of this survey is therefore to identify the development needs for these services.

These services can be either relatively "raw" with the provision of groundwater data, or more complex by integrating agronomic data, abstraction data or even broader economic data.

Questions :

1. Is the issue of the CC's impact on water resources a priority theme for agriculture in the department? Groundwater? (Improvement of clima XXI?)
2. How much of the Agriculture area is irrigated from underground water on your territory?
3. Have irrigation restrictions been increasing over the last 10 years?
4. If yes, are farmers starting to change their cropping practices/cropping systems as a result of these changes?
5. To your knowledge, what information is available on the impact of CC on groundwater resources and what form does it take?
6. What are the information needs on the impact of CC on ESOs that are not sufficiently covered? Which target population?
7. What do you think could be the best method for communicating this information to farmers?
8. What could be the impact of this information?

METE'EAU DES NAPPES

1. *PPT presentation in 5 minutes of the* **METE'EAU NAPPES** *tool.*
2. Have you heard about the MétéEAU Nappes tool?
3. What do you think of this tool?
4. What could be the uses of this tool for the agricultural sector in your territory? Which crops could be particularly concerned?
5. What types of actors would be interested in using this tool?
6. When in the year could the information produced in MétéEAU Nappes be particularly relevant for farmers?
7. What improvements should be made to make the tool more useful to the agricultural sector (e.g. additional coupled information)?