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Information transfer to the viticultural sector

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ADVICLIM



Information transfer to the viticultural sector

Information transfer to the viticultural sector

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ADVICLIM



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FOREWORD

Across the earth, there is growing evidence that a global climate change is taking place. Observed regional changes include rising temperatures and shifts in rainfall patterns and extreme weather events. Over the next century, climate changes are expected to continue and have important consequences on viticulture. They vary from short-term impacts on wine quality and style, to long-term issues such as varietal suitability and the economic sustainability of traditional wine producing areas. As a result, the wine industry is facing many challenges, which includes adapting to these potential impacts, as well as reducing greenhouse gas emissions related to their activities.

In response to these challenges, the LIFE-ADVICLIM project has the objective to evaluate and develop local climate change

adaptation and mitigation strategies. The measurement network and web platform of this project seeks to inform and assist winegrowers on climate change impacts, on rational adaptation scenarios and on greenhouse gas emissions related to their practices at the scale of their vineyard plots. These technologies are evaluated in many European wine growing regions (Figure 1), namely Bordeaux and Loire Valley (France), Sussex (England), Rheingau (Germany), Cotnari (Romania) and Navarra/La Rioja (Spain). These six regions represent the climatic diversity of European wine, ranging from the Mediterranean to Oceanic and Continental climates.

For more information on this project, visit www.adviclim.eu



Figure 1: Position of the six European wine growing regions that are studied in the LIFE-ADVICLIM project.

INTRODUCTION

LIFE-ADVICLIM project has a main objective to make the transfer between the "research and development" towards the applications (shift from "laboratory" to the application) that will allow to change the behaviour of wine professionals and policies. For this purpose, the ClimaVista® Wine web platform, developed by ECOCLIMASOL, has been adapted to respond to the needs of the ADVICLIM Project teams and stakeholders through the VIDAC platform (VID Data Archive Center and Visualization). The VIDAC platform, available in English and French, aims at providing to the project researchers and stakeholders a large set of project data (meteorological stations, satellite data, model outputs, carbon footprint results, adaptation scenario, etc...). These data are helpful for research as well as for responding to the needs of the actors (winemakers, public organizations, political ...) in order to easily release information to the viticultural sector and raise their awareness of climate change (Figure 1).

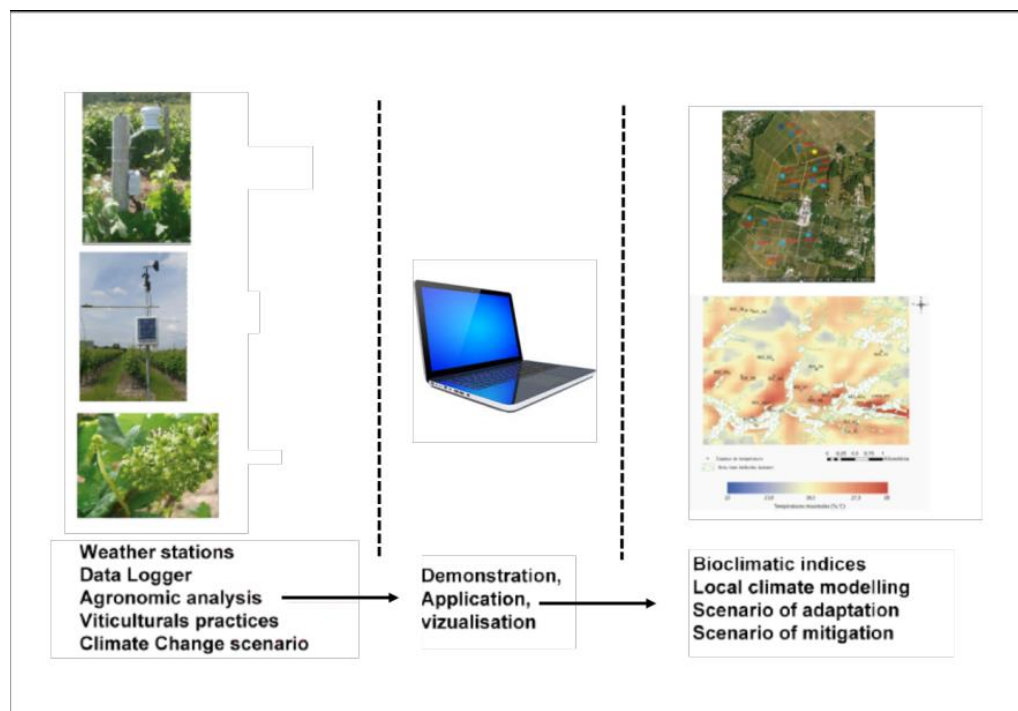


Figure 1. Agro-climatic data acquisition and visualization, and visualization of modeling results into the VIDAC platform to wine and political organizations.

However, throughout the ADVICLIM project, the VIDAC platform was not only responsible for illustrating and making available results. Indeed, it was also used to collect data which were subsequently used as inputs to the models of actions B1 and B2. Due to its ergonomics and ease of use, the platform also made it possible to identify malfunctions in the temperature sensors (outliers and temporal drifts for example).

ACCESS TO THE VIDAC PLATFORM

Two levels of access to the platform (<https://wine.climavista.com/>) are possible.

- **Access for the wine growers participating to the project:**

Access has been given to:

- 95 winegrowers of the Saint-Emilion pilot site,
- 3 winegrowers of the Cotnari pilot site,
- 7 winegrowers of the Coteaux Du Layon pilot site,
- 8 winegrowers of the Saumur-Champigny pilot site,
- 1 winegrower of the Plumpton college pilot site.

Note that there are no wine growers accounts in Germany. Indeed, despite numerous reminders we never received contacts from the responsible of this pilot site.



We have created these accounts but we have also mounted the georeferenced plots. It means that accounts were ready to be directly used by winegrowers in order to facilitate the visualization of ADVICLIM results. All these accounts are single-user accounts, which only give access to their own data and results (action B1 and B2). Because responsible of pilot sites asked us to create private accounts for winegrowers so that private data (temperature data from sensors, and technical, crop data from vineyards and obviously carbon footprint) can only be viewed by their owner, we modified our databases to add the concept of private data.

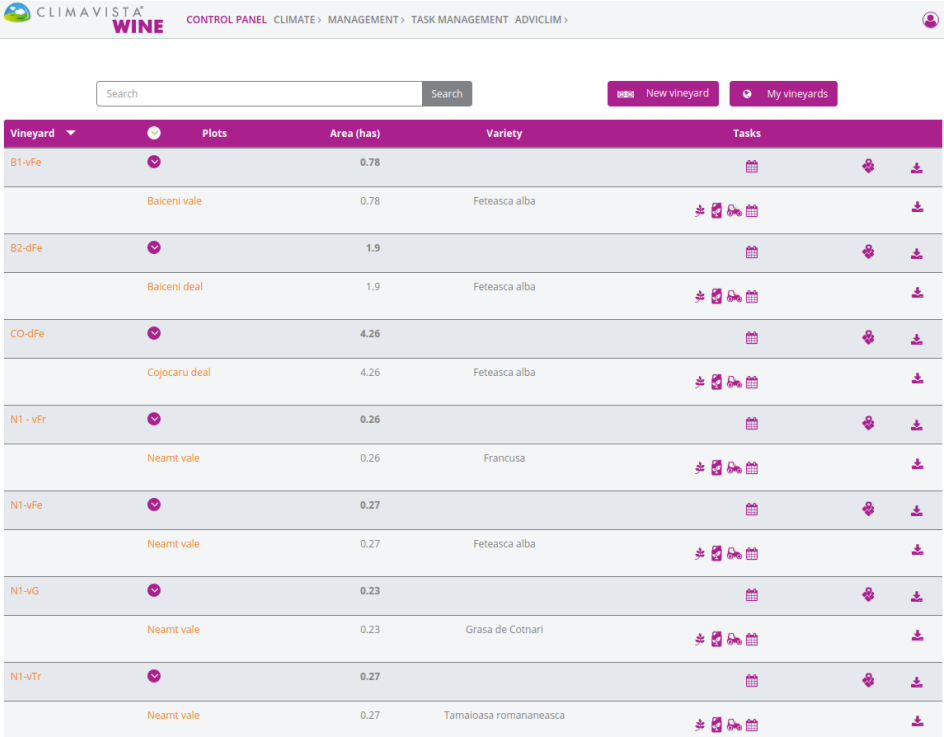
- **Access for the ADVICLIM partners:**

Every ADVICLIM partner has a login and password and currently uses the platform. Their accounts are supra-user accounts at the scale of a pilot site. It means that each supra-user account enables to visualize data from the whole georeferenced vineyards for a given pilot site. In the supra-user account, the map view of all plots and vineyards helps the responsible to have a better geographical visualization of the pilot site he manages.

DIFFERENT STEPS AND RESULTS

- **Georeferencing the Adviclim project experimental vineyards**

The experimental plots in the Adviclim pilot sites (Plumpton, Geisenheim, Cotnari, La Rioja, Saint-Emilion, Coteaux-du-Layon and Saumur-Champigny) have been geolocalised in the VIDAC platform. This information is viewable in the tab “Control Panel” (Figure 2). When the user clicks on a particular pilot site, he or she gains access to a map of the geolocalised plots, and a table listing the plots and their surface areas. The georeferencing for the Plumpton pilot site is shown in Figure 3. The user has always the possibility to edit (via the button ) or to cancel (via the button ) a plot. Figures 4 illustrates how to make the georeferencing of a vineyard and its plots in the platform Figure 5 shows how to register the planted variety and other technical information's.







































Vineyard	Plots	Area (has)	Variety	Tasks
B1-vFe		0.78		
	Balceni vale	0.78	Feteasca alba	  
B2-dFe		1.9		
	Balceni deal	1.9	Feteasca alba	  
CO-dFe		4.26		
	Cojocaru deal	4.26	Feteasca alba	  
N1 -vFr		0.26		
	Neamt vale	0.26	Francusa	  
N1-vFe		0.27		
	Neamt vale	0.27	Feteasca alba	  
N1-vG		0.23		
	Neamt vale	0.23	Grasa de Cotnari	  
N1-vTr		0.27		
	Neamt vale	0.27	Tamaloasa romananeasca	  

Figure 2. Control panel of the platform with the list of geolocalised pilot sites. Example of Cotnari pilot site.

CLIMAVISTA WINE CONTROL PANEL CLIMATE > MANAGEMENT > TASK MANAGEMENT ADVICLIM >

Select farm Plumpton

Vineyard: Plumpton
 Department: West Sussex
 Province: England
 Country:



Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community

Vineyard's Plots			
Plot	Area (has)		Tasks
Seyval	0.3	Seyval	
Bacchus	0.5	Bacchus	
Rondo	0.3	Rondo	
Dornfelder	0.4	Dornfelder	
Bacchus2	0.4	Bacchus	
Acolon	0.7	Acolon	

Figure 3. Geolocalised experimental plots of the Plumpton college pilot site.

CLIMAVISTA WINE CONTROL PANEL CLIMATE > MANAGEMENT > TASK MANAGEMENT FITO ANALYSES > ADVICLIM >

1 INFORMATION **2** GEORREFERENCE

ADD PARCEL IN VINEYARD

Fields highlighted in red are obligatory

Vineyard Layon

Parcel

Variety -- Select --

Purpose -- Select --

18-03-2020

MARCH 2020

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Following Cancel

Figure 4. First step for the creation of a plot: Insert the name of the vineyard, the name of the plot, the variety and the date of the last harvest.

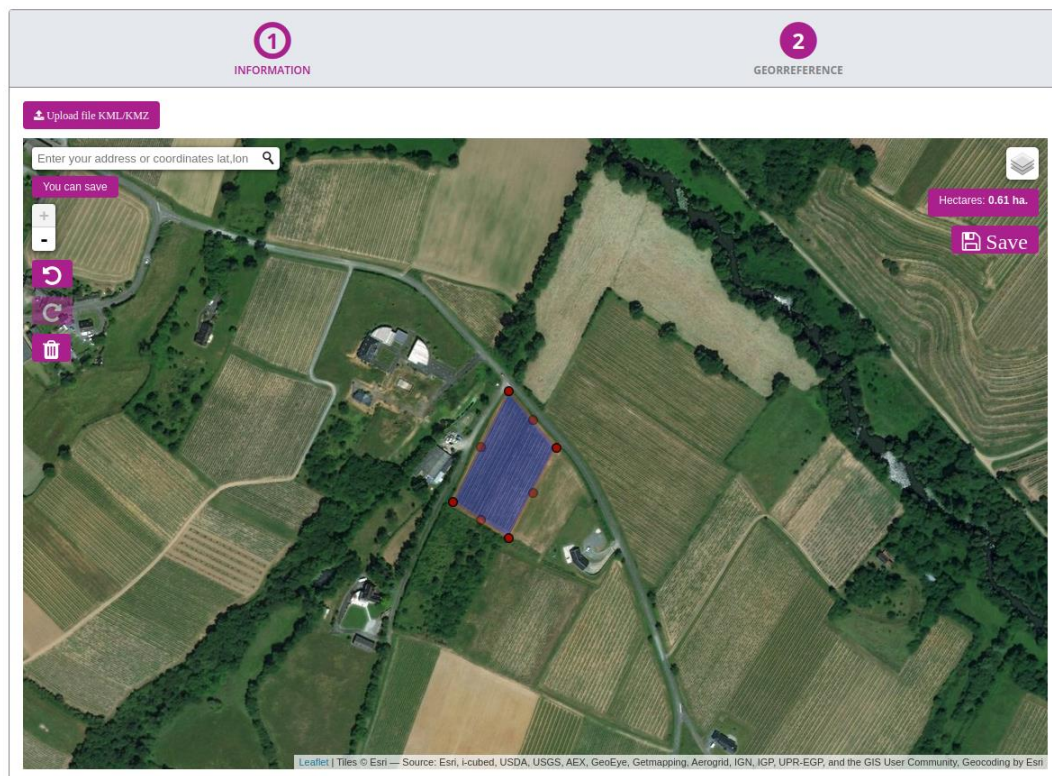


Figure 5. Second step for the creation of a plot: download the kml or kmz file of your plot or make manually the georeferencing on the map and save it.

- **Visualization and download of temperature data (sensors) and other data from public weather stations**

In the tab “Risk Management”, the user can visualize the map of the nearby weather stations by clicking on “Nearby stations”. Among these nearby stations, there are both sensors from the ADVICLIM networks and from the public weather stations monitored by ECOCLIMASOL. The example for the Saint Emilion pilot site is presented in figure 6.

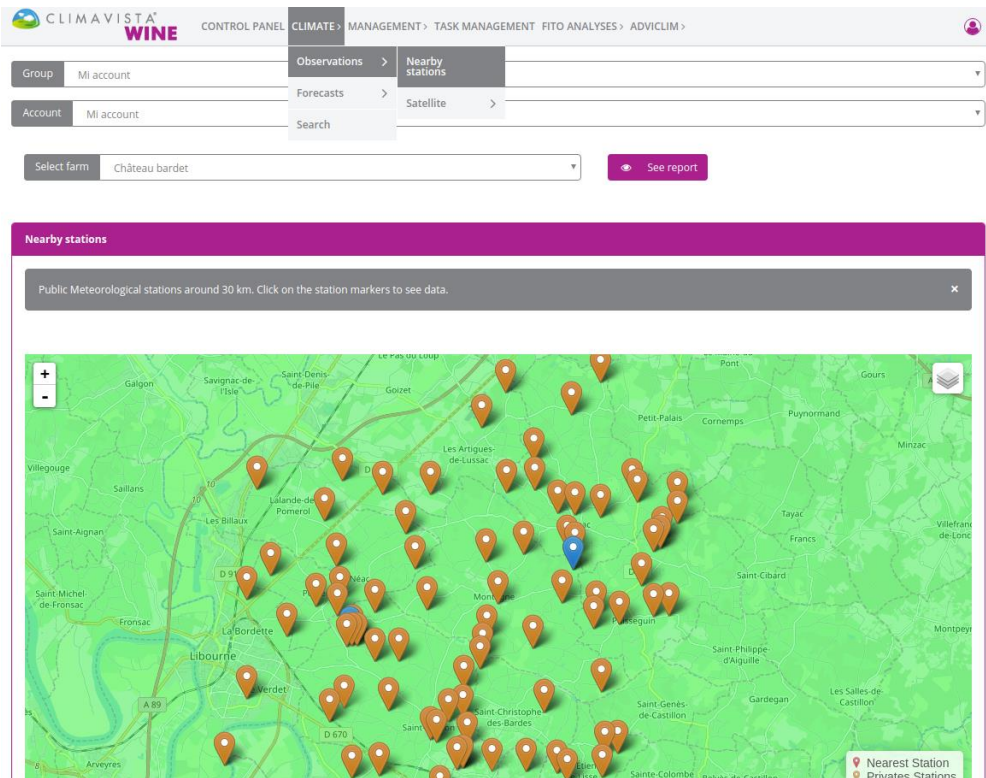


Figure 6. Adviclim temperature sensors and public weather stations monitored by ECOCLIMASOL at Saint-Emilion Pomerol pilot site.

On the nearby stations map, the user can find out the name of the sensor/public weather station, and the last date on which data has been registered, by positioning the mouse on the sensor, as shown in figure 7 for Saint-Emilion. Note that the color of the bubble indicates the status (nearest, private and public) of the sensors.



Figure 7. Information that appears when positioning the mouse on a sensor. Example on Saint-Emilion pilot site

When clicking on a bubble, the user accesses the graphical visualization of the data registered by the given sensor (or public weather station).

The French Adviclim pilot sites are connected to the Orbiwise automatic system, so ECOCLIMASOL can input this data into the VIDAC platform hourly. However, the Plumpton, Cotnari, La Rioja and Geisenheim pilot sites are not connected with the Orbiwise system meaning data must be collected manually and downloaded to the VIDAC platform every month.

Temperature data (min, max and mean) are shown for a chosen period (figure 8) at daily timescale. Indeed, the user has the possibility of selecting a particular range of dates by using the calendar in the right side of the page. The data downloading in a CSV format is completed by clicking on the button “Export CSV”. The figure 9 shows also an estimation of the evapotranspiration (calculated by the Hargreaves method). This parameter is only available at hourly timescale. Note the user can also access to hourly temperature data (not illustrated here).

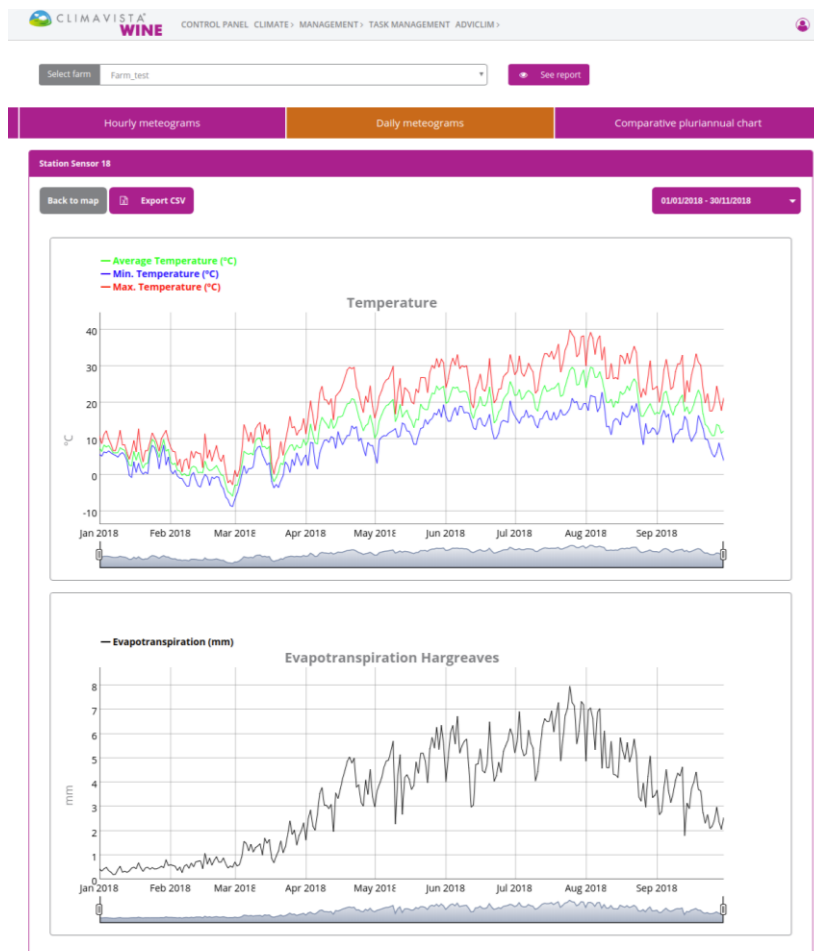


Figure 8. Visualization of the daily temperature and evapotranspiration for a sensor installed in Geisenheim (Germany).

At monthly timescale, the VIDAC platform allows to compare the current year with the previous ones (Figure 9). This functionality is particularly useful for the winegrowers because it permits a comparison by analogy.

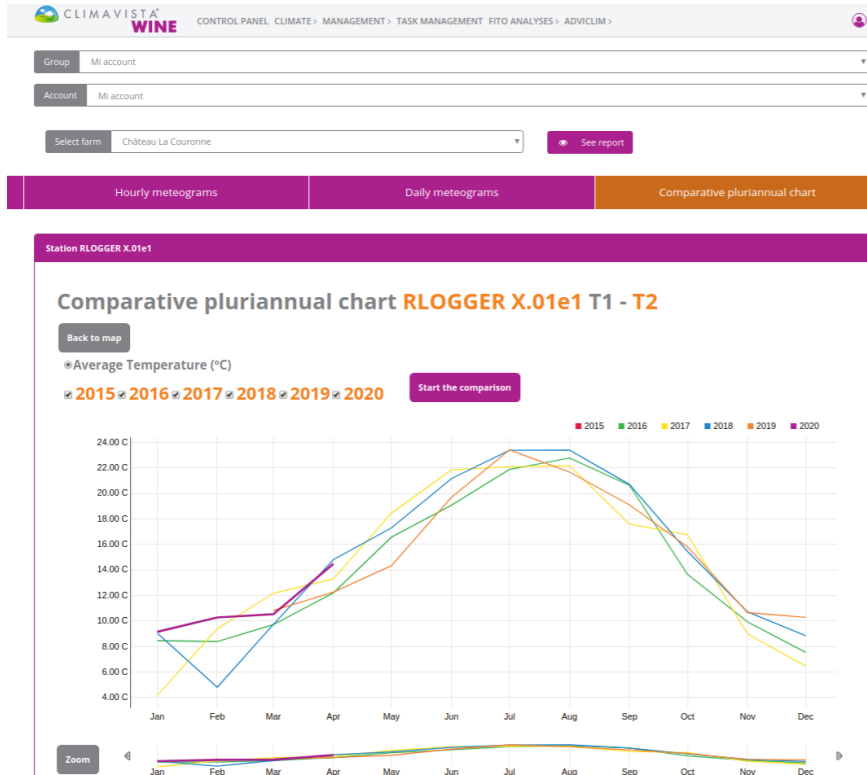


Figure 9. Pluri-annual comparison of monthly temperatures for a sensor installed in Cotnari (Romania).

For the winegrower who have a personal connected raingauge, we have developed a functionality for the observed precipitations (Figure 10).

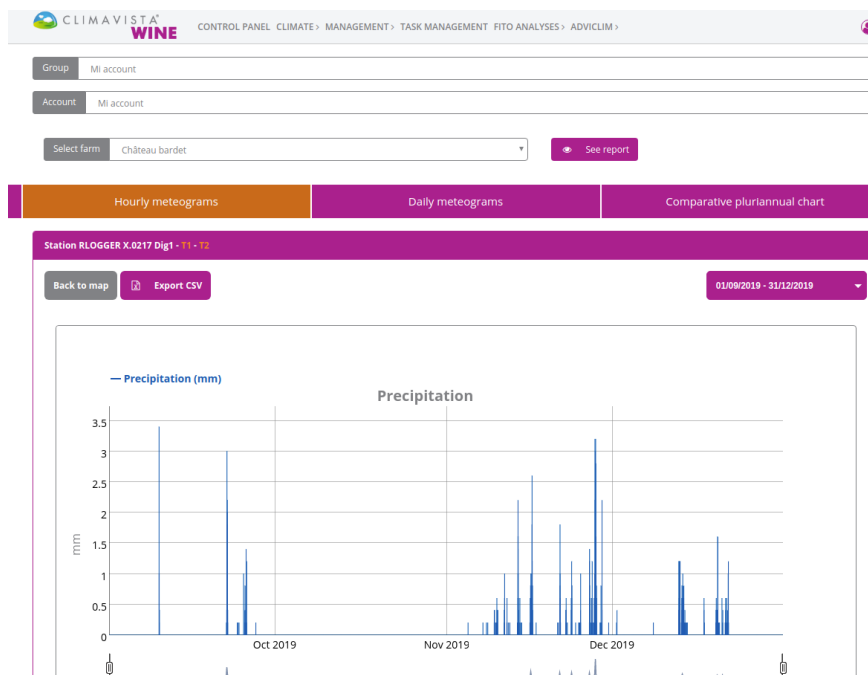


Figure 10. Visualization of hourly precipitations for a raingauge installed in Saint-Emilion (France).

- **Link with climate data modelling**

- ***Bioclimatic indices***

From temperature sensor data (or public station data), VIDAC provides a set of climatic risk indices (e.g. the risk of temperatures above 35°C), together with bioclimatic indices relevant to follow the grapevine growth and development conditions during the growing season. Among these bioclimatic indices, the accumulated degree-days (also called Winkler index) is calculated during the phenological grapevine period (from April to October in the northern hemisphere) and enables to evaluate the accumulation of heat requirements required for grapevine growth and development. VIDAC offers the possibility to visualise these climatic risk and bioclimatic indices for past years, in real-time and short-term forecasts (7 days) depending on the availability of recorded weather data in a given place. Figure 11 shows the temporal chart of the accumulated degree-days for Cotnari in 2018 compared to previous years.

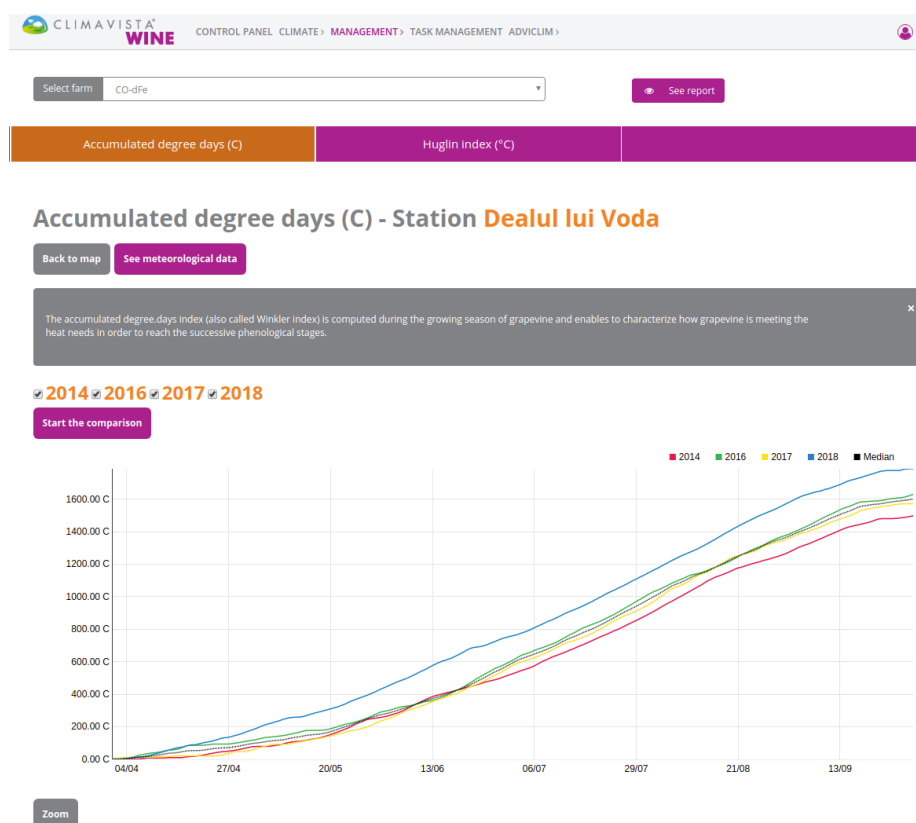


Figure 11. Temporal chart of the accumulated degree-days for a Cotnari sensor in 2018, compared to the previous years.

The VIDAC platform offers also another useful bioclimatic index (Huglin) as shown on Figure 12. The user can compare the Huglin index calculated from temperature sensor in the field with the Huglin index reported by the literature that corresponds to grape maturity for different grapevine varieties (legend to the right of the graph).

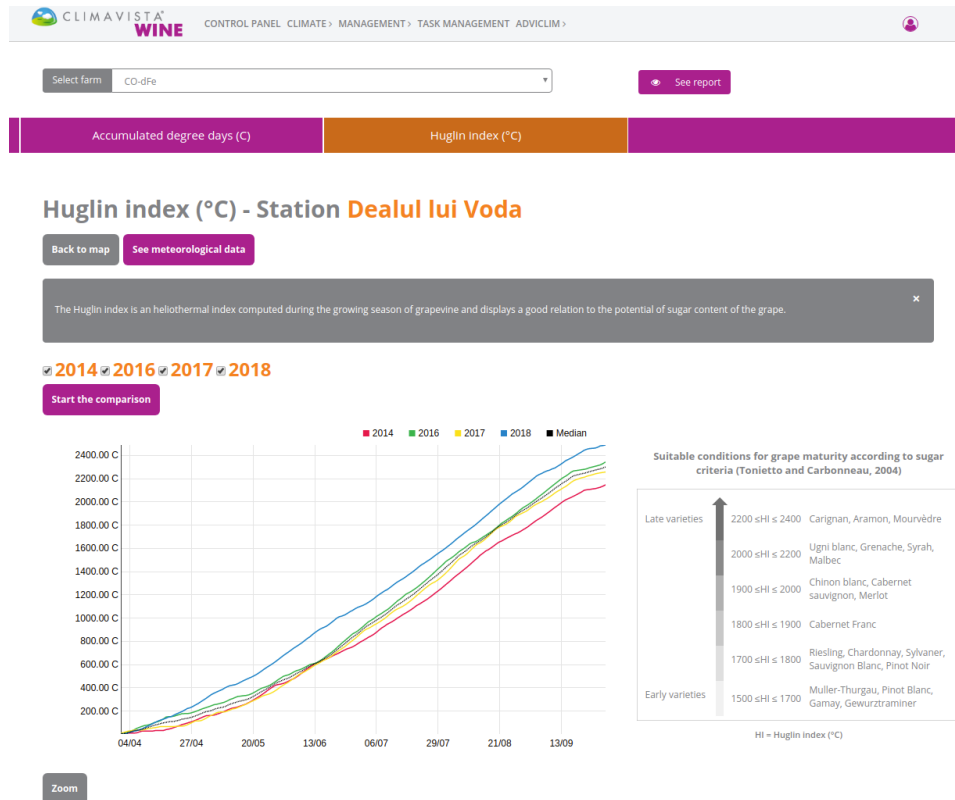


Figure 12. Temporal chart of the Huglin index for a Cotnari sensor in 2018, compared to the previous years. Table showing the suitable conditions for grape maturity according to sugar criteria.

- Maps of spatialized temperatures and bioclimatic indices

An automatic process providing maps of spatialized temperatures and bioclimatic indices was implemented on the platform. The model of spatialization uses temperature sensors and topographical (from a Digital Elevation Model) data, and was developed in action A1 (Le Roux et al., 2017). The service is operational in the tab "Management" for all pilot sites. It provides:

- maps of minimal temperatures, helpful to localize frost zones;
- maps of maximal temperatures, helpful to localize heat stress zones;
- maps of growing degree/days (Figure 14) and Huglin (Figure 15) indices that can help to spatially organize the harvest (heterogeneity in maturity).
- Maps of cool night index (Figure 13)

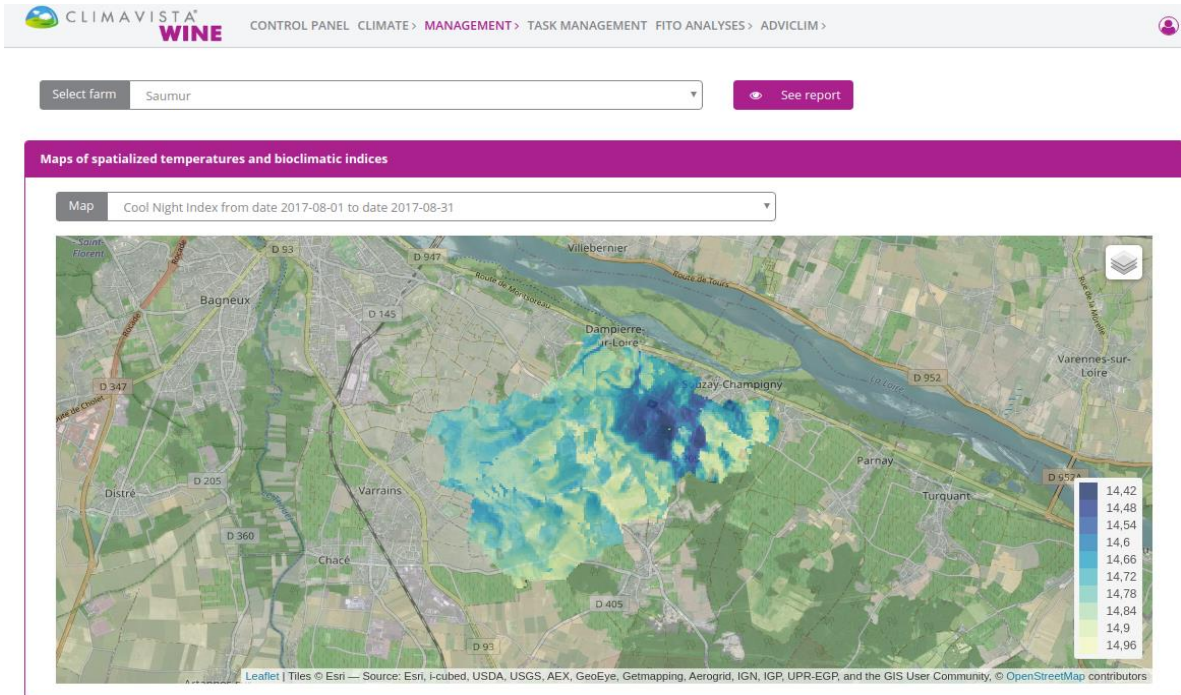


Figure 13. Map of the Cool Night Index computed between 2017-08-01 and 2017-08-31 over Saumur-Champigny pilot site.

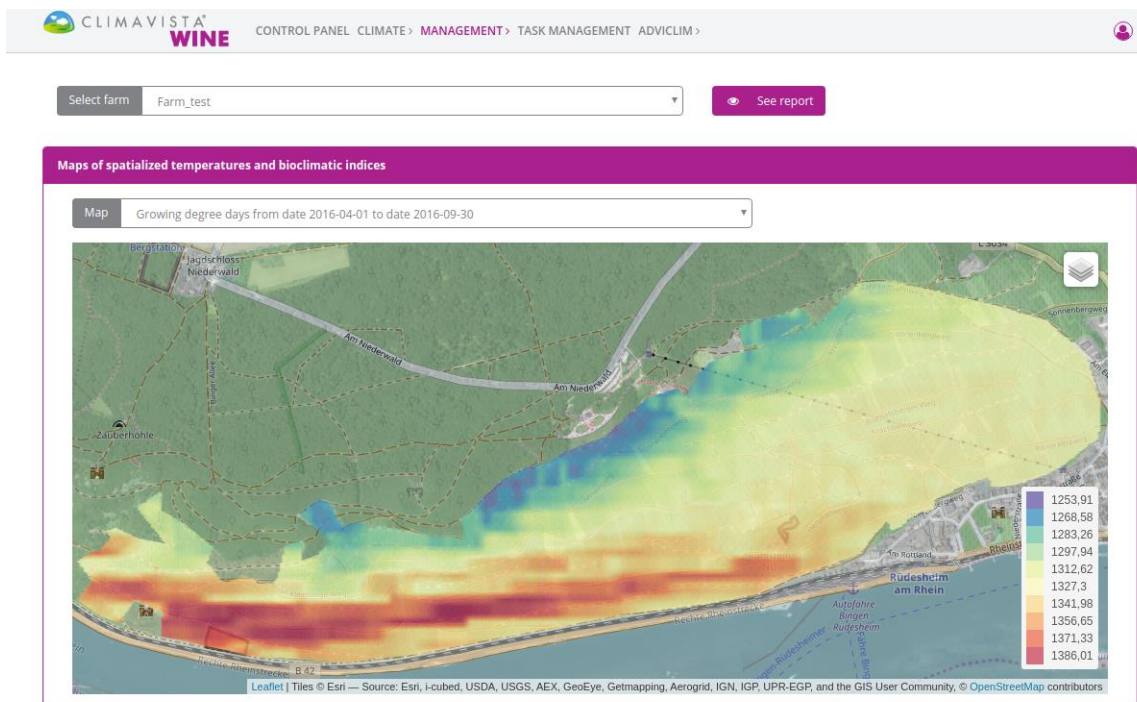


Figure 14. Map of the Growing Degree Days index computed between 2016-04-01 and 2016-09-30 over Geisenheim pilot site.

The time periods available are not only the years observed during the duration of the program. Indeed, some pilot sites provided us with temperature data measured before the start of the program. In addition, future forecasts (horizons 2040 and 2090) are also available for the Huglin index only (Le Roux et al 2018). For each time horizon two scenarios can be viewed. These are two Representative Concentration Pathway (RCP) of global emissions of greenhouse gases (4.5 optimistic and 8.5 pessimistic).

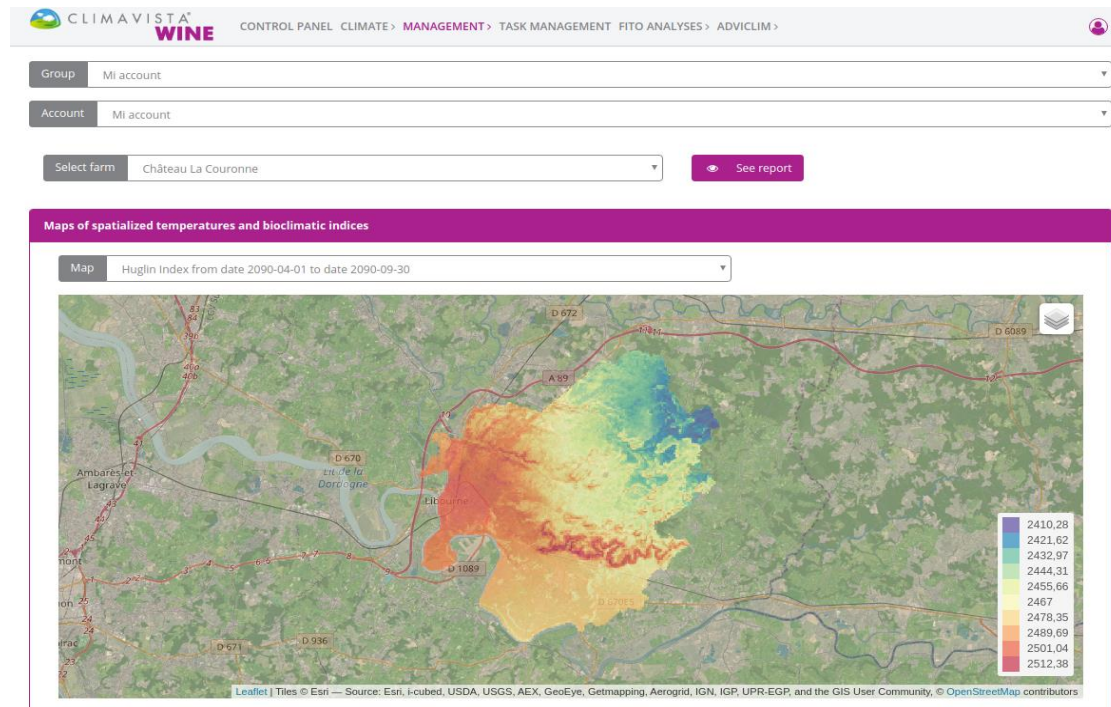


Figure 15. Map of the Huglin index computed between 2090-04-01 and 2090-09-30 over Saint Emilion pilot site for the scenario RCP 4.5.

- **Gathering information for other working groups**

The VIDAC platform offers a tab named “ADVICLIM” with the forms to gather all the vineyard information required for the SEVE model, which aims at simulating the impact of environmental conditions and constraints on grapevine behavior and viticultural activities (action B1), and for the carbon footprint model (action B2). These forms are in accordance with important specifications which were provided to us by the working groups B1 and B2. These online forms are available on different tabs and sub-tabs on VIDAC platform. Hereafter the list of forms:

- Inventory (Tools, Inputs, Equipment, Components and Costs)
- Monitoring (Observations)
- Practices (interventions and Uses of equipment's)

The idea behind putting forms online is to collect data in the same format for all pilot sites. But also to centralize this database in order to facilitate work on actions B1 and B2 by providing them with extractions at their convenience.

- **Displaying the result of B1 and B2 actions at plot scale**

The results of the modeling of actions B1 and B2 are available on the VIDAC platform. They are in private access on winegrower's accounts who participated in the collection of information. Figure 16 displays some results of the carbon footprint model (B2) on a plot at Saint Emilion pilot site. Ten categories of technical operations are compared through the calculation of direct and indirect carbon emissions.

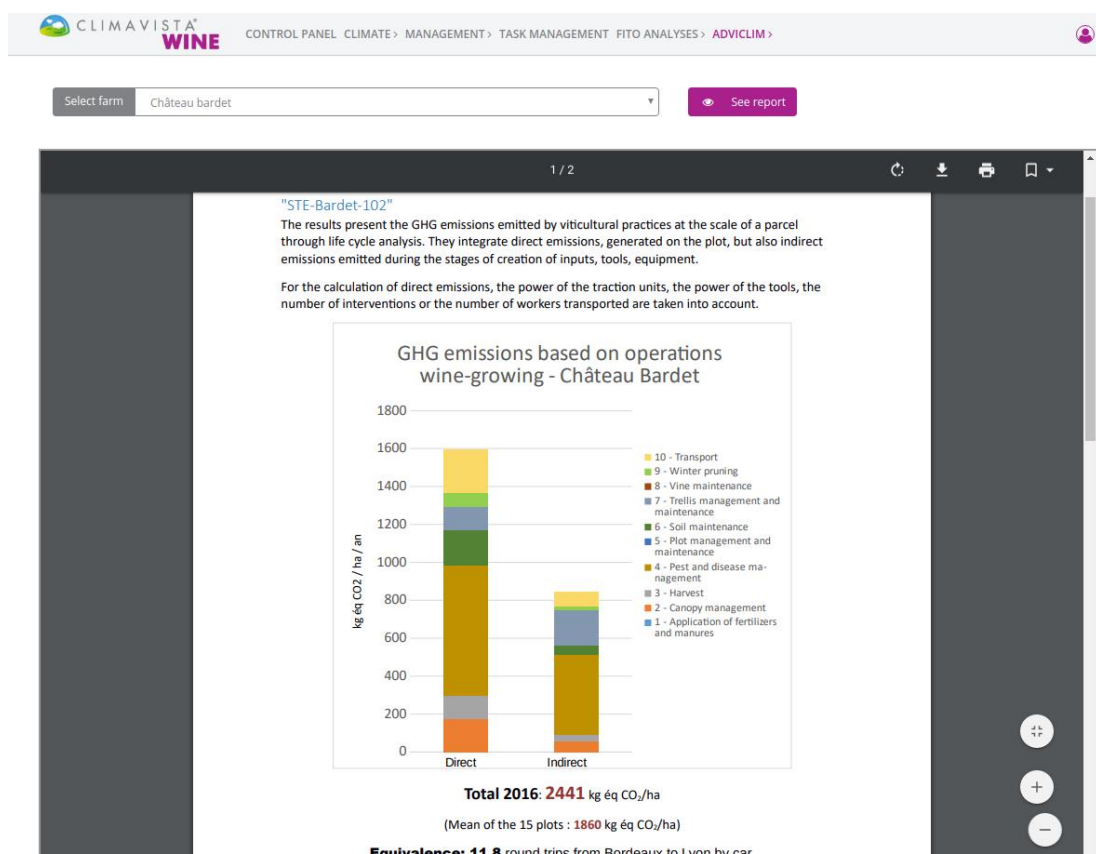


Figure 16. Illustration of results of the carbon footprint model on a plot of the Saint Emilion pilot site.

The graphs of the figure 17 present modeled projections of the evolution of the main phenological stages for the Merlot grape variety. The example of results comes from the WP B1.

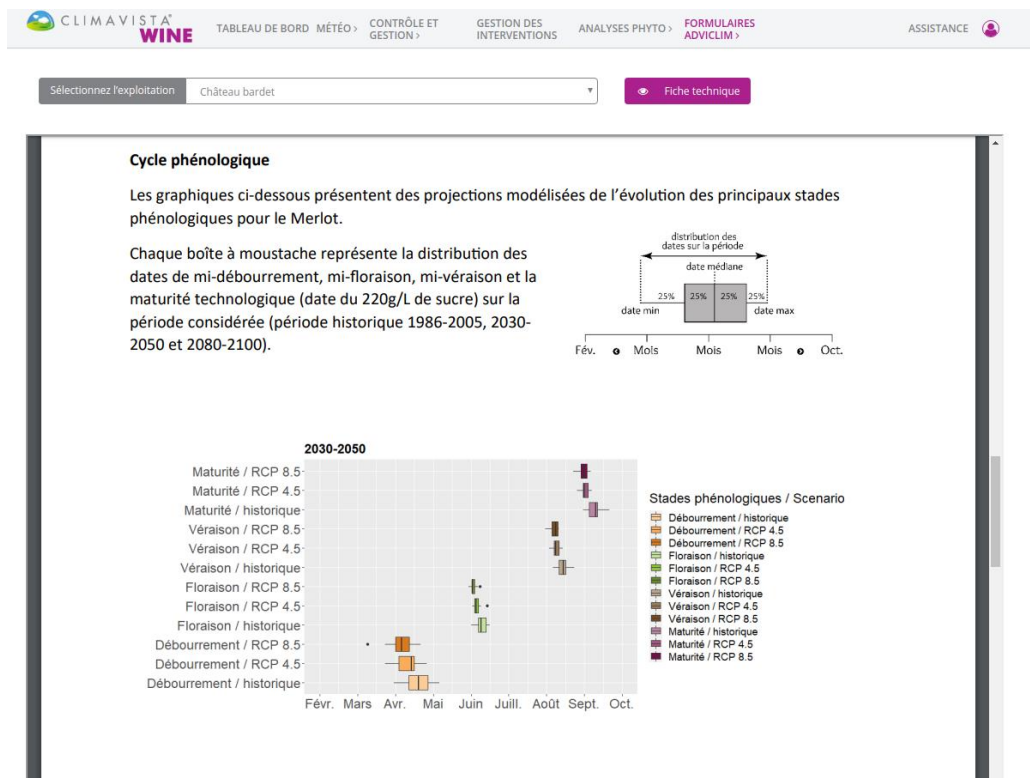


Figure 17. Example of results of the WP B2 at a plot scale. The screenshot is in french because it was taken from a winegrower account from Saint Emilion pilot site.

The results presented (figure 17) on future projections come from modeling integrating numerous uncertainties related to the climate data used. They should therefore be considered as trends for thinking about coping strategies today.

• Redaction of newsletter

As ADVICLIM is a LIFE project, one of the main goals of the project is communication via the dissemination of its results. In this context, in addition to the VIDAC platform, Ecoclimasol has participated in the drafting of newsletters. Two newsletters were written by Ecoclimasol titled:

-The latest maps of bioclimatic indices are now available on the VIDAC platform (<https://www.adviclim.eu/2017/09/19/the-latest-maps-of-bioclimatic-indices-are-now-available-on-the-vidac-platform-provided-by-ecoclimasol/>).

-” *Is the beginning of 2019 warmer or colder than in previous years?*” Sent by email at the ADVICLIM community subscribed the newsletter on July 27th 2019

These two newsletters were constructed from data and illustrations contained in the VIDAC platform.

- **Other services providing by ClimaVista Wine**

ClimaVista® Wine is a web platform providing agroclimatic services to help wine growers to manage their vineyards. In addition to the services presented in previous sections it provides its users (and therefore to the Adviclim partners and stakeholders) the services described below.

- ***The visualization and downloading of estimated precipitations from satellites***

The user can visualise and download estimated precipitations from satellites (Global Precipitation Measurement from NASA) in real time (figure 18). User can also access of spatial distribution and the infra-daily values or precipitations (not shown here).

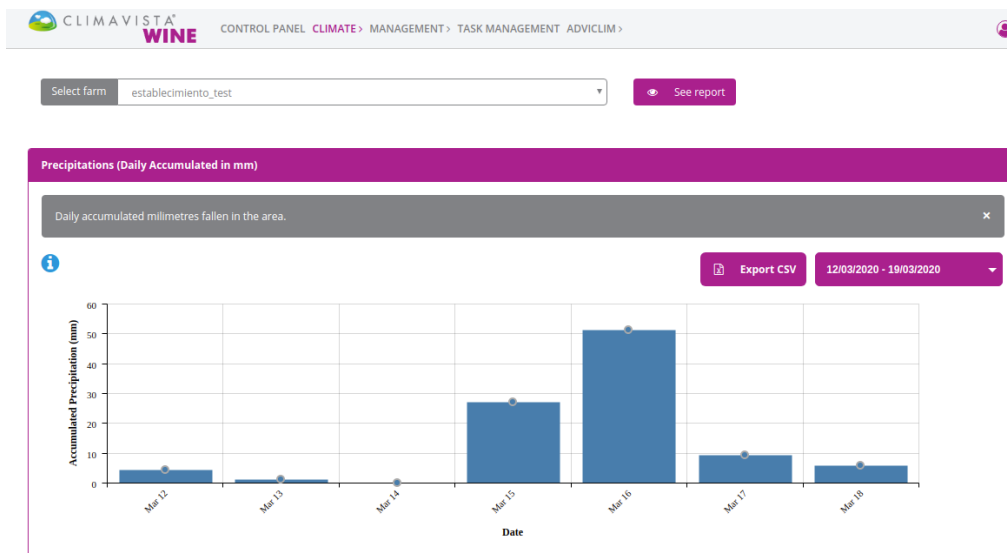


Figure 18. Visualization and downloading of estimated precipitations from satellites (Global Precipitation Measurement from NASA) in La Rioja zone.

- ***A Logbook for the registration of technical intervention***

Wine-growers can also inform and record cultural practices in a logbook (not shown here). The online forms to be completed are as follows:

- batch management
- Agrochemicals
- Fertilizers
- Yield
- Harvest

- **The visualisation of short-term forecasted weather data from the Global Forecast System (GFS) for the next seven days**

The platform furnishes also meteorological forecasts at seven days (precipitations, temperature, cloudiness, wind, surface pressure and relative humidity). Three timescales are available: 3-hours (figure 19), hourly and daily time-step. At hourly and daily time steps, the platform provides, by a color code (green-orange-red), whether the weather conditions are favorable and in accordance with the regulations for applying phytosanitary products.

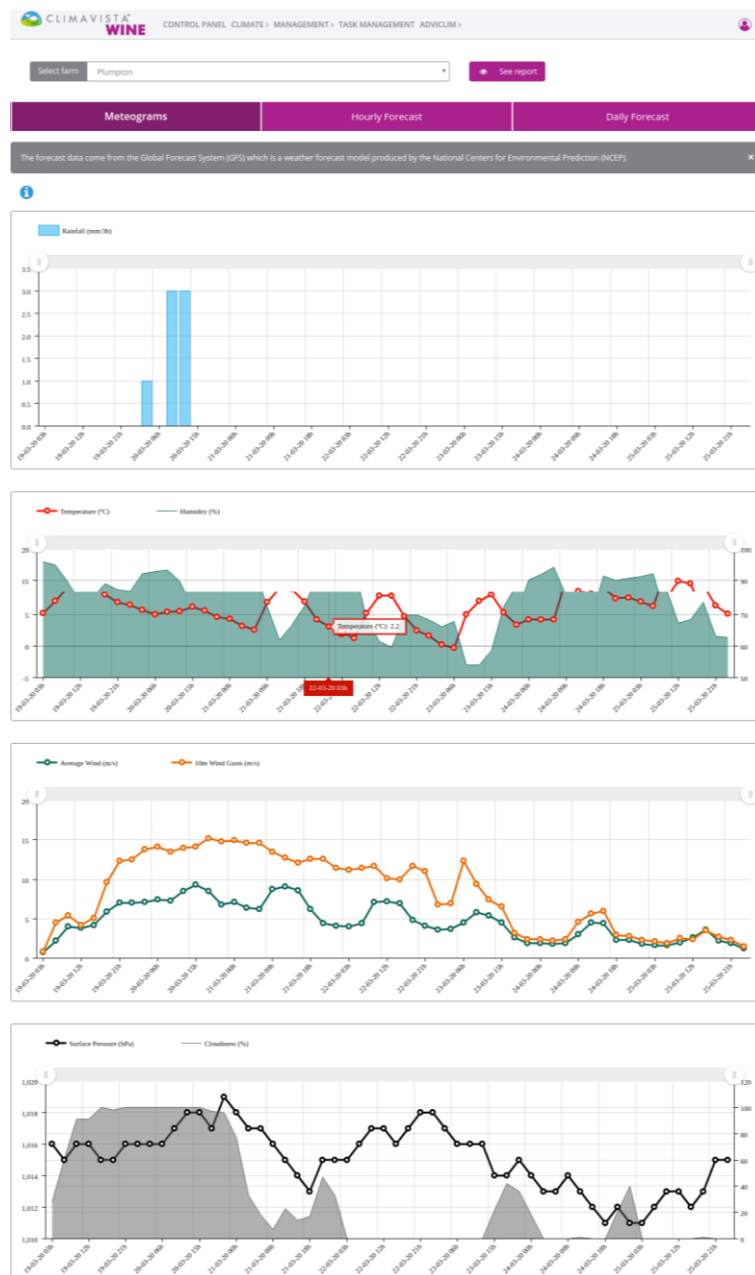


Figure 19. Visualisation of short-term forecasts (GFS data).

- **Functionalities linked to Normalized Vegetation Index estimated by satellite.**

Users can have access to near real-time maps of NDVI (at 15m resolution) of their vineyard and to the historical (3 or 4 years depending on the localization) as shown by figure 20. They can also make an intra-plots classification (based on NDVI pixels distribution) in order to separate homogeneous zones inside the plot. This zonification is editable (regarding to the terrain knowledge of the winegrower) and exportable by the users. It is regularly used to make different technical operations according to the places of the plot.

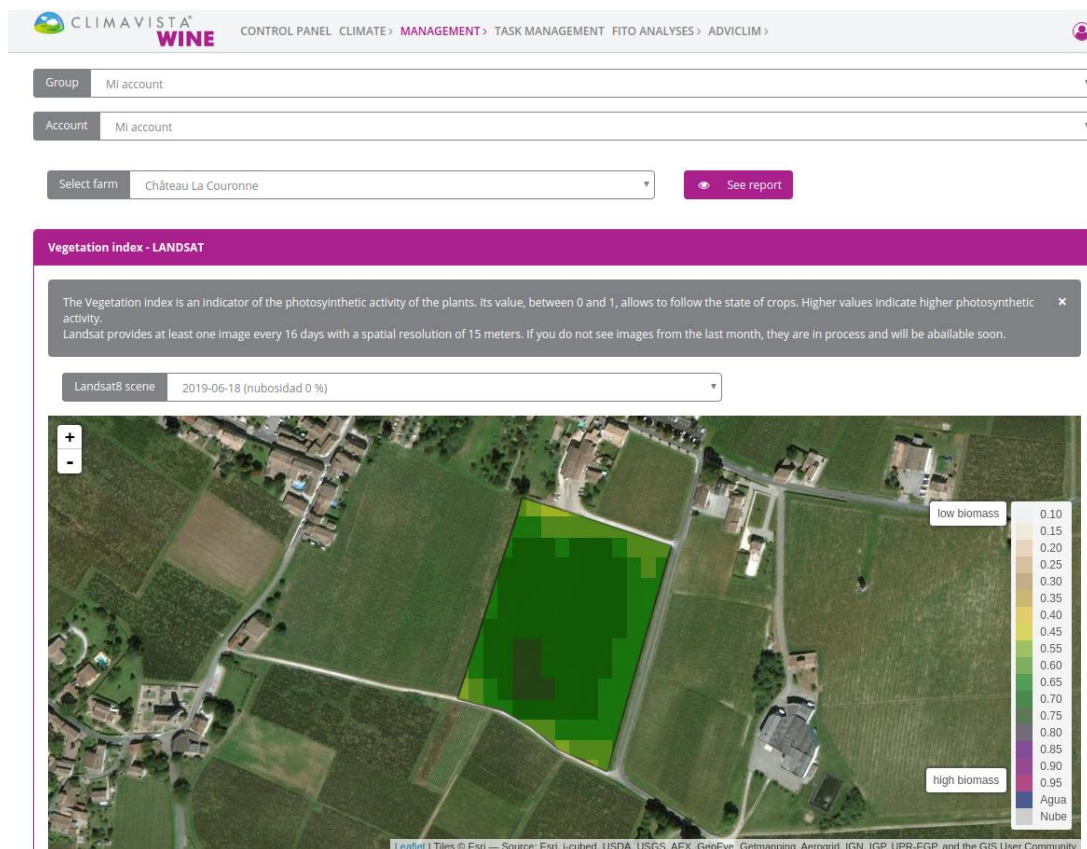
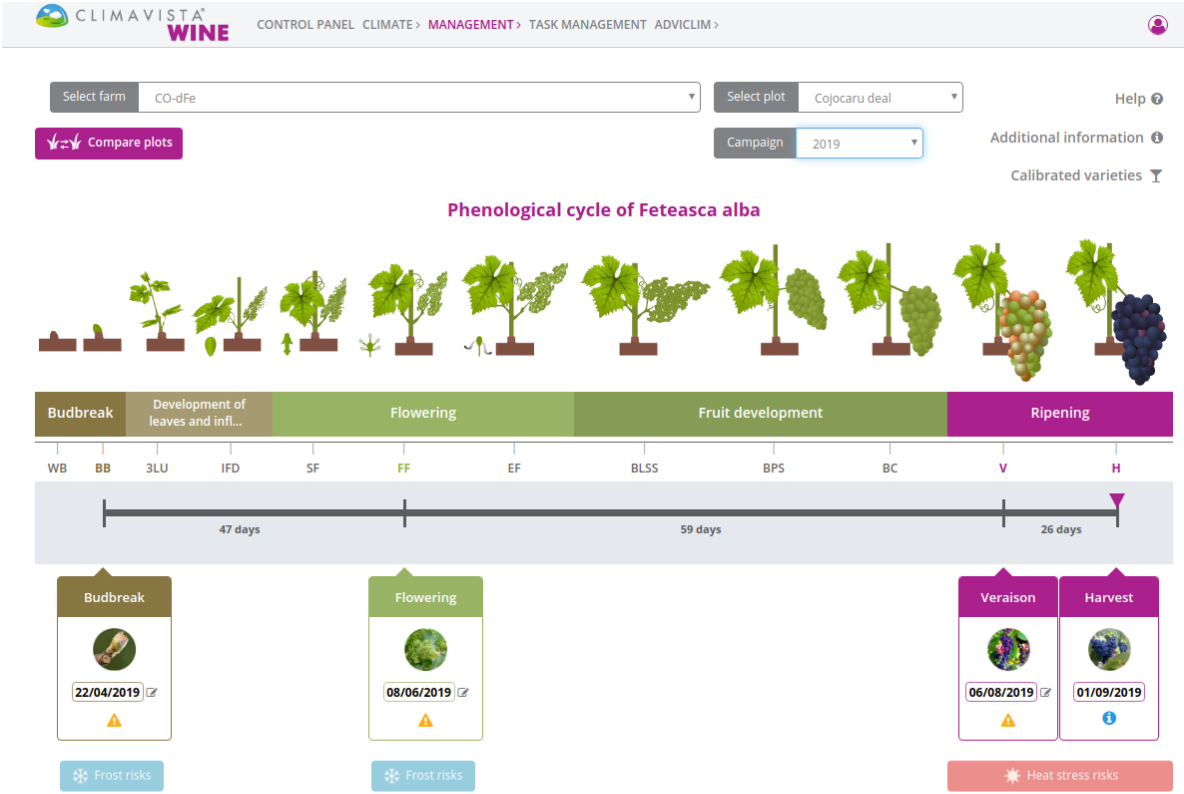


Figure 20. Example of NDVI map (2019-06-18) on a plot of the Saint-Emilion pilot site.

The VIDAC platform provides to users an estimation for past years and a forecast for the current year of the main phenological stages of the grapevine (budbreak, flowering and veraison) based on the models of Parker et al., 2011 and Garcia de Cortazar Atauri et al., 2009 (Figure 21). The calculation is done at the plot level for the variety informed when registering the vineyard, and from temperature data from sensors inside or very closed to the plot. Moreover, it informs about risk of frost around budbreak and flowering, and risk of thermal stress (according to 2 temperature thresholds detrimental for grapevine) between veraison and harvest. This service is very helpful to have a monitoring of grapevine development and anticipate meteorological risks at key stages.



Based on the BRIN and GFV models.
 Model references: Garcia de Cortazar-Atauri, I., N. Brisson, and J.P. Gaudillere. 2009. Performance of several models for predicting budburst date of grapevine (*Vitis vinifera* L.). *Int. J. Biometeorol.* 53:317-326.
 Parker, Amber, et al. "Classification of varieties for their timing of flowering and veraison using a modelling approach: A case study for the grapevine species *Vitis vinifera* L." *Agricultural and Forest Meteorology* 180 (2013): 249-264.

Figure 21. Phenological stages estimated in 2019 for the Cojocaru Deal variety on a plot of Cotnari pilot site.



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