D1.3 Specifications of DIANA services

WP1 Analysis and co-creation

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Table of Contents

List of Tables

List of Figures

Executive summary

Users and other stakeholders are at the heart of DIANA. It is with them and for them that we create the DIANA services, products, and tools. The primary goal is to provide users with tools that help them fulfil their mission and perform their daily routine operations more easily and better.

In this sense, the core philosophy of DIANA is to make the project a joint venture of stakeholders and project team. The objective is to establish a sense or fact of co-ownership, which is an indispensable condition for true empowerment of stakeholders and for sustainable implementation (i.e., continuity of DIANA services beyond the project end) of any tool or measure. Therefore, users and other stakeholders in all pilot areas have been consulted from the very beginning of the project, embedded in a process of co-creating the DIANA products, tools, and services together with users and other stakeholders.

The purpose of this document is to describe the third step in the co-creation process which consisted of *translating user needs and requirements as well as co-creation outcomes into demand-driven service specifications and technical requirements (Task 1.3)*.

The starting point for the development of service specifications was the existing set of platforms (SPIDERwebGIS®[1], Irrisat[2], MOSES[3], Minaret[4]) that have served as pre-alpha version of the DIANA platform on one hand and that will continue forming part of the final DIANA platform configuration (available for more detailed requests of expert users) on the other hand.

This document describes the activities and results of Task 1.3. It provides a detailed characterization of the user roles, applications, links with existing platforms, use cases, required functionalities of back-end and front-end, platform components, and graphical user interface (GUI).

The first two steps in the co-creation process have been described in two companion documents D1.1 (Users' and stakeholder's requirements analysis) and D1.2 (Report on co-creation outcomes: DIANA services and pilot use cases).

[1] www.SPIDERwebGIS.org

[2] www.irrisat.com

[3] moses-project.eu/moses_website

[4] Mateos et al. (2013); González-Dugo et al. (2013)

1. Introduction

1.1. Purpose and scope of the document

Users and other stakeholders are at the heart of DIANA. It is with them and for them that we create the DIANA services, products, and tools. The primary goal is to provide users with tools that help them fulfil their mission and perform their daily routine operations more easily and better.

In this sense, the core philosophy of DIANA is to make the project a joint venture of stakeholders and project team. This is particularly reflected in the fact that in some pilot areas the core users are members of the project consortium. In others, they are closely associated with a consortium member by means of subcontracts or other agreements. The entire workpackage WP1 is dedicated to this interaction.

The objective is to establish a sense or fact of co-ownership, which is an indispensable condition for true empowerment of stakeholders and for sustainable implementation (i.e., continuity of DIANA services beyond the project end) of any tool or measure.

Therefore, users and other stakeholders in all pilot areas have been consulted from the very beginning of the project, embedded in a process of co-creating the DIANA products, tools, and services together with users and other stakeholders.

The purpose of this document is to describe the third step in the co-creation process which consisted of *translating user needs and requirements as well as co-creation outcomes into demand-driven service specifications and technical requirements (Task 1.3).*

The starting point for the development of service specifications was the existing set of platforms (SPIDERwebGIS®[5], Irrisat[6], MOSES[7], Minaret[8]) that have served as pre-alpha version of the DIANA platform on one hand and that will continue forming part of the final DIANA platform configuration (available for more detailed requests of expert users) on the other hand.

This document describes the activities and results of Task 1.3. It provides a detailed characterization of the user roles, applications, links with existing platforms, use cases, required functionalities of back-end and front-end, platform components, and graphical user interface (GUI).

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[7] moses-project.eu/moses_website

[8] Mateos et al. (2013); González-Dugo et al. (2013)

1.2. Recapitulating user requirements

Much of the work in DIANA is based on the comprehensive work carried out in precursor projects (e.g., SIRIUS[9], ERMOT[10], Irrisat[11]) and in particular the Copernicus study "Applying Earth observation to support the detection of non-authorised water abstractions" (DG-ENV 2014).

Therefore, the platforms developed in those projects form the basis for the DIANA platform. During the first project year, pre-campaigns have been conducted in all pilot areas, using these existing platforms, considered as pre-alpha versions (see D1.2), in order to facilitate Core Users experience and help define what additional or new functionalities they would need.

These platforms will also continue forming part of the final DIANA platform configuration, available for more detailed requests of expert users, in particular for map consultations.

Given this pre-existing condition (which very likely will also apply to new water manager users, who already will be using a GIS-based tool or platform of their own), the most important part of the new DIANA platform is the DIANA interactive viewer. This viewer has been conceived as a simple user-friendly web app including the most relevant data and graphs derived from DIANA system in order to give a quick-and-easy overview to the potential users.

The conceptual workflow for a Water Manager (in charge of a given operational area) is as follows:

Step 1. Getting "the big picture", i.e., an overview at first glance of the situation in their operational area by means of four data text boxes (mean values of key parameters, see example in Section 6) and two overview graphs (one of temporal evolution of accumulated volumes and one of volume per crop types).

Step 2. Getting details on features of interest observed in Step 1:

(a) where they happen (breakdown by crop type &/or by water management unit, by means of cake diagrams)

(b) when they happen (monthly graphs, which in turn may be broken down by crop type &/or water management unit)

Step 3. Getting more location-based details from displaying and analyzing maps and guiding routine field inspection. This step will normally be performed using the pre-existing platforms of each user.

Step 1 and Step 2 will require the new DIANA interactive viewer as defined in section 6, with underlying components defined in section 2.3.

[9] www.sirius-gmes.es

[10] http://maps.spiderwebgis.org/login/?custom=ermot

[11] www.irrisat.com

Step 3 will require an automated login connection from the viewer back to the pre-existing platform. Some water managers will for some of their routine tasks want to login directly to their usual platform & access the new DIANA layer products from there.

1.3. Timing of DIANA platform development

This document describes the complete specification based on user requirements analysis.

The development of the DIANA platform will happen in a step-by-step process, starting with a minimal requirements version (for the 2018 campaign) and completing the system over time 8for the 2019 campaign).

The priority for the minimal requirements version is the interactive viewer (section 6), covering as many components as feasible with the available resources.

2. Definition of services and user roles

2.1. Definition of DIANA services

DIANA is developing a suite of three complementary services (see also D1.2):

1- (Non-authorized) water abstractions service;

2- Seasonal drought forecast and monitoring service;

3- WFD implementation support service.

Their details are defined in the following **Error! Reference source not found.**, Table 2 and **Error! Reference source not found.**.

Table 1. Details of DIANA Integrated Water Abstractions Service.

DIANA Integrated Water Abstractions Service (DIWAS)	
Purpose: Monitoring irrigation water abstractions (water exploitation planning, monitoring, and control, detection and documentation of non-authorized irrigated areas and/or non-authorized volumes)	
Users addressed	Water manager of WUA (or other WMU); Water manager of regional or river-basin authority (planning and control); National Hydrological Planning Office.

Core Products
>>> monthly, at 1ha resolution, during growing season, and accumulated at end of season <<<
>>> delivery during first week of following month and within 4 weeks of season end <<<
(also seasonal scenarios)	

*** maps of irrigated areas (total and per parcel) and crop inventory **(draft during irrigation season; final at end of season)**	Basic planning aid; Monitoring and control of exploitation plan (per farm, per water management unit, per aquifer, per sub-river basin, per crop)
*** maps of crop water consumption and abstracted volumes **(monthly & end of season)**	
*** maps: irrigation water requirements, crop water requirements, water balance & prediction; NDVI & RGB color composite **(weekly-monthly)**	Monitoring net water demand (from groundwater, reservoirs,…) for agriculture purposes
Scales of interest * Water body (aquifer, river) * Water management unit (drawing from the same source, e.g., dam, hydrant, canal) * Farm holding	
DIANA platform: online spatial analysis, dynamic interactive visualization, spatial aggregation, temporal accumulation, customized pdf report generation	
DIWAS Additional Products >>> monthly during growing season <<< Statistics & time-series analysis of all above products; Maps of crop water requirements (prediction one week ahead);	
Use of EO data	Bi-weekly to monthly images from high-resolution (HR) Virtual Constellation (Sentinel 2A/2B, Landsat); no real-time need for core products
Use of non-EO data	Weekly agrometeorological station and rain gauge data; Soil maps (texture and depth); Rural cadastre; orthophoto; public maps; vector maps of farms and water management units Field data (water distribution; water meter records)

Optional module	*Purpose*	*Additional features and EO requirements*
Integrated Farm Advisory Service (IFAS) module	Near-real-time irrigation scheduling	Same HR images, but in near-real-time image download and processing, delivery to user within 24 h of satellite overpass

Table 2. Details of DIANA Seasonal Drought Forecast and Monitoring Service.

<table>
<tr><td colspan="3">DIANA Seasonal Drought Forecast and Monitoring Service</td><td> 
</td></tr>
<tr><td colspan="4">Purpose: Planning and Monitoring water allocations; drought management</td></tr>
<tr><td>Users addressed</td><td colspan="3">Water manager of regional or river-basin authority (planning);
National Hydrological Planning Office.</td></tr>
<tr><td colspan="4">Core Products
>>> daily, weekly, monthly, during growing season, and annually before irrigation season <<<
(also seasonal scenarios)</td></tr>
<tr><td colspan="2">*** Maps of climate/weather forecast
(annually before irrigation season & updates during season)</td><td colspan="2" rowspan="4">Basic planning and management support</td></tr>
<tr><td colspan="2">*** Mid- & long-term forecast of crop water requirements
(weekly to seasonal)</td></tr>
<tr><td colspan="2">Maps of water scarce areas
(annual forecast, weekly update)</td></tr>
<tr><td colspan="2">Tracking river beds continuity
(weekly)</td></tr>
<tr><td colspan="4">Scales of interest
* Water body (aquifer, river)
* national</td></tr>
<tr><td colspan="4">DIANA platform: dynamic interactive visualization, customized pdf report generation</td></tr>
<tr><td>Use of EO data</td><td colspan="3">Bi-weekly to monthly images from high-resolution (HR) Virtual Constellation (Sentinel 2A/2B, Landsat);
no real-time need for core products</td></tr>
<tr><td>Use of non-EO data</td><td colspan="3">Numerical weather prediction models at different resolutions;
Weekly agrometeorological station and rain gauge data;</td></tr>
</table>

Table 3.Details of DIANA WFD Implementation Support Service.

<table>
<tr><td colspan="2">DIANA WFD Implementation Service</td></tr>
<tr><td colspan="2">Purpose: Monitoring and decision support for implementation tasks of various Articles</td></tr>
<tr><td>Users addressed</td><td>Water manager of WUA (or other WMU);
Water manager of regional or river-basin authority (planning and control);
National Hydrological Planning Office.</td></tr>
<tr><td colspan="2">Core Products
Same as for DIANA Water Abstractions Service

Scales of interest
* Water body (aquifer, river)
* National</td></tr>
<tr><td>Purpose</td><td>DIANA information product</td></tr>
<tr><td>Article 4 (quantitative monitoring / balance abstractions & recharge)</td><td>abstractions monitoring</td></tr>
<tr><td>Article 5 (monitoring of human activities impact on water status)</td><td>abstractions monitoring</td></tr>
<tr><td>Article 9 (water services cost recovery)</td><td>crop water requirements/ consumption/abstractions mapping</td></tr>
<tr><td>Article 11 (program of measures)</td><td>update of abstractions registry</td></tr>
<tr><td>Optional:
Article 14 (Public information & consultation)</td><td>Aspects of DIANA platform / portal</td></tr>
<tr><td colspan="2">DIANA platform: as for DIANA Water Abstractions Service</td></tr>
</table>

2.2. User roles

In the DIANA platform we distinguish three different types of users: “super-administrator” (SA), group administrator (GA) and water manager (WM). Their roles are shown below.

- **Super-Administrator (SA).** The super-administrator will be responsible for providing the access to different groups at first (group administrator), and to water manager in second term. SA will manage the authorizations of users.

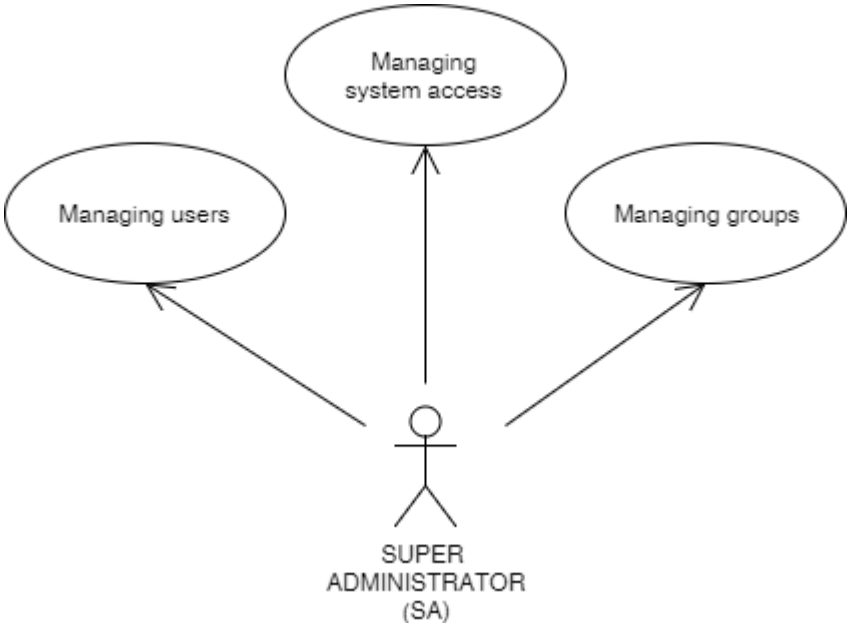


Figure 1 Main functions of Super-Administrator (SA).

- **Group-Administrator (GA).** Group-administrators will manage one or several operational areas (add, edit, …). GA will upload images, maps and calculate different products for the DIANA platform. GA will give access to the information to the end users (water manager).

Figure 2. Main functions of Group-Administrator (GA).

- **Water Manager (WM).** Water managers at different levels (aquifer, irrigation scheme, etc. see D1.2) will be the end users of DIANA platform. They will consult the information of their operational areas in an effective and simple way. WM will be able to generate reports, operate sub-areas, consult, analyze, and export data and maps.

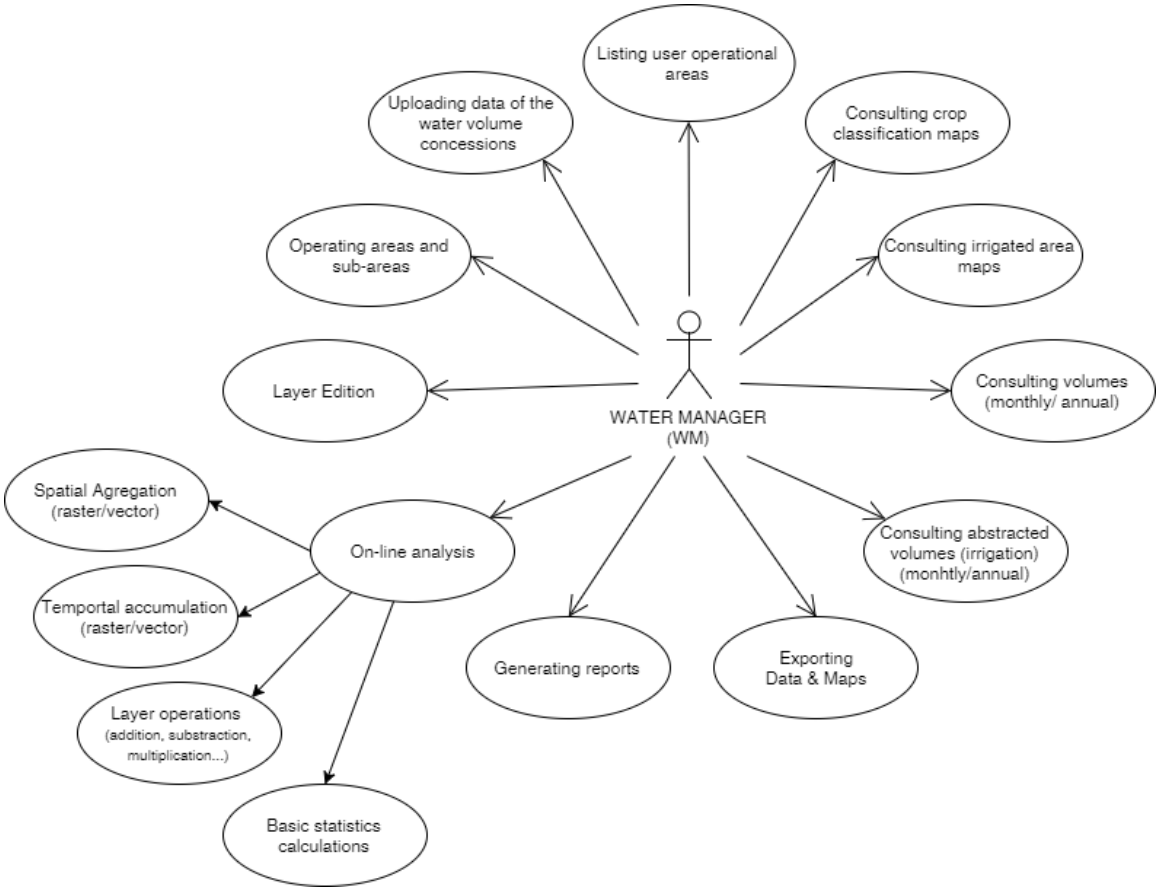


Figure 3. Main actions of Water Managers (WM) in DIANA platform.

2.3. Components

The components of the system are described in this section.

- Administration Component (AC)

The administration component allows the SA and GA to customize the status and permissions of the users (GA users in the case of SA, and WM users for GA). Administrators will see a list of the users with their preferences, access, permissions, and it should be possible to select them by filtering features.

- Operational Areas Management Component (OACMC)

OACMC allows the administrators to manage the operational areas. It will be possible to add, edit or delete operational areas of which the administrators have given access and permission. In the case of GA, they will provide access to defined areas to specific WM.

- Map Inputs Manager Component (MIMC)

MIMC is responsible to upload the different map inputs as water requirements and crop classification necessary to generate the DIANA products. In the case of water manager, group administrator will define the access to selected maps.

- Uploading Data of Water Volume Concessions Component (UDAWVCC)

This component allows to upload the data of how much of water volume is assigned to the area of interest. In principle, this information will be provided by the water managers. Information can be given either as vector layer or table.

- Map of Irrigated Areas Data Generation Component (MIADGC)

A map of irrigated area is generated by this component from the products of Map Inputs Manager Component. This product will be used to distinguish the irrigated and non-irrigated zone in the operational area.

- Maps of Crop Water Requirements Data Generation Component (MCWRDGC)

Crop water requirements will be estimated from a specific methodology by the GA. They will upload the maps to be consulted by the WM.

- Maps of Abstracted Volumes Data Generation Component (MAVDGC)

These products will be generated by soil water balance models from satellite images and other inputs and products of other components in the platform.

- Crop Inventory Data Generation Component (CIDGC)

This component will show different crop data (classification, surface, etc …) generated in the platform over time in the operational areas. It should be possible to consult previous data filtering by date.

- Calculation Manager Component (CMC)

CMC will calculate the different data in the operational areas. The calculations will make use of the image/maps inputs uploaded into the platform as well as the products of the other components.

- Web Map Visualization Component (WMVC)

WMVC will provide an interactive display of geographic information to the users. For the WM, the access to the maps will be provided by the group-administrators. Users will be able to select what information (layers) they want to see on the maps.

- Geo-localization of Layers Component (GLC)

GLC will be a tool to facilitate the location of the areas of interest in an easy way for the user. This could be done using internet browsers as Google, Open Street map, Bing…

- Layer Edition Component (LEC)

This component will provide to the user the capacity to edit layers and do operations with them. [e.g., layer algebra, vector-raster crossing, temporal accumulation of (pixel or raster) values from layer tiles)

- Spatial Aggregation Component (SAC)

Aggregation of values from all pixels located in the same raster element. This requires online vector-raster crossing.

- Temporal Accumulation Component (TAC)

Accumulates (pixel or raster) values from layer tiles (consisting of time series of images or maps)

- Basic Statistics Calculations Component (BSCC)

BSCC will allow to do a statistical analysis of the DIANA products. It will be possible to analyse selecting spatial and temporal features (time period, area, etc…).

- Notification Management Component (NMC)

NMC provides an alerting service where the users can configure their alert preferences from several options, such as content (new information available as maps or images), the type of notification, frequency (daily, weekly, monthly), etc...

- Reporting Management Component (RMC)

RMC allows users to generate reports from monitoring the information (data and maps) about irrigated areas, crop water requirements, crop classification and abstracted volumes. The component allows to select from s a range of visualization graphs and tables at different temporal and spatial scale (monthly/ annual; WMU/crops). Additionally, the RMC has the option to export data and maps in different formats (csv, xls, pdf, jpg, png….) and data reports.

3. Existing platforms, applications, and links

3.1. SPIDERwebGIS®, Irrisat, MOSES, Minaret

The starting point for the development of service specifications was the existing set of platforms (SPIDERwebGIS®[12], Irrisat[13], MOSES[14], Minaret[15]) that have served as pre-alpha version of the DIANA platform on one hand and that will continue forming part of the final DIANA platform configuration (available for more detailed requests of expert users) on the other hand.

[12] www.SPIDERwebGIS.org

[13] www.irrisat.com

[14] moses-project.eu/moses_website

[15] Mateos et al. (2013); González-Dugo et al. (2013)

The System of Participatory Information, Decision support and Expert knowledge for irrigation River basin water management (SPIDERwebGIS®) has been developed by the Remote Sensing and GIS Lab of the University of Castilla-La Mancha during a series of European projects. SPIDERwebGIS® has evolved from the prototype on-line Space Assisted Irrigation Advisory Service (e-SAIAS®) developed in the DEMETER project (DEMonstration of Earth observation TEchnologies in Routine irrigation advisory services, 2005). Based on the potential of the Earth Observation technologies (EO) applied to the typical functions of the Irrigation Advisory Service (IAS) (Calera A. et al. 2005), e-SAIAS® was a prototype tool based on savings potential water through the traditional IAS and greatly expanded its capacity through the use and development of new technologies such as EO. During the PLEIADES project (Participatory multi-Level EO-assisted tools for Irrigation water management and Agricultural Decision-Support, 2009) the SPIDERwebGIS® has moved from a prototype to an operational reality that remains active to present. The main novelty incorporated in SPIDERwebGIS® was its global coverage, so that it can be used in any place around the world, and covering needs from different actors in agriculture and beyond this domain, not only focusing on water management at different levels, but also for crop monitoring by farmers and technicians, as well as hydrological, forest fires prevention or other environmental applications. Subsequently, this system has served as the technological basis for other projects among them SIRIUS (Sustainable Irrigation Water Management and River-basin governance: Implementing User-driven Services, 2013) and FATIMA (Farming Tools for external nutrient inputs and water Management, currently in force until 2018). These projects allow to implement new features, obtain new derivatives products and to maintain and technologically improve the service.

Irrisat is an irrigation advisory service developed by Ariespace. The platform is based on an innovative technology that integrates satellite observations (Landsat, Sentinel and Deimos images) with high-resolution spatial and temporal weather forecasts (Cosmo LEPs model). Irrisat provides daily irrigation requirements maps predicting up to five days ahead. In addition, through simple and intuitive webapp, the system allows analysis of the state of the crop and weather data (evapotranspiration, rain, temperature, vegetation indices). It serves farmers, irrigation water users associations in Italy, as well as the regional government of Campania Region in South Italy.

MOSES platform is a Decision Support System (DSS) providing services to support end users (water providers) to make an optimized decision for scheduling water procurement and for the management of its supply. To this end the MOSES DSS integrates GIS technologies with seasonal and in-season weather forecast technologies and remote sensing technologies, with the objectives of managing and reducing the risks of droughts, saving irrigation water, improving services to farmers, reducing financial and energy costs. The MOSES DSS is designed to provide strategic information to water managers before the irrigation season (using seasonal forecasts and EO data) as well as during the irrigation season (using short-term weather forecasts and EO data). The present platform is one of the outcomes of the MOSES project, a Horizon 2020 Innovation Action (http://moses-project.eu/moses_website/). Further details, guidelines and tutorials can be found in the Platform training section: http://moses-project.eu/moses_website/platform-training/

MINARET is a system developed, validated and used at the Guadalquivir River Basin to classify crops and estimate unstressed ET in the irrigable areas of the basin. The system is based on the

ability of vegetation indices to trace crop growth and thus to derive basal crop coefficients. Vegetation indices, provided by a series of high spatial resolution satellite images for 2007, 2008, 2009, 2015 and 2017 support the assessment of daily to seasonal ET of individual fields, enabling crop-oriented and individual water use to be analysed. The segmentation of the basin into zones with homogeneous climate and crop-growth patterns was the first step towards crop identification based on temporal trends in the Soil-Adjusted Vegetation Index (SAVI). Non-permanent crops are classified with good accuracy. Existing spatial databases of permanent crops enable land use to be determined. The applied methodology has been compiled in a planning and operational tool (named MINARET: MonitorINg irrigated AgriculturRe ET) for routinely monitoring crop water consumption in the irrigated lands of the Guadalquivir basin and it is now available for the Guadalquivir river authority. See Mateos et al. (2013) and González-Dugo et al. (2013).

3.2. Required links and applications

The existing platforms summarized above (plus in the future possibly others) already provide the necessary data layers for the DIANA services and they will continue to be used by more experiences users for detailed queries. Therefore, the DIANA platform needs to provide a simple, easy, and effective way to access these data in order to visualize them, as well as to access these platforms directly (possibly using the same user credentials).

For information purposes, the calculation schemes from deriving irrigated area maps and irrigation volumes are shown as a flowchart in Annex A, using the example of SPIDERwebGIS®, and in Annex B using the example of Irrisat (in other platforms they are slightly different).

The DIANA platform has been conceived as the integration of two different systems related between them by means of services of data exchange:

GIS/viewer web platform: The existing platforms will be the framework for providing maps (raster o vector) derived from DIANA system for visualizing and working with them. At a later stage, DIANA system will integrate the different methodologies currently used in the pilot areas for estimating the water abstraction and crop water requirements (see examples in Annexes A and B), and the algorithms for crop classification.

DIANA web app (interactive viewer): An easy-to-use web app displaying the most relevant statistical data and graphs by collecting different characteristics of the water abstractions and irrigated crops grown within pilot areas. This information is derived from the maps generated by DIANA system visualized in the GIS platforms. Therefore, the DIANA system will be able to create statistics based in the spatial layers (raster / vector) and export the data in pie-charts and graphs. The figures displayed by the system will be configurable in order to have a high extent of adaptability to meet the needs of different user profiles.

These two systems will communicate by an API integrated in both, which will transfer the information in the proper format:

- Georeferenced exchange format: …WMS, geojson…
- Alphanumeric data exchange: json, csv…

From the user perspective both systems will include a button which allows them to switch the interface from DIANA web app to GIS/viewer web platforms.

3.3. Applications

The Graphical User Interface requirements will apply to both PC and mobile applications in terms of information contents and user browsing experience.

4. DIANA platform required functionalities

In this section, a first description of the functionalities in DIANA platform is shown. They are differentiated in use cases (UC). The UC available in the platform for each user will depend on the functions and needs of the users (section 2.2).

In the next table the main functions for the users are shown.

Table 4. Main functions of Super Administrator, Group Administrator and Water Manager.

Use Case (UC)	SA	GA	WM
UC-01 Managing groups	✓		
UC-02 Managing users	✓		
UC-03 Managing users	✓	✓	
UC-04 Managing operational areas		✓	
UC-05 Managing crop classification maps		✓	
UC-06 Managing crop water requirement maps		✓	
UC-07 Calculating data of operational data		✓	
UC-08 Uploading water requirements images		✓	
UC-09 Uploading crop classification image		✓	
UC-10 Managing crop categories and classification		✓	
UC-11 Listing the operational areas of users		✓	✓
UC-12 Consulting crop classification		✓	✓
UC-13 Analyzing crop water requirements		✓	✓
UC-14 Analyzing abstracted volumes		✓	✓
UC-15 Consulting irrigated area maps		✓	✓
UC-16 Operating sub-areas		✓	✓
UC-17 Export		✓	✓

4.1. Managing groups

UC-01	Managing groups

Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as it is described in the following use case, when the Administrator wants to manage the groups of the system. The systme has groups that allow to isolate both users and operational areas to improve the management of the system.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assignated the security action: ADMINISTRATOR_SYSTEM
	2	The system will enable and disable the operations to be performed according to the user's seccurity actions: ADD: to call the use case "Create group". EDIT: to call the use case "Edit group". DELETE: to call the use case "Delete group". EXIT: Exception
	3	The system returns the list of existing groups and which user is a group administrator.
	4	The system will wair for the selection of the desired operation by the user and activates the specific use case.
	5	The Administrator actor selects a specific register and activates the desired operation.
	6	The system finish the use case.
Post-condition		
Exceptions	Step	Action
	1	If the Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	2	If the "EXIT" option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	1	n seconds

	2	n seconds
Expected frequency	1 time / month	
Importance	Important	
Urgence	Immediatly	
Comments	Without comments	

UC-01.1	Create group	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as it is described in the following use case, when the Administrator wants to manage the groups of the system. The systme has groups that allow to isolate both users and operational areas to improve the management of the system.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The Administrator actor selects the “Create Group” option.
	2	The system will validate that the user has assigned the security action: ADMINISTRATOR_SYSTEM.
	3	The system requests the following associated information: Group name, description, logo, country, language and user group manager.
	4	The Administrator provides the required data and requests the system to store them.
	5	The system finish the use case.
Post-condition		
Exception	**Step**	**Action**
	2	If the Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	3	If the “EXIT” option is selected, use case is without effect.
Efficiency	**Step**	**Time**

	5	1 second
Expected frequency	1 time / month	
Importance	Important	
Urgence	Immediatly	
Comments	The creation of groups allows ordering the different geographical areas and delimiting that the group administrators can freely manage the users, zones, data, etc.	

UC-01.2	Edit group

UC-01.3	Delete group

4.2. Managing users (by Super-Administrator)

UC-02	**Managing users (by Super-Administrator)**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as it is described in the following use case, when the Administrator wants to manage the users of the system.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: ADMINISTRATOR_SYSTEM.
	2	The system will enable and disable the operations to be performed according to the user's seccurity actions: ADD: to call the use case "Create user". EDIT: to call the use case "Edit user". DELETE: to call the use case "Delete user". EXIT: Exception
	3	The system returns the list of ALL existing users and belonging groups.

	4	The system will wait for the selection of the desired operation by the user and activates the specific use case.
	5	The Administrator actor selects a specific register and activates the desired operation.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	2	If the "EXIT" option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	1	n seconds
	2	n seconds
Expected frequency	3 time / month	
Importance	Important	
Urgence	Immediatly	
Comments	Wihout comments	

4.3. Managing users (by Group Administrator)

UC-03	**Managing Users (by Group Administrator)**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as it is described in the following use case, when the Administrator wants to manage the users of the system.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: ADMINISTRATOR_GROUP.

	2	The system will enable and disable the operations to be performed according to the user's seccurity actions: ADD: to call the use case "Create user". EDIT: to call the use case "Edit user". DELETE: to call the use case "Delete user". EXIT: Exception
	3	The system returns the list of existing users in the group.
	4	The system will wait for the selection of the desired operation by the user and activates the specific use case.
	5	The Group Administrator selects a specific register and activates the desired operation.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	2	If the "EXIT" option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	1	n seconds
	2	n seconds
Expected frequency	3 times / month	
Importance	Important	
Urgence	Immediatly	
Comments	Wihout comments	

4.4. Managing operational areas

UC-04	**Managing operational areas**
Version	v1
Authors	AgriSat
Sources	<source of current version>
Associated objectives	<objective name>

Description	The system should behave as it is described in the following use case, when a Group Administrator wants to add a study/operational area.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: ADMINISTRATOR_GROUP.
	2	The system will enable and disable the operations to be performed according to the user's seccurity actions: ADD: to call the use case "Create area". EDIT: to call the use case "Edit area". DELETE: to call the use case "Delete area". EXIT: Exception
	3	The system returns the list of interesting areas registered.
	4	The system will wait for the selection of the desired operation by the user and activates the specific use case.
	5	The Group Administrator selects a specific register and activates the desired operation.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	2	If the "EXIT" option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	1	n seconds
	2	n seconds
Expected frequency	3 times / month	
Importance	Important	
Urgence	Immediatly	
Comments	Wihout comments	

UC-04.1	Create operational area	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	OBJ- Managing operational area	
Description	The system should behave as it is described in the following use case, when a Group Administrator wants to create a study/operational area.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The Group Administrator selects the option “Create area”.
	2	The system will validate that the user has assigned the security action: ADMINISTRATOR_GROUP.
	3	The administrator provides the feature (GeoJson) of the operational area. Either drawn on a map or uploading the file shapefile or GeoJson.
	4	The system requests the following associated information: Name of the operational area and to associate users who will have access to that area of the group.
	5	The system ends the registration of the area of interest and launches the use case of calculation processes for the area of interest.
	6	The system finish the use case.
	n	
Post-condition		
Exceptions	**Step**	**Action**
	2	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	3 y 4	If the “EXIT” option is selected, use case is without effect.
	5	When the process ends incorrectly, it sends a notification to the Administrator. If the process ends correctly, it sends a notification to the associated users in that area of interest.
Efficiency	**Step**	**Time**

	3	10 seconds
	5	2 minutes
Expected frequency	3 times / month	
Importance	Important	
Urgence	Immediatly	
Comments	The notification format is pending to be defined, this can be by e-mail, event records in the system, SMS, etc…	

UC-04.2	Edit area	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	OBJ- Managing operational area	
Description	The system should behave as it is described in the following use case, when a Group Administrator wants to edit a study/operational area.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The Group Administrator selects the option “Edit area”.
	2	The system will validate that the user has assigned the security action: ADMINISTRATOR_GROUP.
	3	The administrator displays the operational area in a map viewer.
	4	The Group Administrator edits graphically the area of interest.
	5	The system requests the following associated information: Name of the operational area and link with users who will have access..
	6	The system ends the update of area of interest and launchs the use case of calculation processes for the area of interest.
	7	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**

	2	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	3,4,5	If the "EXIT" option is selected, use case is without effect.
	4	If the geometry is not correct, the system informs the user.
	6	When the process ends incorrectly, it sends a notification to the Administrator. If the process ends correctly, it sends a notification to the associated users in that area of interest.
Efficiency	**Step**	**Time**
	3	10 seconds
	6	2 minutes
Expected frequency	3 times / month	
Importance	Important	
Urgence	Immediatly	
Comments	The notification format is pending to be defined, this can be by e-mail, event records in the system, SMS, etc… Step 4 could have the file uploar option to cailitate editing, similar to creating an area of interest.	

UC-04.3	Delete area	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	OBJ- Managing operational area	
Description	The system should behave as it is described in the following use case, when a Group Administrator wants to delete a operational area.	
Pre-condition	User correctly authenticated	
Normal sequence	**Step**	**Action**
	1	The Group Administrator selects the option "Delete area".
	2	The system will validate that the user has assigned the security action: ADMINISTRATOR_GROUP.

	3	The Group Administrator selects the area of interest that GA wants delete from a list.
	4	The system ask if the data to be delted are correct.
	5	The Group Administrator must verify this information before deleting.
	6	The system eliminates the link of users associated to this area of interest and eliminates the data associated to this area.
	7	The system finish the use case.
Post-condition	All information calculated from that area will be removed from the system, in addition the users fo that area will be disassociated.	
Exceptions	**Step**	**Action**
	2	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	3, 4, 5	If the "EXIT" option is selected, use case is without effect.
	6	If the process ends incorrectly, send a notification to the Administrator. If the process completes correctly, it sends a notification to the users associated with that area and the administrator.
Efficiency	**Step**	**Time**
	3	1 seconds
	6	2 seconds
Expected frequency	1 time / month	
Importance	Important	
Urgence	Immediatly	
Comments	The format of area selection to be deleted can be from a list or from a map.	

4.5. Managing crop classification maps

UC-05	**Managing crop classification maps**
Version	v1
Authors	AgriSat
Sources	<source of current version>
Associated objectives	<objective name>

Description	The system should behave as it is described in the following use case, when a Group Administrator wants to delete a operational area.	
Pre-condition	User correctly authenticated and loaded maps.	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: ADMINISTRATOR_GROUP, ADMINISTRATOR_SYSTEM
	2	The system will enable and disable the operations to be performed according to the user's seccurity actions: ADD: to call the use case "Create map". EDIT: to call the use case "Edit map". DELETE: to call the use case "Delete map". EXIT: Exception
	3	The system returns all the list and / or map of the different zones of classification maps.
	4	The system will wait for the selection of the desired operation by the user and activates the specific use case.
	5	The Group Administrator selects a specific record and activates the desired operation.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	2, 3	If the "EXIT" option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	3	<2 seconds
Expected frequency	1 time / month	
Importance	Important	
Urgence	Immediatly	
Comments	Ninguno	

4.6. Managing crop water requirements images (HM)

UC-06	Managing crop water requirement images (HM)	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as it is described in the following use case, when a Group Administrator wants managing the images of the calculation of water requeriments in the system per month.	
Pre-condition	User correctly authenticated.	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: ADMINISTRATOR_GROUP, ADMINISTRATOR_SYSTEM,
	2	The system will enable and disable the operations to be performed according to the user's seccurity actions: ADD: to call the use case "Load image HM" EDIT: to call the use case "Edit metadata HM" DELETE: to call the use case "Delete image HM" EXIT: Exception
	3	The system returns all the list of images available monthly and with the possibility of filter by parameters; projection, date, descriptor, etc.
	4	The system will wait for the selection of the desired operation by the user and activates the specific use case.
	5	The Group Administrator selects a specific record and activates the desired operation.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.

	2, 3	If the “EXIT” option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	3	<2 seconds
Expected frequency	2 times / day	
Importance	Important	
Urgence	Immediatly	
Comments	Without comments	

4.7. Calculating data of operational area

UC-07	**Calculating data of operational area**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as described in the following use case when the system executes the statistical data calculation algorithm in the system.	
Pre-condition	The registration of the operational area must exist in the system, and the input layers in the area (Maps of crop classification and crop water requirements).	
Normal sequence	**Step**	**Action**
	1	The system is executed by demand of some use case.
	2	The system will validate the area of interest and the base layers to perform the calculations that are available in the area.
	3	The system performs the geoprocesses of statistical calculations of the layers.
	4	The system records the calculation data in a temporary space in the system.
	5	The system notifies that the calculations have finished.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**

	2	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	3, 4, 5	If the "EXIT" option is selected, use case is without effect.
	6	If the process ends incorrectly, send a notification to the Administrator. If the process completes correctly, it sends a notification to the users associated with that area and the administrator.
Efficiency	**Step**	**Time**
	2	1 - 25 seconds
	3	0 <10 minutes
Expected frequency	1 time per month and per operational area	
Importance	Important	
Urgence	Immediatly	
Comments	Complementing the use case information with the flow sheme of product processing.	

4.8. Uploading water requirements images

UC-08	**Uploading water requirements images**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	OBJ- Managing images HM	
Description	The system should behave as described in the following use case when the Group Administrator and / or the system loads images of crop water requirements.	
Pre-condition		
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the Security Action: ADMINISTRATOR_GROUP, ADMINISTRATOR_SYSTEM
	2	The images is uploaded to the system, either loaded by the administrator and / or automatic system.
	3	The system obtains the metadata of the image.

	4	The system records the image in the system and the metadata of information of interest; bounding box of the zone, year, month, type, projection, etc.
	5	The system executes the use case of data calculation for the affected areas.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	2	If the "EXIT" option is selected, use case is without effect.
	5	If the process ends incorrectly, send a notification to the Administrator. If the process completes correctly, it sends a notification to the users associated with that area and the administrator.
Efficiency	**Step**	**Time**
	2	1 - 25 seconds
	5	<1 minute
Expected frequency	1 time / month	
Importance	Important	
Urgence	Immediatly	
Comments	Uploading of images and registration to the system can be done by the administrator, or there may be an automatic system that publishes the images that are in a repository.	

4.9. Uploading crop classification image

UC-09	**Uploading crop classification images**
Version	v1
Authors	AgriSat
Sources	<source of current version>
Associated objectives	OBJ- Managing of crop classification.
Description	The system should behave as described in the following use case when the Administrator loads the map and / or crop classification map.
Pre-condition	

Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the Security Action: ADMINISTRATOR_GROUP, ADMINISTRATOR_SYSTEM
	2	The system will wait if desired to upload a crop classification map already done (A) or a classification raster image (B) to determine the map. Definition of Steps with option B.
	3	The Administrator uploads the classification images into the system.
	4	The system executes the use case of transformation and unification of classification raster image to polygons to obtain the elaborated map of crop classification in vectorial form, that is to say, the product of Step 2.A.
	5	The system registers the map in the system and the metadata of information of interest; bounding box of the zone, year studied, type, projection, classification categories, etc.
	6	The system finish the use case.
Post-condition	The system has a product or base layer of crop classification to obtain the calculations of the areas of interest.	
Exceptions	**Step**	**Action**
	1	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	2	If the “EXIT” option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	2	1 - 25 seconds
	5	<1 minute
Expected frequency	1 time per year	
Importance	Important	
Urgence	Immediatly	
Comments	The upload of images and registration to the classification image system is annual. This can be from a raster product to be treated by the system or an already elaborated classification map, which is only registered in the system.	

4.10. Managing crop categories and classification

UC-10	Managing crop categories and classification	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	OBJ- Manager of crop classification maps	
Description	The system should behave as described in the following use case when the Group Administrator wants to manager the crop categories or classification legends.	
Pre-condition	To have the classification maps calculated.	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the Security Action: ADMINISTRATOR_GROUP
	2	The system will enable and disable the operations to be performed according to the user's seccurity actions: ADD: to call the use case "Add label" EDIT: to call the use case "Edit label" BORRAR: to cal de use case "Delete label" EXIT: Exception
	3	The system returns the all list of labels (classification legend) associated with the codes of types of classification maps.
	4	The system will wait for the selection of the desired operation by the user and activates the specific use case.
	5	The Group Administrator selects a specific record and activates the desired operation.
	6	The system finish the use case.
Post-condition	The system has a product or base layer of crop classification to obtain the different types and their codes.	
Exceptions	**Step**	**Action**
	1	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.

	2, 3	If the “EXIT” option is selected, use case is without effect.
Efficiency	**Step**	**Time**
	2	1 - 25 seconds
	5	<1 minute
Expected frequency	1 time per year	
Importance	Important	
Urgence	Immediatly	
Comments	Due to the different nomenclature of crop classifications by groups, the Group Administrator can create a legend adapted to the crop classification for each operational area.	

4.11. Listing the operational areas of users

UC-11	**Listing the operational areas of users**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as described in the following use case when the Administrator wants listing their operational areas	
Pre-condition	User correctly authenticated, asigned to a group and with at least one area of interest.	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: WATER_MANAGER
	2	The system returns a list of operational areas and water management units (WMU) involver in that group.
	3	The system will wait the area selection to show the information belonging to that area.
	4	The system finish the use case.
Post-condition	Once an action area has been selected, it will be the work management unit. The data shown will be those of the selected unit.	

Exceptions	**Step**	**Action**
	1	If the WM does not have the required Security Action, the system will notify the user and then this use case will be left without effect.
	2	If the Exit option is selected, the use case remains without effect.
Efficiency	**Step**	**Time**
	1	n seconds
	2	n seconds
Expected frequency	50 times / day	
Importance	Important	
Urgence	Immediatly	
Comments	The area of interest implies that the statistics for that area has been calculated monthly for the HM images and classification.	

4.12. Consulting crop classification

UC-12	**Consulting crop classification**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as described in the following use case when the water manager wants to list the types of crop clasiffication in its area of action.	
Pre-condition	User correctly authenticated and area selected. The definition of a operational area implies the statistical calculation of this, based on the basic input of classification.	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: WATER_MANAGER
	2	The system returns a representation of the crop types involved in that area and their associated statistical data.
	3	The WM selects one o several types of crops.

	4	The system shows the results associated with these types of graphic form for that area: surface, type, year, with the objective of comparing types.
	5	The user can define analysis parameters for the representation of data, such as date of action to compare years, crop types, area, etc.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the Water Manager does not have the required Security Action, the system will notify the user and then this use case will be left without effect.
	2	If the Exit option is selected, the use case remains without effect.
Efficiency	**Step**	**Time**
	1	n seconds
	2	n seconds
Expected frequency	50 times / day	
Importance	Important	
Urgence	Immediatly	
Comments	The consult of crop classification in the area, is a tool of data analysis to compare the different types of crops and see the dimensions of these with respect to others and their evolution over time.	

4.13. Analyzing crop water requirements

UC-13	**Analyzing crop water requirements**
Version	v1
Authors	AgriSat
Sources	<source of current version>
Associated objectives	<objective name>
Description	The system should behave as described in the following use case when the water manager wants to analyze the water requirements data per crop in their operational area.
Pre-condition	User correctly authenticated and selected the operational area. The definition of a operational area implies the

	statistical calculation of this, based on the basic input of classification.	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: WATER_MANAGER
	2	The system returns a representation of the types of crops involved in that area and their associated statistical data.
	3	The WM selects if the consult is annual or monthly.
	4	The WM selects one or several types of crops.
	5	The system shows the results associated with these types of graphic form for that area: surface, type, year, month, volume of water, etc. with the objective of analyzing the data.
	6	The user can define analysis parameters for the representation of data, such as date of action to compare years, crop types, area, etc.
	7	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the WM does not have the required Security Action, the system will notify the user and then this use case will be left without effect.
	2	If the Exit option is selected, the use case remains without effect.
Efficiency	**Step**	**Time**
	1	n seconds
	2	n seconds
Expected frequency	50 times / day	
Importance	Important	
Urgence	Immediatly	
Comments	The consult of crops classification in zone, is a tool of data analysis to compare the different types of crops and see the dimensions of these types with respect to others and their evolution over time.	

4.14. Analyzing abstracted volumes

UC-14	Analyzing abstracted volumes	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as described in the following use case when the WM wants to analyse the water requirements data per crop and operational area.	
Pre-condition	User correctly authenticated and selected the operational area. The definition of a operational area implies the statistical calculation of this, based on the basic input of classification..	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: WATER_MANAGER
	2	The system returns a representation of the types of crops involved in that area and their associated statistical data.
	3	The WM selects if the consult will be annual or monthly.
	4	The WM selects one o several crops.
	5	The system shows the results of water volumes extracted graphically.
	6	The system has a set of tools in which the user can interact to configure different data analysis parameters. The user can define analysis parameters for the representation of data, such as period, crop types, surface, etc.
	7	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the WM does not have the required Security Action, the system will notify the user and then this use case will be left without effect.
	2	If the Exit option is selected, the use case remains without effect.
Efficiency	**Step**	**Time**

	1	n seconds
	2	n seconds
Expected frequency	50 times / day	
Importance	Important	
Urgence	Immediatly	
Comments	The consult of crop classification in the area, is a tool of data analysis to compare the different types of crops and see the dimensions of these types with respect to others and their evolution over time.	

4.15. Consulting irrigated area maps

UC-15	**Consulting irrigated area maps**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	<objective name>	
Description	The system should behave as described in the following use case when the water manager wants to analyze the data of water requeriments per crop in their operational area.	
Pre-condition	User correctly authenticated and selected the operational area. The definition of a operational area implies the statistical calculation of this, based on the basic input of classification.	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: WATER_MANAGER
	2	The system returns a representation of irrigated and non-irrigated crops in the operational area.
	3	The WM can select both areas to consult the data associated with irrigation.
	4	The system shows the results associated with these areas: surface, type of classification involved, year, volume consumed, etc.
	5	The user can analyze the data provided in the areas temporarily, to compare different affected surfaces per years, consumptions, etc.

	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the WM does not have the required Security Action, the system will notify the user and then this use case will be left without effect
	2 ,3 ,4, 5	If the Exit option is selected, the use case remains without effect.
Efficiency	**Step**	**Time**
	1	n seconds
	2	n seconds
Expected frequency	1 time / day	
Importance	Important	
Urgence	Immediatly	
Comments	.	

4.16. Operating sub-areas

UC-16	**Operating sub-areas**	
Version	v1	
Authors	AgriSat	
Sources	<source of current version>	
Associated objectives	OBJ- Data analysis	
Description	The system should behave as described in the following use case when a water manager wants to add an operational area.	
Pre-condition	User correctly authenticated.	
Normal sequence	**Step**	**Action**
	1	The WM selects th option “Operating sub-area”.
	2	The system will validate that the user has assigned the Security Action: ADMINISTRATOR_GROUP
	3	The administrator provides the feature (GeoJson) of the operational sub-area. Either drawn on a map or uploading the file shapefile or GeoJson.
	4	The system requests the following associated information: Name of operational area.

	5	The system ends the registration of operatioanl sun-area, it calcules that the parameters are corrects and launches calcultation processes for the area of interest.
	6	The system shows the data extracted from the analysis of the sub-area then the users can analyze the classification, water requirements and water volumes.
	6	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	2	If the Group Administrator does not have the required security action, the system will notify the user, then this use case is without effect.
	3 y 4	If the "EXIT" option is selected, use case is without effect.
	5	When the process ends incorrectly, it sends a notification to WM. If the process ends correctly, it sends a notification to the users associated to that area of interest.
Efficiency	**Step**	**Time**
	3	10 seconds
	5	2 minutes
Expected frequency	40 times / month	
Importance	Important	
Urgence	Immediatly	
Comments	The system must verify that the surface of the sub-area is not too large to obtain the results almost immediatly.	

4.17. Export

UC-17	**Export**
Version	v1
Authors	AgriSat
Sources	<source of current version>
Associated objectives	<objective name>
Description	The system should behave as described in the following use case when the water manager wants to export data of an unit.

Pre-condition	User correctly authenticated and selected the operational area or unit. The definition of a operational area or unit implies the statistical calculation of this, based on the basic input of classification..	
Normal sequence	**Step**	**Action**
	1	The system will validate that the user has assigned the security action: WATER_MANAGER
	2	The system returns a representation of the features involved in the operational area.
	3	The WM selects if the data to export will be annuals or monthly.
	4	The WM will can export the data associated to that determined areas per type of crop.
	5	The system request the El sistema solicita the export format: - Data: text, excel, CSV, etc. - Maps: GeoJSON, shape, etc. - Layers: Download images.
	6	The user selects a format and obtains a file with the surface data, type of classification, mean, deviation, year, volumes, etc.
	7	The system finish the use case.
Post-condition		
Exceptions	**Step**	**Action**
	1	If the WM does not have the required Security Action, the system will notify the user and then this use case will be left without effect.
	2 ,3 ,4, 5	If the Exit option is selected, the use case remains without effect.
Efficiency	**Step**	**Time**
	4	3 seconds
Expected frequency	1 time / month	
Importance	Important	
Urgence	Medium	
Comments		

5. Interactive Graphical User Interface (GUI) design

5.1. Overview screen

The DIANA interactive viewer has been conceived as a simple user-friendly web app including the most relevant data and graphs derived from DIANA system in order to give a quick-and-easy overview to the potential users.

The conceptual workflow for a Water Manager (in charge of a given operational area) is as follows:

Step 1 (screenshot 1 in Figure 5). Getting an overview "at first glance" of the situation in their operational area by means of four data text boxes (mean values of key parameters, e.g, in this example, total abstracted volume, total of peak month, total irrigated hectares, total non-irrigated hectares) and two graphs (one of temporal evolution of accumulated volumes and one of volume per crop types).

Step 2 (screenshot 2 in Figure 6). Getting additional overview information, while maintaining the data text boxes, by means of two additional graphs (one of temporal evolution of monthly average volumes and one of area per crop types)

The screenshots have been generated from the following products for the year 2016 in the Spanish pilot areas:

- Maps of irrigated areas
- Maps of crop inventory
- Maps of crop water requirements
- Maps of abstracted volumes

Working with this spatial information, an exercise of statistical analysis has been performed manually with GIS software in order to obtain the graphs and data to integrate them in a real example screenshot of DIANA web app for one Spanish pilot area.

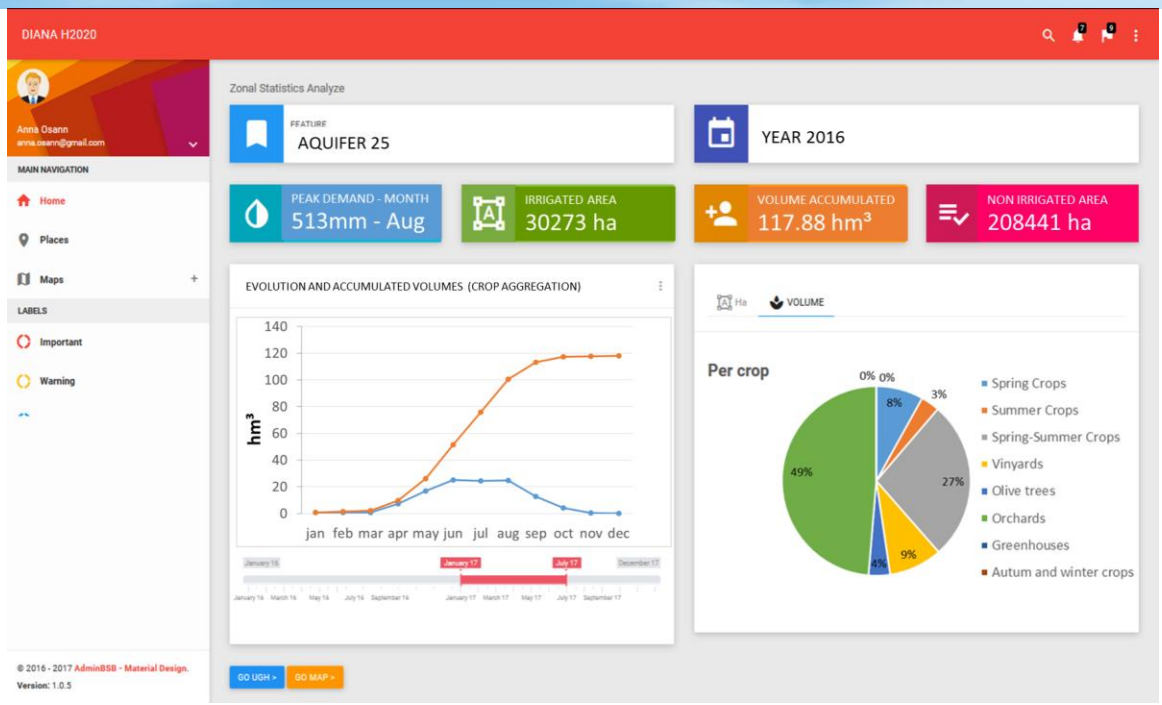


Figure 4: Screenshot 1 of DIANA example web app including real-data of one Spanish pilot area in 2016.

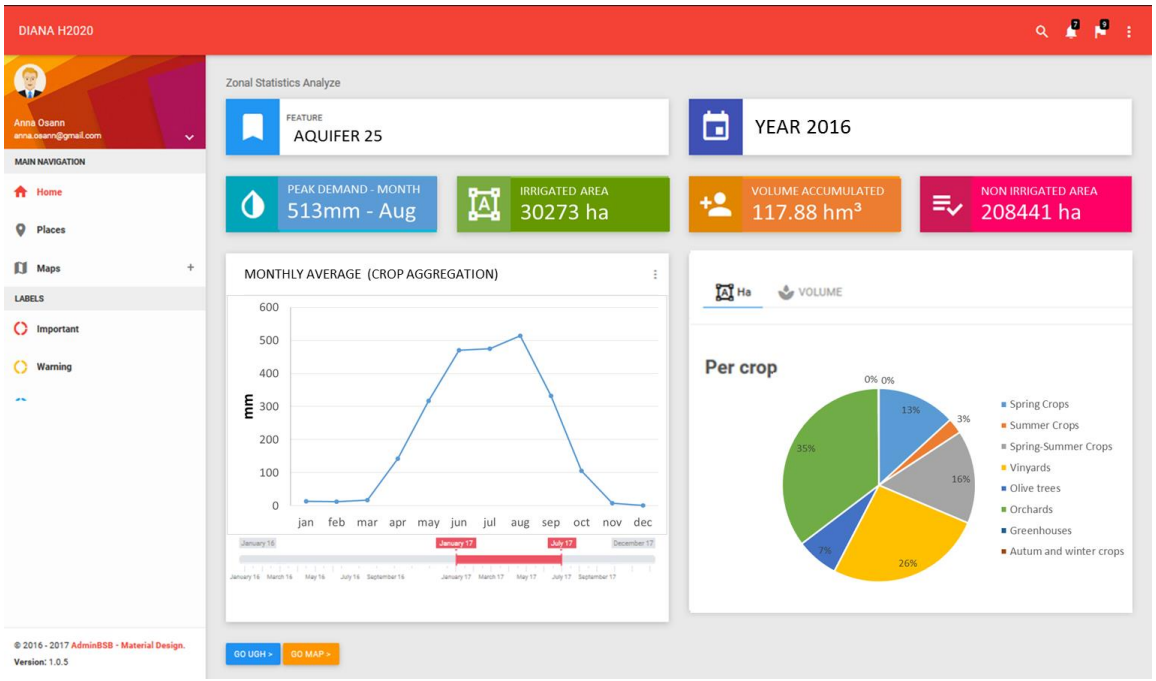


Figure 5: Screenshot 2 of DIANA example web app including real-data of one Spanish pilot area in 2016.

5.2. Data text boxes

The data shown in the four colored boxes have been selected as relevant data according to their usefulness in the routine operations of a water manager. They will be configurable (by the group administrator) in order to meet the needs of the user. The example presented here shows the following data:

Blue box: The maximum monthly value of the year and the month which has been reached it. It represents the average of the irrigation requirements in that month. The value has been calculated aggregating the averages of irrigation requirements of each crop type per month and the month peak has been selected. This value has been considered relevant in order to characterize and identify the critical moment of the year when the needs are in the most demanding moment.

Green box: Surface in hectares classified by the system as irrigated area.

Orange box: Maximum water volume accumulated at the end of the year. This data corresponds to the temporal and spatial aggregation of the irrigation requirements of the totality of the crops.

Pink box: Surface in hectares classified by the system as non-irrigated area.

Another option would be (depending on availability of water rights data): total authorized volume, total actual volume, total authorized hectares under irrigation, total actually irrigated hectares.

5.3. Cake diagram screens

Theses pie charts has been considered useful in order to make a visual comparison between the different characteristics of the classified crops. The example case shows two options. A button at the top allows to switch from one pie chart to the other.

1) Irrigation requirements percentages per crop type (*Figure 6*). Percentage over the total of water needed to irrigate each type of crop considering the irrigation requirement mean of the area occupied of each crop, multiplied by the extension of the surface. The example shows that orchards require almost the 50% percent of the total of the water needed to feed the whole irrigated area at the end of the year 2016.

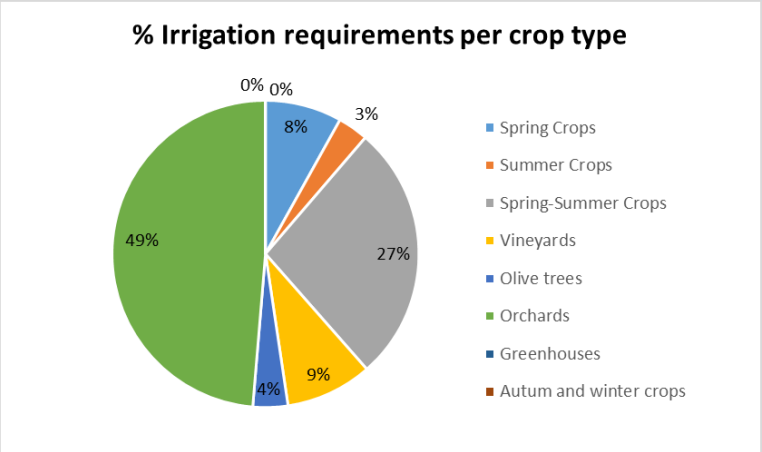


Figure 6. Irrigation requirements percentages per crop type.

In addition, another button can be implemented that allows to change the temporal scale of this pie chart option. This button will have a drop-down list including the months of the year where the user can choose one of them and generate a new monthly pie chart. However, the option by default will be at annual scale.

2) Surface occupied per each type of crop (ha/crop type) expressed in percentages (*Figure 7*). Percentage from the total irrigated surface covered by each crop. In this case the graph shows that vineyards and orchards cover the 60% of the irrigated area.

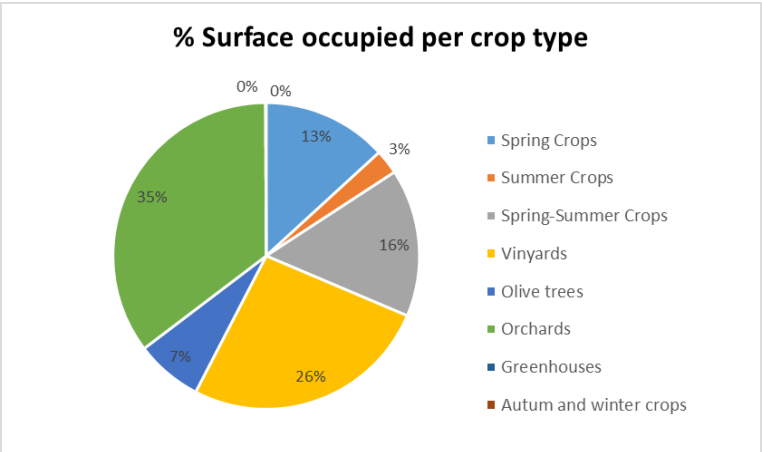


Figure 7. Surface occupied per each type of crop (ha/crop type) expressed in percentages.

Other charts have been obtained in order to adapt the DIANA web app to the needs of the users. As follows two examples:

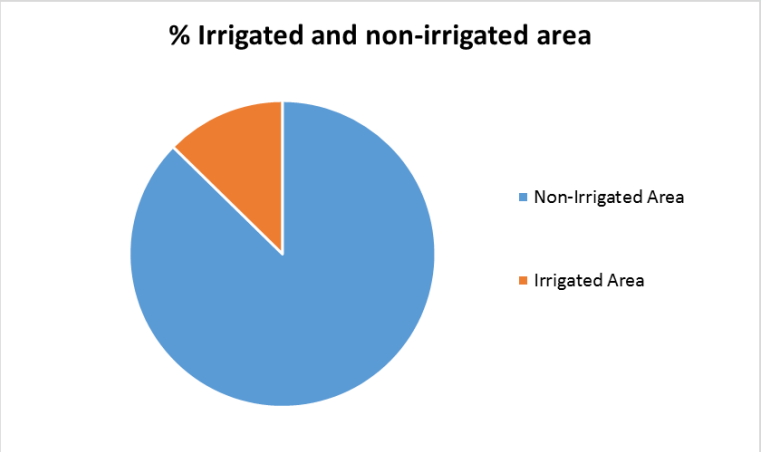


Figure 8 Percentage of irrigated and non-irrigated area over the total of the surface in 2016.

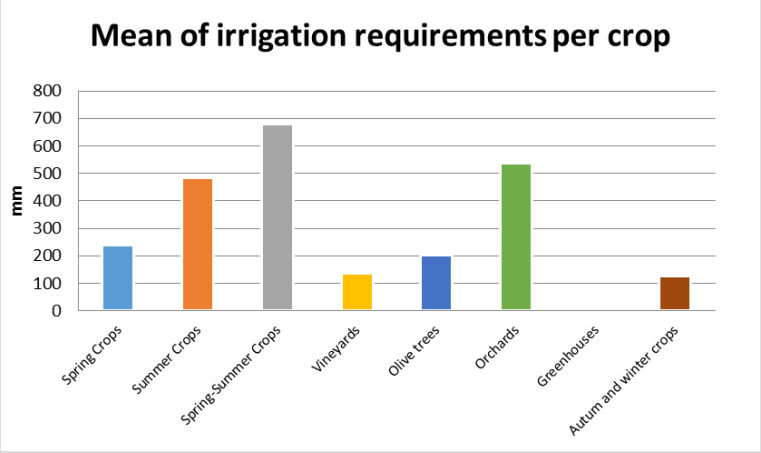


Figure 9 Mean of irrigation requirements accumulated at the end of the year 2016 for each type of crop.

5.4. Temporal evolution graph screens

Two different temporal evolution graphs have been taken into account. They both represent aggregated values of the all types of irrigated crops. However, there should be (in a third step) the possibility of choosing one or several crops by clicking in the pie-chart and generating two new temporal evolution graphs corresponding to the crops chosen (*Figure 12*).

In addition, the temporal slider bar could be used to filter the time interval shown (*Figure 4* & *Figure 5*).

The initial screen will include one of the graphs by default and it will include a button to switch the graphs as explained below.

1) Accumulation and evolution of irrigation requirements (*Figure 10*).

The graph at the initial screen will include two curves: The accumulated values and monthly evolution of crop aggregation irrigation requierments as shown in the following figure. With this graph the user can see the volume of water needed monthly accumulated to feed the irrigated area (aggregating averages of monthly irrigation requirements of the totally of crops) and the monthly evolution of this data informs the user when water demand is highest and lowest.

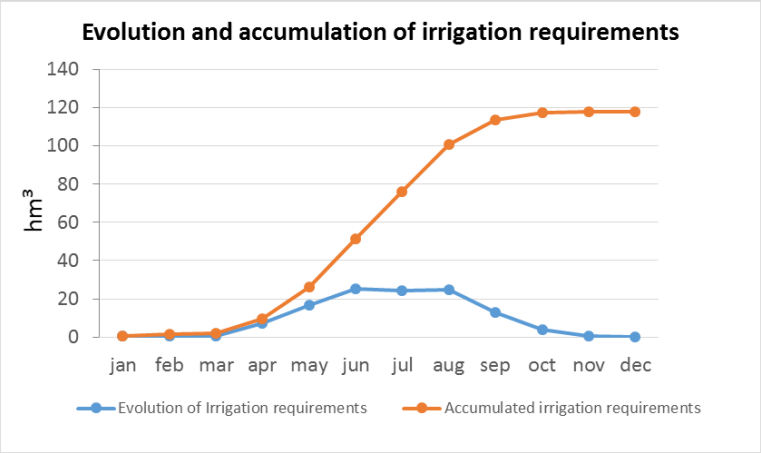


Figure 10. Evolution and accumulation of irrigation requirements.

2) Monthly evolution of water requirements (aggregating crop averages) (mm).

In this part of the DIANA initial interface screen there will be a button that allows the user to change to the next figure (*Figure 11*).

The curve represents the evolution of the average (aggregating all crop averages) of the irrigation requirements expressed in millimeters. This curve can help users identify and characterize the volumes in l/m² required for irrigation every month of the totality of the irrigated area.

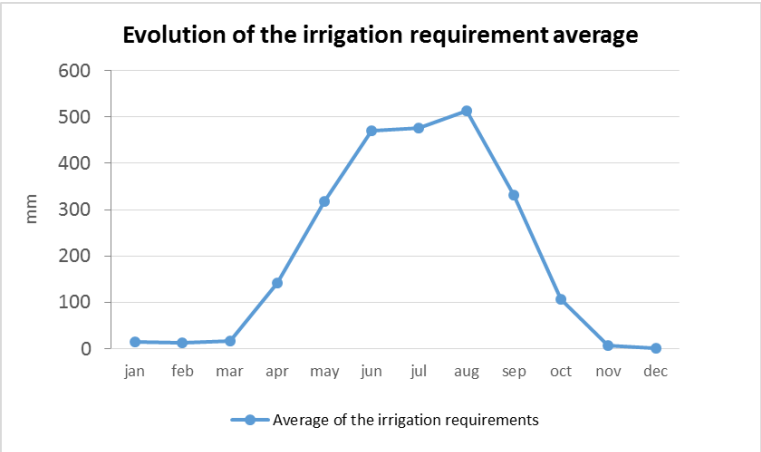


Figure 11. Evolution of the irrigation requirement average.

Figure 13 shows an example of the temporal evolution graph in the hypothetical case that the user selects all crops in the pie chart.

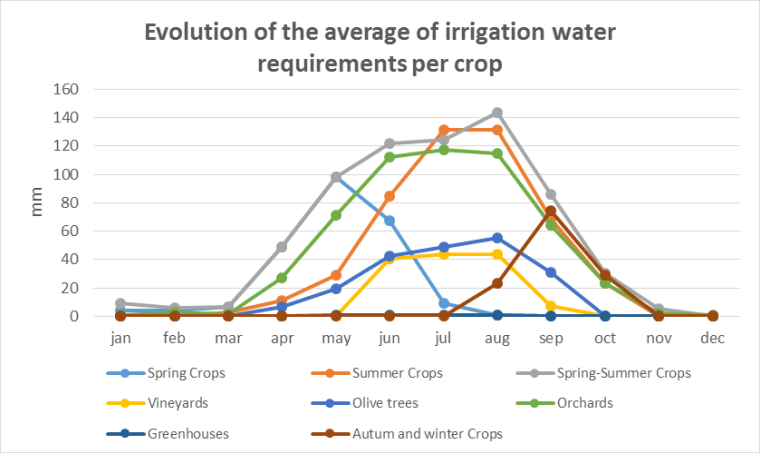


Figure 12: Example of graph created after having selected the total of crop types by clicking on pie-chart.

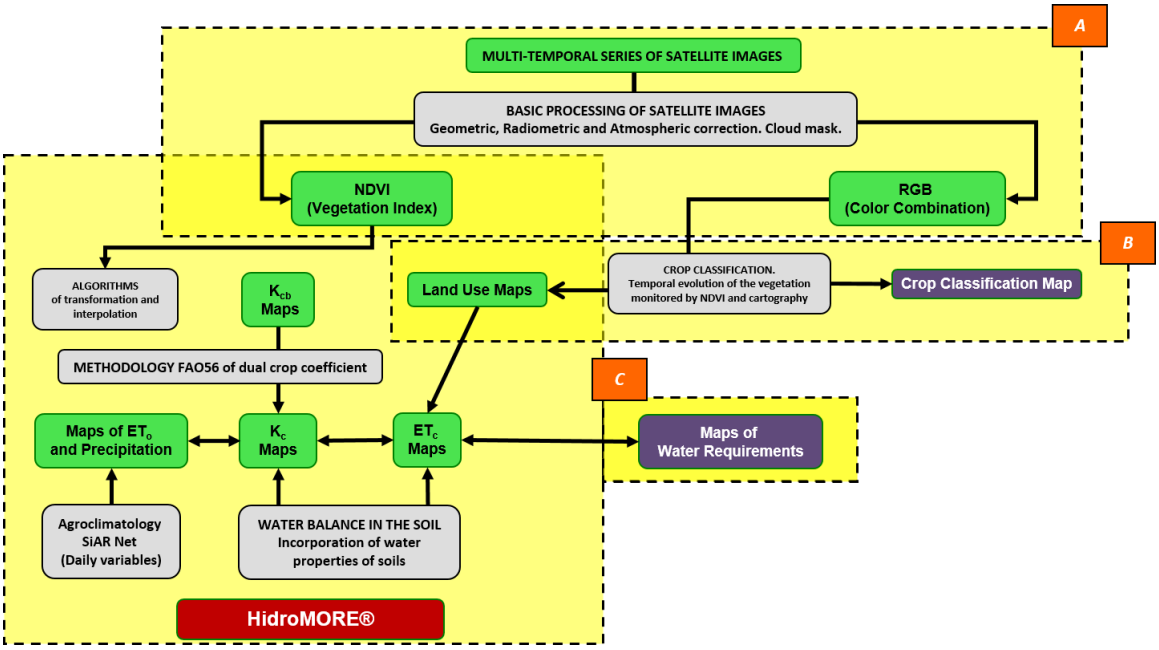
References

- González-Dugo, M.P., Escuin, S., Cano, F., Cifuentes, V., Padilla, F.L.M., Tirado, J.L., Oyonarte, N., Fernández, P., Mateos, L. 2013. Monitoring evapotranspiration of irrigated crops using crop coefficients derived from time series of satellite images. II. Application on basin scale. Agricultural Water Management. 125:92-104
- Mateos, L., González-Dugo, M.P., Testi, L., Villalobos, F.J. 2013. Monitoring evapotranspiration of irrigated crops using crop coefficients derived from time series of satellite images. I. Method validation. Agricultural Water Management. 125:81-91.

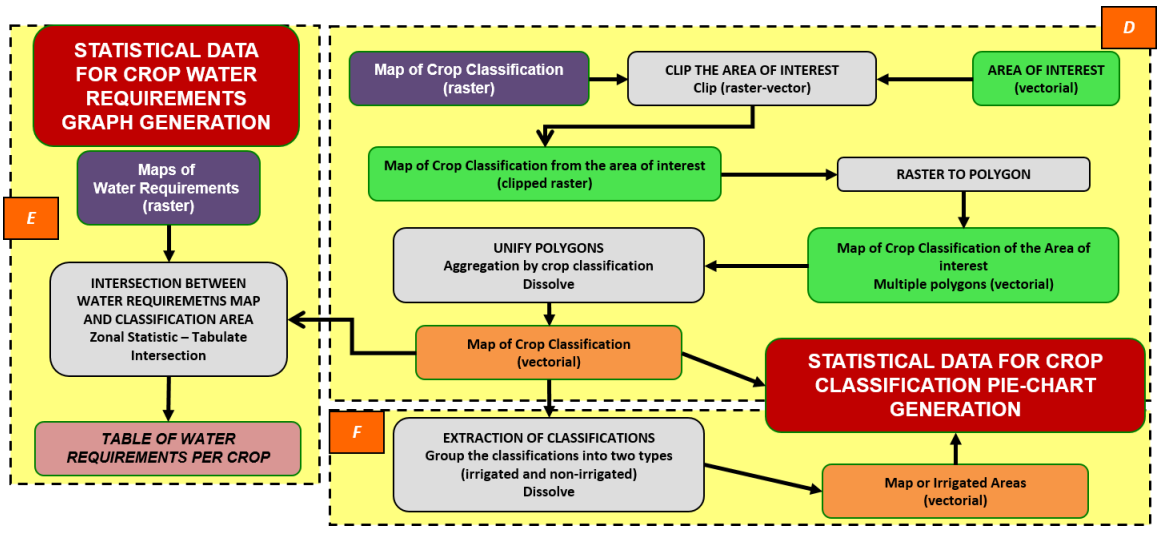
Annexes

Annex A. Flow-chart of product generation (AgriSat-UCLM)

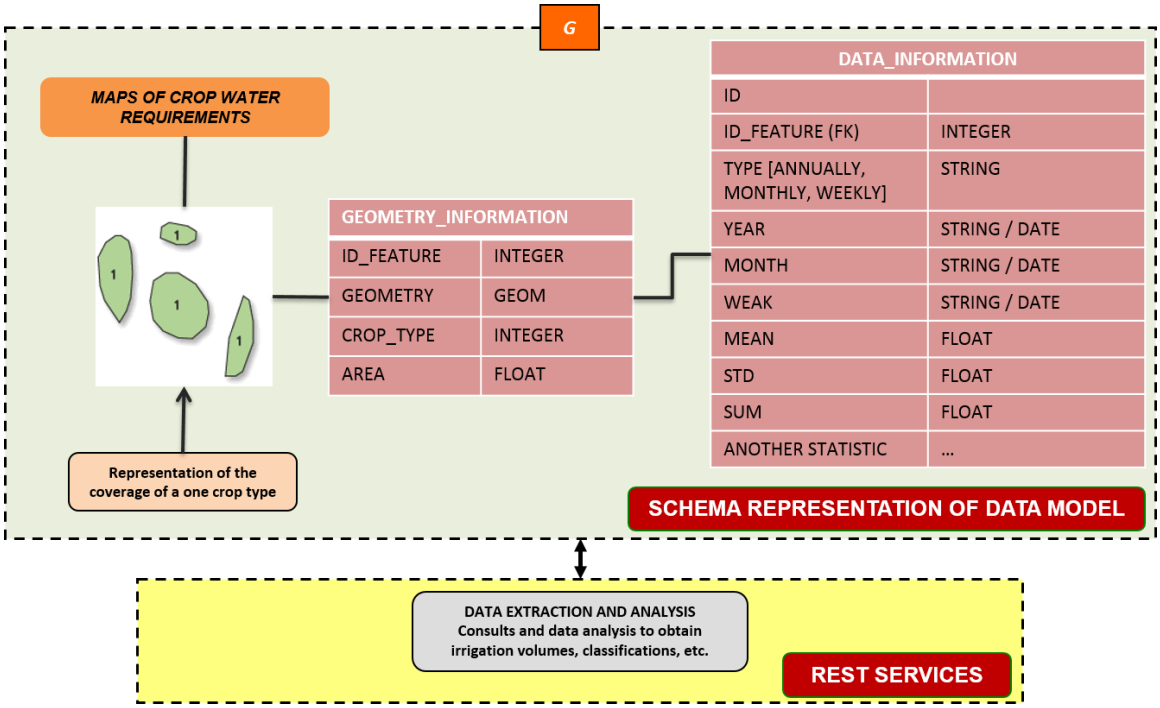
AgriSat-UCLM flow-chart for product generation as maps of irrigated area, crop classification and maps of water requirements methodology.



AgriSat-UCLM flow-chart for GUI generation.

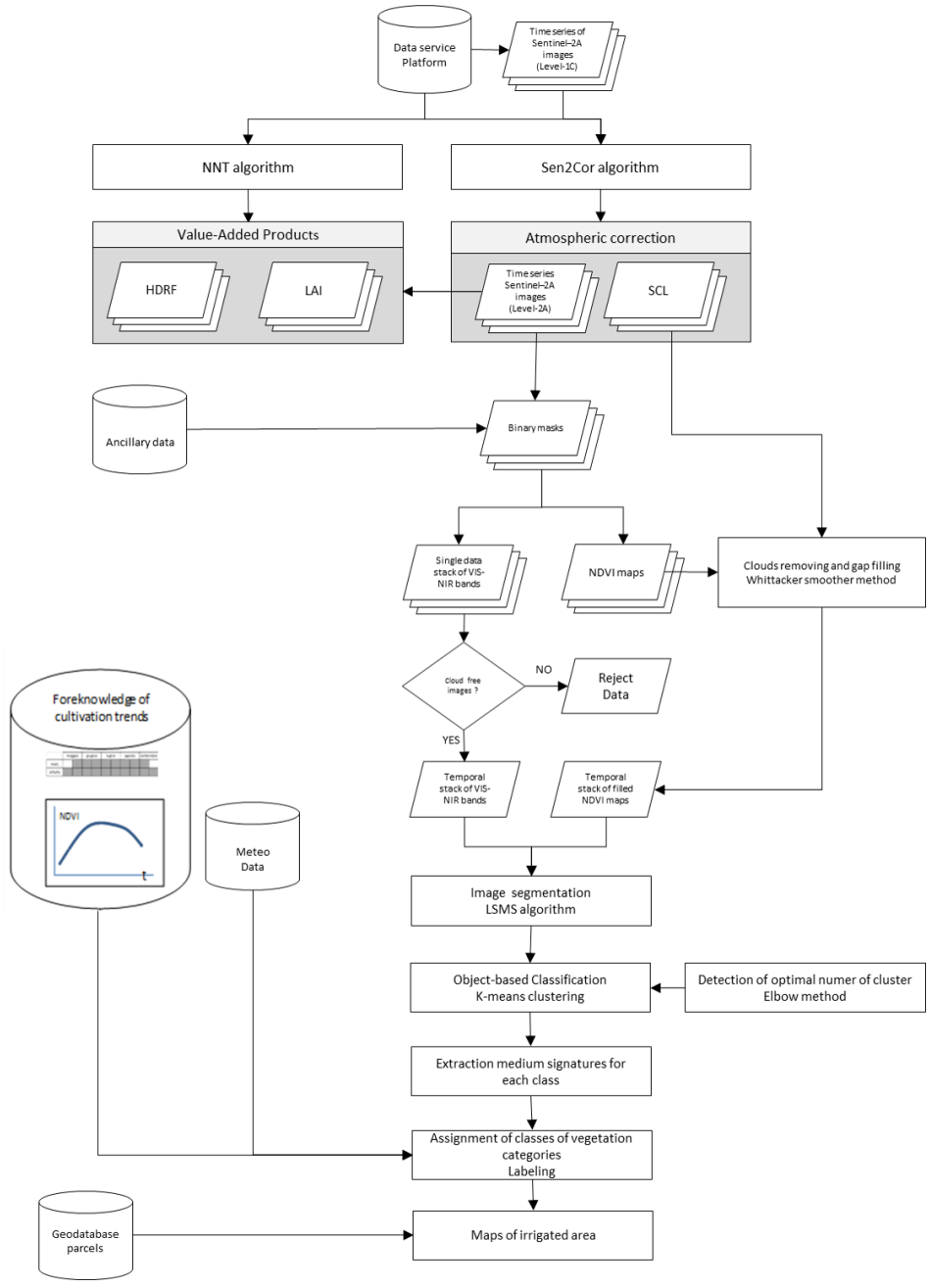


Proposal of schema of data model representation.



Annex B. Flow-chart of product generation (Irrisat)

Irrisat - Flowchart of the Irrigated areas detection process (for more details see deliverable 2.1).



Irrisat Flowchart of the CWR (for more details see deliverable 2.1).