From the Plot to the River Basin

AgriSatwebGIS®: A Tool for Efficient Water Management

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Rigorous management of water in agriculture must be considered from the point of view of all its actors, covering the information and knowledge needs of each one of them: from supporting the farmer in making irrigation decisions at the plot level, up to the collection and management of objective information at the basin scale, through planning and control at the user community level. Today, it is inconceivable to tackle this enormous task without resorting to the available technological arsenal, but to speak of complex technologies is to speak of a high degree of specialization that escapes individual capacities. In this context, successful solutions arise from cooperation between entities of different nature. An example of this is the collaboration between the Remote Sensing and GIS Group of Regional Development Institute of the University of Castilla-La Mancha and the company AgriSat Iberia S.L., which have created a dynamic work flux of continuous innovation to, firstly, transfer complex knowledge to the farmer in format of simple services of direct application, later, with the information generated at intra-parcel level, scaling to the level required by the entities or authorities involved in water governance, and finally, redirecting the efforts and resources in research, development and innovation based on a better knowledge of their perception, degree of adoption and suggestions for improvement in this regard.

The latest result of this fruitful collaboration has been the development of an application that integrates information on the state of crops, from satellite images, to reliably predict at intra-parcel scale (with a resolution level of 100 m^2) its water needs within a week. This makes it possible to quantify, at any point in the crop cycle, its accumulated demand for water, and to add it spatially up to farm level, irrigators community or river basin. From the estimation of the relative photosynthetic activity obtained from the images, it is possible to know the evolution of the crops throughout their growth and development cycle, as well as their spatial variability, in a simple and intuitive way.

Together, there are three technologies that facilitate this important leap in water management: Remote Rensing, Geographic Information Systems (GIS), and Information and Communication Technologies (ICT). AgriSatwebGIS®, which is the name of this new platform, is conceived as an online GIS (webGIS) that integrates Earth Observation technologies. These types of platforms are traditionally used to show large areas of the territory efficiently, through the use, for example, of orthophotos, as is the case with the renowned Spanish SIGPAC viewer. Therefore, it has a map viewer, which allows the visualization and analysis of different Earth Observation data sources (raster data) as well as geo-referenced vector layers, and incorporates, as an innovative element, tools for management and analysis of temporal raster information, mostly satellite images, through layers of virtual tiles of temporary information, the management of this type of data being its main advantage over a traditional map viewer. Dense time series of free images of the main Earth Observation satellites operated by NASA and the European Space Agency are used as the main source of information. The structure of this type of layers (temporary virtual tile layers), allows to have sets of images, in any cartographic reference system worldwide, organized in a temporal space, managing agilely, in the same layer,

information of large areas using satellite images. It also allows managing various raster information sources (different satellites and / or flight images) with different resolutions, creating a map viewer capable of representing layers of temporal information with different configurations.

AgriSatwebGIS® offers, due to its internal architecture, the possibility of making queries at specific locations and time periods in order to visualize and analyze the temporal evolution of parameters related to the state of the crops, as seen in figure 2, taking into account the pixel size of the images counts (10 x 10 square meters). To be able to make this type of query would be equivalent to having a network or mesh of virtual sensors on the plot located by tiles of 100 square meters, which could be consulted independent and comparative.

It offers tools to independently manage spatial data sets, and to process and display analyzes of the information contained in them. It is a powerful tool that allows analyzing data generated by external models and making the most of the visualization of large and complex databases, in addition to analyzing the time evolution of the information they contain.

This new tool is a "re-evolution" of the SPIDERwebGIS® platform, a national and international benchmark for webGIS platforms for the consultation and exploitation of time series data from satellite images. The development of this new application is based on a technological leap and a modular concept that allows its growth and extensibility in a much more agile, flexible and orderly way. This new development philosophy has an impact on greater functionality, potential and operability, in line with the current standards of the Open Geospatial Consortium (OGC), which defines open and interoperable standards within Geographic Information Systems. In addition, it allows viewing and consulting data on external services offered by other IDEs (Spatial Data Infrastructures), public or private, that provide their data through these standards.

It stands out for its usability and graphic design, for which it has had the collaboration of specialists in the design of this type of online services. Its management adapts to all types of devices, including touchs such as tablets and smartphones.

It also stands out for its versatility and flexibility, which allows it to adapt to the needs of a wide range of user profiles: multinationals in the agricultural sector, agri-food producers, distributors, technicians, cooperatives, irrigation communities, researchers, and of course farmers. In this sense, it allows the personalization of access to information and its management, from the editing of registers to the uploading and downloading of raster and vector geographic information. This software is customizable according to each user and project, allowing the creation of work groups with local and / or global geographic scope, which includes the customization of the viewer and the configuration of personalized styles of representation of the geographic information that can be assigned to each user or the work group, in the style of the most popular Content Management Systems. Selective access to information and management of the system layers based on associated spatial, temporal or alphanumeric criteria can be configured in each group, as well as a complete and versatile catalog of combinations of permissions and restrictions.

Multilingual support on the fly offers translations into almost a dozen languages and can be extended simply by adding new language dictionaries.

To also review the ability to formulate multi-criteria spatial queries using a powerful advanced filter and whose results can be represented at both the database and map levels.

All this new functionality makes it much more attractive for users with a more advanced profile and who manage large areas made up of a large and diverse number of plots, such as cooperatives, technical consultants, irrigation communities or watershed managers.

It also has connectivity with the well-known AgriSat® app for mobile devices, both applications forming the visible part of the new information processing, management and exploitation system called AgriSat®. Its online nature makes it a service accessible from anywhere with a data connection, and in turn makes it a "living" system not only for its capacity for functional expansion but also for the possibility of increasing the quantity and quality of the sources of information, allowing access to each new improvement immediately.

Figure 1. Temporary query data visualization and exploitation interface in AgriSatwebGIS®

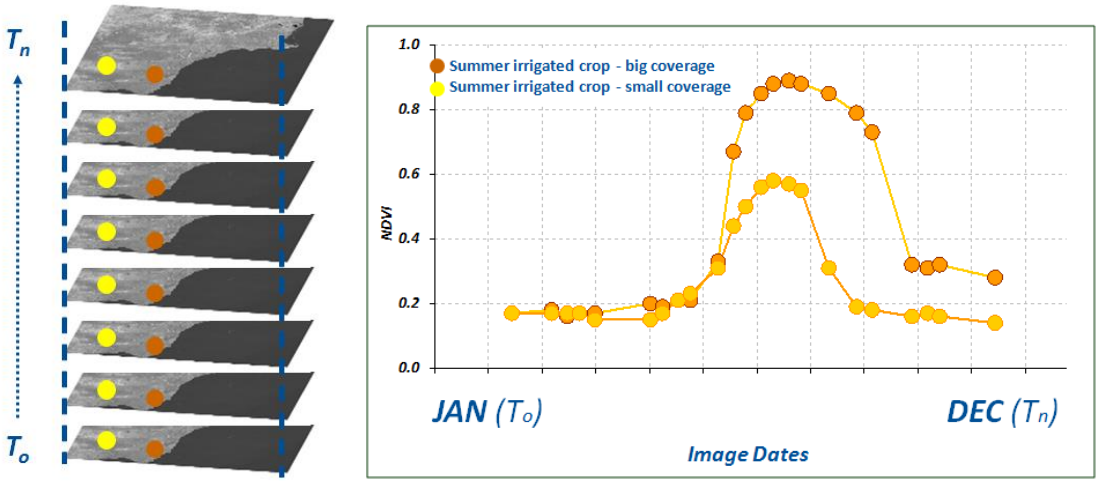

Figure 2. Time evolution of the NDVI extracted from a time series of satellite imagery products at selected points