Application of INSPIRE directive to water management on large irrigation areas

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Application of INSPIRE directive to water management on large irrigation areas

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Abstract. The goal of this paper is to illustrate how INSPIRE can facilitate orientation and advice to calculate the water requirements of crops. These technologies can provide information adapted to specific conditions, updated daily and in an interactive way. These tools permit the integration and management of georeferenced agroclimatic data, soil maps, quality of waters, crop information and technical parameters of a farm. The final objective is to develop a decision support system to facilitate decision-taking processes in a comfortable and generic access on-line, incorporating different techniques and access into GIS data. The information technologies and in a more precise way, the new technologies, applied in different agriculture environments, can introduce important improvements in optimization of the agricultural production factors. Directive 2007/2/EC1 of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) entered into force on the 15th May 2011. INSPIRE lays down general rules to establish an infrastructure for spatial information in Europe for the purposes of Community environmental policies, and policies or activities which may have an impact on the environment. One of the aspects that INSPIRE regulates is the interoperability and harmonization of spatial data sets and services for 34 so-called data themes that are laid down in the three Annexes to the INSPIRE directive. These include land-cover, land-use and weather data.

Keywords. INSPIRE – GIS – OGC – Remote sensing.

Application de la directive INSPIRE à la gestion de l'eau sur de grandes zones irriguées

Résumé. *Le but de cet article est d'illustrer comment les nouvelles technologies peuvent faciliter l'orientation et le conseil pour calculer les besoins en eau des cultures. Ces technologies peuvent fournir des informations adaptées aux conditions spécifiques, mises à jour quotidiennement et de manière interactive. Ces outils permettent l'intégration et la gestion de données agroclimatiques géoréférencées, de cartes des sols, de la qualité des eaux et de l'information concernant les cultures et les paramètres techniques des exploitations. L'objectif final est de développer un système d'aide facilitant les processus de prise de décision, par le biais d'une application en ligne aisément accessible, incorporant des techniques différentes et permettant la consultation de données SIG. Les technologies de l'information et, plus précisément, les nouvelles technologies, appliquées à différents environnements agricoles, peuvent apporter des améliorations importantes dans l'optimisation des facteurs de production agricole. La Directive 2007/2/EC1 du Parlement européen et du Conseil du 14 mars 2007 établissant une infrastructure d'information géographique dans la Communauté européenne (INSPIRE) est entrée en vigueur le 15 mai 2007. INSPIRE établit les règles générales destinées à établir une infrastructure d'information géographique en Europe aux fins de la politique communautaire de l'environnement, et les politiques ou les activités susceptibles d'avoir une incidence sur l'environnement. Un des aspects qui réglemente INSPIRE est l'interopérabilité et l'harmonisation des ensembles de données et des services géographiques, pour 34 thèmes précisés dans les trois annexes de la directive. Parmi eux, on trouve notamment l'occupation des terres, leur usage et les données météorologiques.*

Mots-clés. *INSPIRE – SIG – OGC – Télédétection.*

I – Introduction

TELERIEG project, "Remote sensing use for irrigation practice recommendation and monitoring in the SUDOE space" (www.telerieg.net), aims to achieve a more efficient and rational management of water resources in agriculture. One of its objectives is to improve irrigation advice on the main crops in the area of the Tajo-Segura Aqueduct (ATS), which covers 150,000 ha between the provinces of Murcia and Alicante (South-East Spain) (Fig. 1).

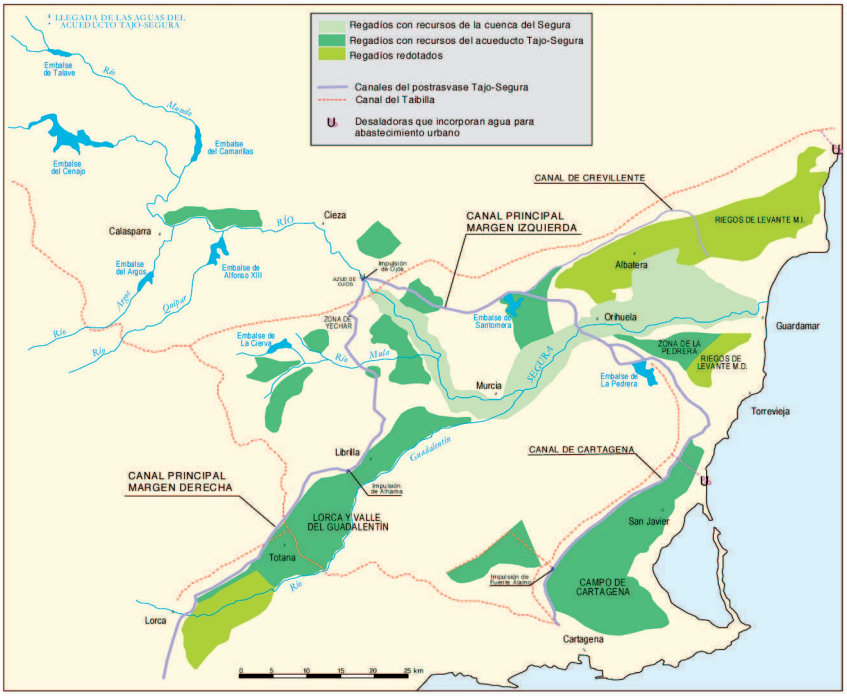

Fig. 1. Pilot zone: Irrigation areas of Aqueduct Tajo-Segura.

TELERIEG sought to integrate information from different European, national and regional governments by using standards recommended by the INSPIRE directive, in order to provide added value for agriculture and climate risk management in the pilot project areas covered by the project. The EU has already developed very advanced initiatives which implement this directive, especially related to soil at European level, such as those described in the publications of the Joint Research Centre Institute for Environment and Sustainability (JRC, 2011).

II – Material and methods

When trying to improve water management, one of the main issues we face is that we need a lot of agroclimatic data from various government and agencies, which generally store their data in different formats that greatly complicate their use. To solve this problem, global standards have been defined that tend to make data more accessible and open regardless of its origin. Therefore, the OGC (Open Geospatial Consortium) created, among other services, a series of standards for search, access and distribution, applicable to any spatially-referenced data. In this sen-

se the EU developed the INSPIRE Directive, aiming to solve many issues related to accessibility and interoperability of spatial data (INSPIRE, 2007).

The equipment used to improve the irrigation advisory service in the ATS area, as defined in Rincón and Erena (1998), consists of (Fig. 2):

Hardware:

- WA database server for weather data.
- Two servers for NOAA satellite images.
- A server to connect stations with GSM modem.
- 48 weather stations (3 different types of stations: Campbell, Thies, Geonica): 11 with a GPRS modem (data capture in real time) and 37 with a GSM modem.

Software:

- PC208W: a commercial application to manage Campbell stations.
- SADECA: an application developed in Visual Basic to manage Thies and Geonica stations.
- Oracle Database 11g Release 1 (11.1.0.6.0) for Oracle Linux.
- The Dartcom HRPT/CHRPT Grabber software.
- The Dartcom SIAMIV (Satellite Image and Meteorological Information Viewer) software.
- Adobe® Flash® Builder™ 4.5.
- Cartographic Viewer done with FLEX language using API's from ESRI.
- ArcGIS Server 9.3.1.

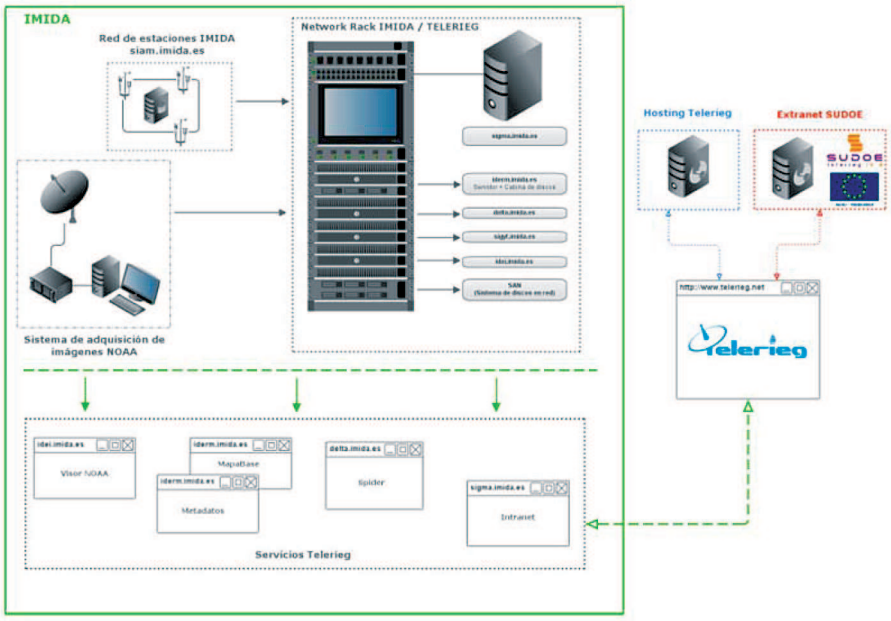

Fig. 2. System architecture of the TELERIEG project (http://www.telerieg.net).

The Fig. 3 below shows the functionality of the software used to develop the geoportal, following the standards of the INSPIRE directive (ESRI, 2007).

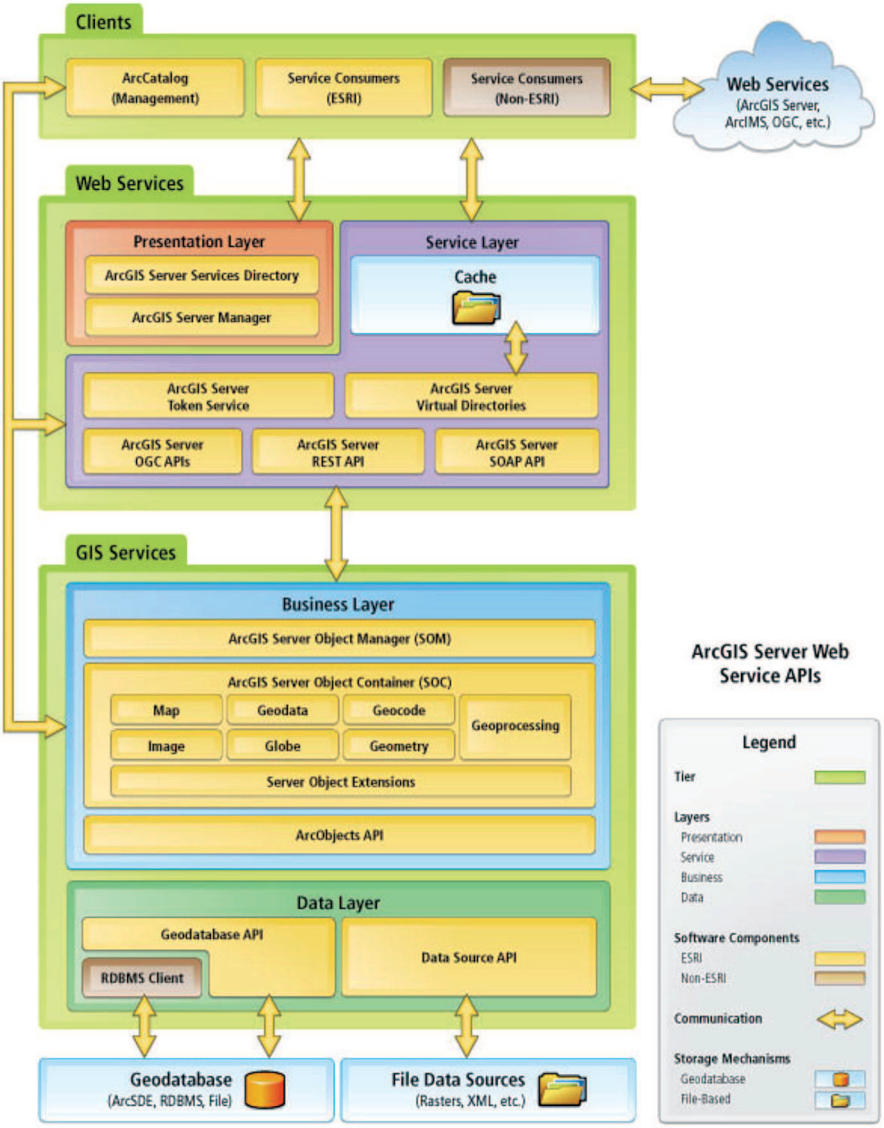

Fig. 3. System description of GIS component.

The INSPIRE directive (INSPIRE, 2007), aiming at the establishment of an Infrastructure for Spatial Information in the European Community, entered into force in May 2007. This directive recognizes that the general situation on spatial information for environmental purposes in Europe is one of fragmentation of datasets and sources, gaps in availability, lack of harmonization between datasets at different geographical scales and duplication of information collection. The

initiative intends to trigger the creation of a European spatial information infrastructure that delivers to the users integrated spatial information services. These services should allow the users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an inter-operable way for a variety of uses. Policy-makers at European and national level are among the main targeted users who would need access to a number of services that include the visualization of information layers, overlay of information from different sources, spatial and temporal analysis, etc.

III – Results and discussion

The geo-portal developed within the project Telerieg integrates datasets from various government bodies which have in common a spatial component that allows its location in the territory. In this sense, the INSPIRE directive has been applied as a framework. Furthermore, a spatial data infrastructure based on OGC services (OGC, 2004; IDEE, 2007) has been built to query and manage useful information, especially for irrigation communities, becoming a support tool in decision-making for efficient water management in ATS irrigation areas.

For this purpose, a highly functional map viewer that integrates the information obtained by the SIAM (Agricultural Information System of Murcia) from the agro-climatic stations network of the Region of Murcia has been created in the Oracle® APEX environment on an Oracle® 11g database. The viewer uses the application programming interface (API) of ArcGIS for Adobe Flex, providing the basis of a web application that includes the following services: map viewer, geocoding, metadata access and geoprocessing based on ESRI ArcGIS Server. The abovementioned ArcGIS API for Adobe Flex allows us to develop high-performance applications that deliver GIS content and functionality for geo-portal users (Fig. 4).

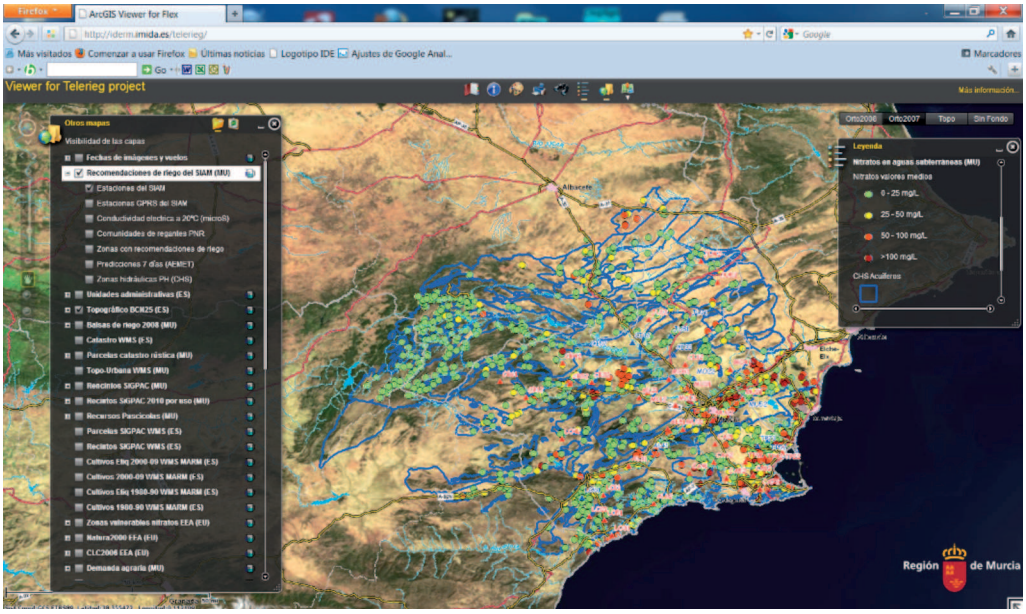

Fig. 4. Flex viewer on the TELERIEG website (http://iderm.imida.es/telerieg/).

IV – Conclusions

In order to provide a service rich and adapted to the new technologies that make the Web 2.0, we have used those technologies along with GIS, remote sensing, agro-climatic data and recommendations of the INSPIRE directive for improving the irrigation advisory systems in the pilot area. Irrigators and other particular users easily get a great deal of information that will be useful to improve the efficiency of water use in agriculture, as this information is essential for proper irrigation scheduling based on climatic evolution and crop development.

We believe that these technologies are well suited for the implementation of systems which support the definition of irrigation programs on farms, thus improving crop development, as well as some water savings, which is especially important in areas with limited resources such as the south-eastern Spain.

Acknowledgments

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