



THE EIMS GEOPORTAL TO THE RESCUE

AN ENVIRONMENTAL INFORMATION MANAGEMENT SYSTEM FOR THE SAUDI ARABIAN PRESIDENCY OF METEOROLOGY AND ENVIRONMENT – ADOPTING INTERNATIONAL BEST PRACTICE FOR A BETTER LIVELIHOOD

Saudi Arabia is a country with a fast growing population of around 28 million inhabitants mostly concentrated in a small number of urban centers, facing harsh environmental conditions in most parts of the Kingdom. Saudi Arabia covers a huge area on the Arabian Peninsula (approximately 2.15 million km²) where most parts are extremely arid desert land. To establish a sustainable economy and a sustainable and healthy livelihood for its citizens in this environment is one of the major tasks for the Saudi government.

As in other parts of the world, environment and sustainable development are growing concerns and environmental information is a basic need of societies. Therefore the Kingdom of Saudi Arabia established an environmental administration – the Presidency of Meteorology and Environment (PME) - in Jeddah. This authority is in charge of all environmental information gathered and disseminated in Saudi Arabia. PME has the mandate to manage this data and sees itself as the driver of up-to-date and complete environmental information.

Goals

The main goals of PME are to serve all relevant environmental information to Saudi citizens and civil administrations and to contribution to a number of international obligations and environmental treaties to demonstrate its commitment to improve the environmental situation. To manage the spatial environmental information, PME started to implement an Environmental Information Management System (EIMS).

The EIMS project – first phase

To serve the above needs, GAF AG (Munich) and Summit GeoServices (Riyadh), together with technology partners DLR-CAF (German Aerospace Agency – Centre for Atmosphere Research) and e-GEOS, Italy, provider of CosmoSkyMed radar satellite data and services, established the EIMS-Geoportal and the PME “GIS and Remote Sensing Centre” (GIS/RS-Centre) as a central hub for geospatial information and as a service centre.

Additionally three basic information services including capacity building and training are delivered in the first phase of the project. For every domain – land, sea, air – one initial satellite data based service was set up comprising a national land use and land cover map (1:100 000 scale), an air quality monitoring and forecast system, and an oil spill detection and monitoring system.

Approach

The EIMS-Geoportal and the GIS/RS-Centre were established to collect, store and process all necessary environmental information. The main tool for dissemination and management of the national environmental geospatial data was introduced with the EIMS Geoportal at PME’s GIS/RS-Centre. In the first step, the EIMS-Geoportal serves as the main information hub for PME internally, but provides options to open it to other authorities, the industry and general public to share and disseminate environmental information.

Standards and international best practice

PME wishes to adopt and use existing standards and newest trends for web based environmental data management and policies. Therefore the European partners supported PME with a technical implementation based on Open Geospatial Consortium (OGC®) standards and rules from the pan-European SDI INSPIRE Directive as far as applicable in this national setting. This approach guaranteed an implementation of best practice without reinventing the wheel. Later, the technical applications were supported by a set of business processes integrating the available spatial information into the day by day workflows of PME's different departments.

Technical implementation

The Geoportal and GIS/RS-Centre is based on a combination of open source and standard off-the-shelf software systems to support existing know-how at PME. An initial workforce of ten GIS and remote sensing

experts in the PME GIS/RS-Centre are responsible for delivering base information and to supervise the data and information content of produced maps and the EIMS Geoportal. Data is hosted and edited in an ESRI environment based on the ArcGIS® / ArcServer® suite. From here the relevant spatial information is fed into the EIMS-Geoportal after quality control.

The Geoportal has the capability to present a great number of raster and vector data layers in the same view. Starting from this unlimited selection and combination of information layers it is possible to generate a large variety of reports and maps using GAF's "Print Module/Druckmodul".

Technical background

The EIMS-Geoportal is developed to be easily scalable and to be flexible to accommodate future extension and changes. A three tier architecture is chosen separating presentation logic, business logic and data storage.

Development of the EIMS-Geoportal is based on open source tools like OpenLayers® and MapServer® in a Java Environment. To be

fully compatible to the INSPIRE requirements emphasized by the client, the EIMS-Geoportal's user and security management is using securityManager® and for the metadata management and search mechanisms the catalogue service terraCatalogue® of the commercial sdi.suite® (from con terra GmH).

As described above, all data produced or delivered to PME is controlled by the GIS/RS-Centre in an ESRI ArcGIS® environment. So the data and maps are provided through ArcGIS Server®.

Capacity building

One of the key issues during the project was to spread knowledge of the existence of digital geospatial data within PME and to train personnel on the use and understanding of the contents of the EIMS-Geoportal. In the past, most staff of PME were only familiar with working with paper maps.

Training and capacity building was a priority during in house activities at PME. Workshops and training on how to use the geospatial information available through the EIMS-Geoportal via the PME Intranet was provided day by day throughout all interested and available departments.

User orientation

The EIMS-Geoportal is designed to serve PME's approximately 900 staff internally with environmental information. Future planning is dedicated to provide spatial environmental information to a variety of different authorities and the general public. Therefore a caching technique is used in the EIMS-Geoportal presentation tier providing map views, once produced, instantaneously even for large numbers of users.

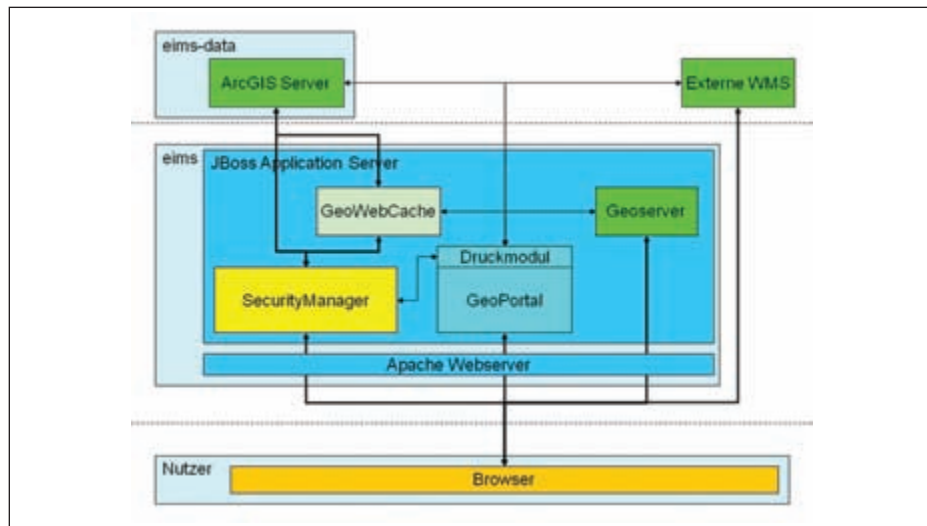
Besides the enhanced performance, all information is accompanied by standards conformant metadata and a help function to provide detailed information on the Geoportal's contents and scientific background, in both English and Arabic. This makes it a valuable information source for different user groups. The information contents to be provided to these user groups can be controlled easily by PME through the user management functions of the EIMS-Geoportal.

Services provided

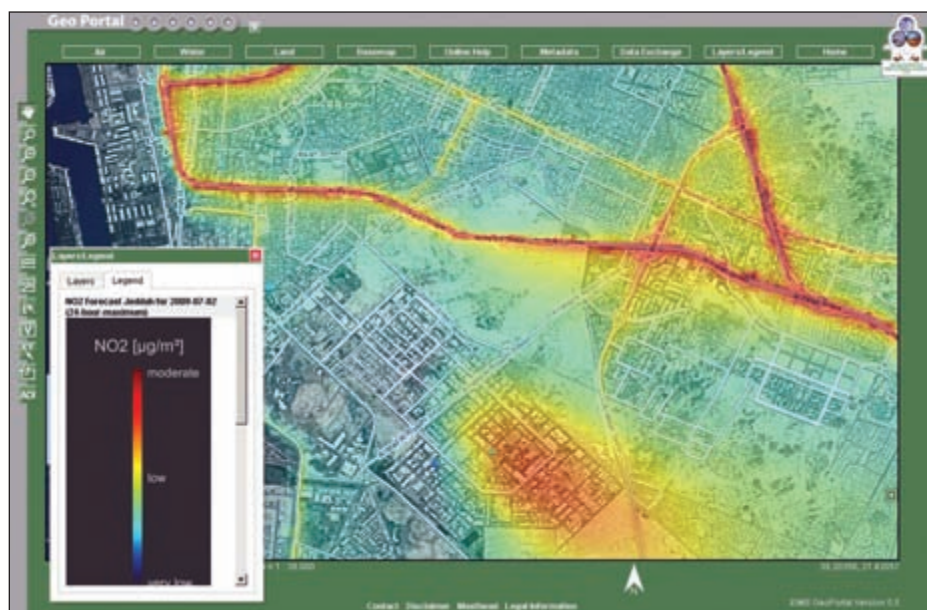
During the first phase an initial package of EO based environmental information services was delivered to PME after in-depth analysis of the needs and readiness of the different departments.

Base layers: Image map, DEM and Land Use/Cover and Change Maps

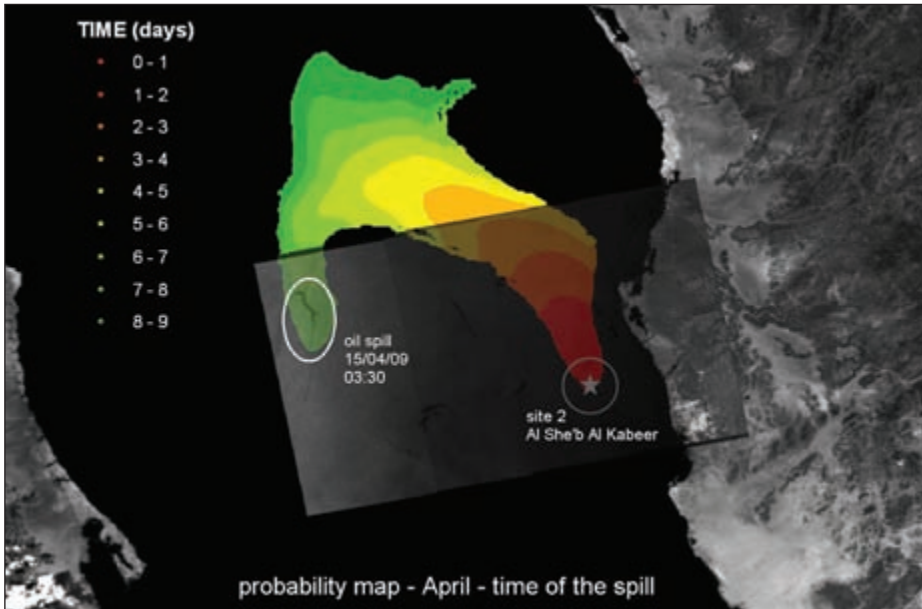
Basic spatial information here is an up-to-date satellite image layer derived from some 60 IRS P6-AWIFS scenes mainly from 2007 and 2008 covering the complete Kingdom, accompa-



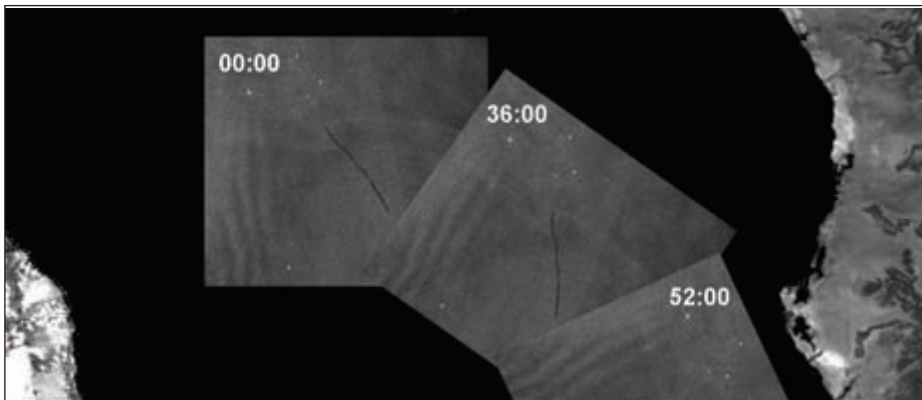
Concept of the EIMS Geoportal - Software Architecture



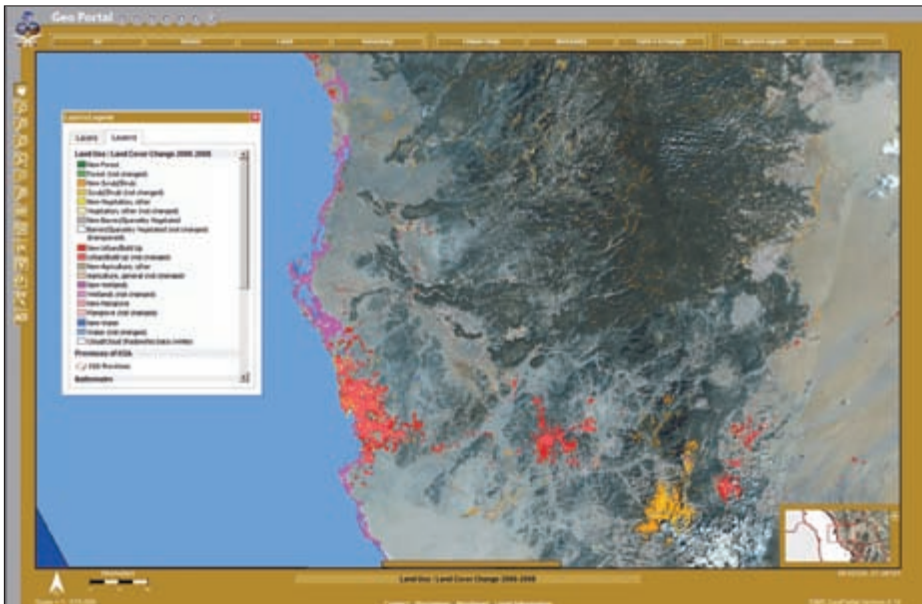
Air Quality forecast Jeddah on street level provided through EIMS Geoportal (© DLR / GAF 2009 for PME)



Oil Spill probability map showing possible impact time on a critical site – here a coral reef (© 2009 e-GEOS)



Oil spill radar images



Land Use/Land Cover Change map 2000-2008

nied by a homogenous digital elevation model used for ortho-correction of the satellite images and providing a base layer for different environmental analyses.

The image layer was the basis for the land use/land cover (LULC) map of Saudi Arabia and a change detection map based on other

LULC data dating from 1990 and 2000. Classification is based on an adjusted CORINE mapping approach. As in Europe, the results will be used for statistics and other environmental reporting, such as UNFCCC reporting or for the derivation of national environmental policies.

Air Quality

These base maps and data are further used to adopt the models of the Air Quality monitoring and forecast system provided by DLR for O_3 , SO_2 , NO_x and $PM_{10/2.5}$. The service is designed for nationwide information on the air quality and additionally included a pilot service showing street level Air Quality monitoring and forecasting in Jeddah during June 2009.

This air quality monitoring can be an important full coverage service for the health and environmental community to provide information and treatment to affected people. It is proposed to support other cities, like Makkah, especially during Hadj season, to better plan and monitor the situation when millions of pilgrims visit the Kingdom. It provides valuable information, e.g. for traffic planning and improved preparedness of the health and Hadj authorities in charge.

Oil Spill Detection and Monitoring

Another application provided through the Geoportal using the above described base layers was the implementation of a pilot service for maritime oil spill detection and monitoring. The information is mainly derived from radar satellite image data, here especially from the new CosmoSkyMed Constellation. This data provides detailed monitoring on smaller areas besides ERS and ENVISAT radar data used to monitor the complete pilot region in the Red Sea. Oil Spill detection monitoring was provided during the pilot phase. Additionally slick drift monitoring and damage assessment were simulated to show the potential of the system.

The PME departments in charge for the oil spill detection and monitoring appreciated the outcomes very much and it was proposed to extend the service to the whole of the Red Sea Saudi waters and the Arabian Gulf, where oil transport is an important issue. It was shown that this technique has the potential to significantly speed up and improve the reaction to a detected spill and response time of the PME emergency management. The information can be easily and rapidly distributed to all relevant national and international organizations in the region by means of the EIMS-Geoportal.

Outlook

Phase one of the project has shown that the EIMS-Geoportal and the provided remote sensing based information services are an important step towards operational environmental monitoring and information management in the Kingdom. The next steps should be dissemination of this information to other authorities and the general public to broaden understanding and exchange of environmental information for the benefit of the Kingdom and all stakeholders in the process.

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