

# RISK-EOS, FLOOD AND FOREST FIRE RISK INFORMATION SERVICE

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## ABSTRACT

Started in 2003, RISK-EOS is a network of European service providers delivering geo-information services to support the management of floods, forest fires and others natural hazards throughout all phases of the risk and disaster management cycle (Prevention, Early warning, Crisis, Post crisis).

The RISK-EOS services combine the use of satellite observation data with exogenous data (in-situ data, socio-economic data, etc.) and modelling techniques.

They are targeted to serve the needs of all risk management actors at European, National and Regional levels (civil protections, fire fighting and rescue services, land planning and risks prevention services, territorial communities).

RISK-EOS is part of the GMES Service Element (GSE) funded by the European Space Agency

## 1. RISK-EOS OBJECTIVES

### 1.1. What is RISK-EOS?

The RISK-EOS service portfolio is dedicated to support the management of Flash Floods, Plain Floods and Forest Fires throughout all phases of the risk management process.

These services are primarily dedicated to public administrations acting at local, regional and national levels:

- land planning services,
- civil protection and rescue services,
- forestry management services,
- environmental agencies,
- local communities.

The RISK-EOS services have been defined during the first stage of the RISK-EOS project (2003-2004), and selected on the basis of priorities expressed by a group of "core users" spread throughout Europe (France, Germany, Italy, Spain, Sweden).

The objective for RISK-EOS stage 2 (2005-2008) is to extend this service portfolio - with additional services - to new users and European regions.

### 1.2. A user driven approach

The RISK-EOS Service Network is managed in full cooperation with the Users communities. End-users are well represented and federated by a User Executive Body, which is in charge of driving the services improvement, based on systematic users' feedbacks collection process, organized every year.

A RISK-EOS Steering Committee that gathers representatives of seven National Civil Protection Services in Europe, and the European Civil Protection Unit (MIC), is in charge of providing high-level recommendations and guidelines for the management of the services network.

### 1.3. A portfolio of services already widely deployed in Europe

The RISK-EOS services are delivered to a large number of European users. At this stage, 30 Service Level Agreements (SLA) have been defined and signed with regional organisations spread in Bulgaria, France, Germany, Italy, Spain, Slovakia, Sweden, Portugal, Luxembourg and Greece. Moreover, The RISK-EOS service network also serves the entire community of European Civil Protections via its involvement in Rapid Mapping operations and its link to the International Charter on Space and Major Disasters.

Each Service delivery is driven by a set of Service Level Agreements (SLA), which are placed between the concerned users and the RISK-EOS Service Providers. The SLAs specify the terms and conditions for service delivery and products qualification. This SLA formalization permits to adapt to a regional approach in order to satisfy the users' community organisation while ensuring standardized and harmonized RISK-EOS Services.

The RISK-EOS service network intends to demonstrate progress towards long-term sustainability for a set of seven GMES services:

- Assets Mapping
- Rapid Mapping
- Automatic Burn Scar Mapping
- Burn Scars Mapping
- Regional Fire Monitoring
- Flash Flood Early Warning
- Flood Risk Analysis

## 2. DESCRIPTION OF THE SERVICES

### 2.1. Assets Mapping

The Assets Mapping service provides regularly updated cartography of urban area, isolated buildings, infrastructures and their evolution, by using high (HR) and very high resolution (VHR) satellite optical imagery respectively for decametric products (10m-5m resolution) and for metric products (1m-5m resolution). It aims at maintaining up to date information on elements at risk, improving the knowledge of prone risk areas and the actual or potential impact of natural disasters. This service is intended to be a local to national level service, close to the users in order to be adapted to their local specifics, needs and existing data (cartographic databases, exogenous data formats, etc). It is a multi-risks service which can be use in each phase of a crisis regarding floods, fires or others natural hazards.

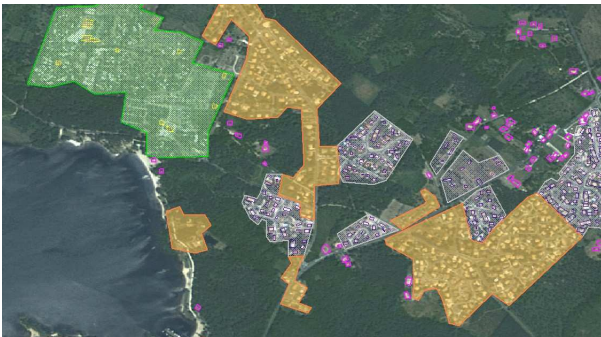


Figure 1. Asset mapping in France based on SPOT 5  
(© Infoterra France, 2006)

### 2.2. Rapid Mapping

Dedicated to the emergency management of natural disasters by national civil protection services and regional to local authorities, the RISK-EOS Rapid Mapping service provides crisis mapping products showing the instantaneous extent and impact of the disasters. The first Rapid Mapping products are delivered within 6 h after EO data reception. These products are generated for each available and exploitable EO crisis image. In the case of long standing emergency (e.g. plain flooding), daily satellite image acquisitions are planned in order to provide the rescue services with daily products on the extent of the events they are facing.

The RISK-EOS Rapid Mapping services are delivered in 2 operational modes:

- In support to the International Charter On Space and Major Disasters, for major events,
- Directly to local agencies (municipalities, regional authorities) for events with narrower geographical extent.

This Rapid Mapping service is intended to be a central service, having an organization with permanent on duty personnel (24h/7d), who works in cooperation with European (MIC), national and local civil protection agencies, adapting their service deliveries to the specificities of the rescue services (e.g. local adaptation, a posteriori refinement, specific validation and delivery aspects).

The Rapid Mapping products are delivered in two steps:

- Near real time products for information support to the rescue services during the crisis,
- Non real time products refined and validated by field actors for post-crisis exploitation.

### 2.3. Automatic Burn Scar Mapping

The Automatic Burn Scar Mapping service provides, during the summer fire season, daily products regarding burn scars mapping at medium-resolution for burnt areas larger than 50 hectares. The maps are an important information source for a fast damage assessment at National to Regional level. The products give a clear and objective overview of the situation on the territory, valuable information in case of a high number of fires of medium/large size occurring at the same time. The processing chain is completely automatic with final product quality checks by expert operators.

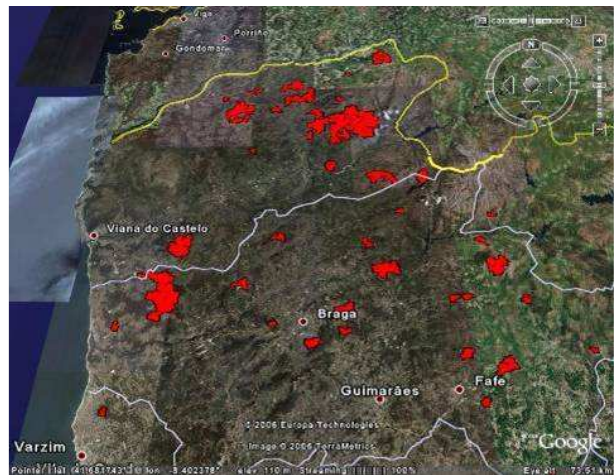


Figure 2. Automatic Burn Scar Mapping in Portuga  
(© Critical Software, Portugal, 2006)

### 2.4. Burn Scar Mapping

The Burn Scar Mapping service package provides, seasonally, after the summer and winter fire seasons, information products regarding burn scar mapping at high-resolution (Landsat, SPOT, IRS data) for support to Fire Fighting Planning at regional/provincial scales, to Environment and Natural Resources Planning at regional / provincial scales (yearly or less frequently) and to Land Conservation Planning at Regional / Provincial Scale.

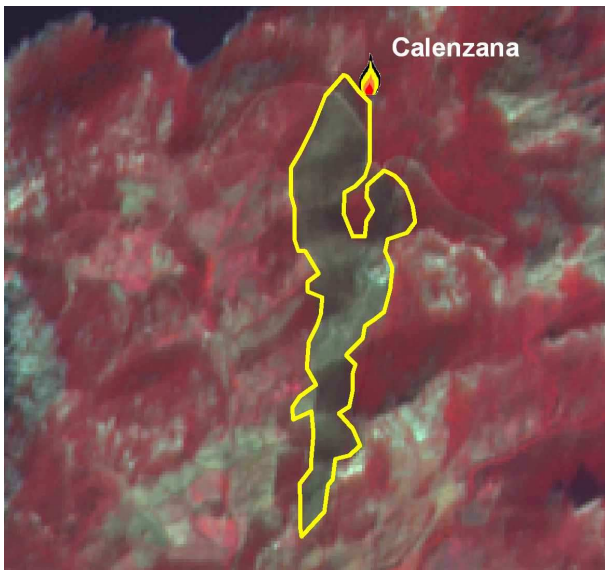


Figure 3. Burn scar mapping in Corsica with SPOT 4  
(© Infoterra France, 2006)

## 2.5. Regional Fire Monitoring

The Regional Fire Monitoring service consists in the provision of near real time information on active forest fires, based on middle resolution satellite data, to keep forests under continuous surveillance.

The overall service objective is to provide reliable information about the active fires situation to managers working at different geographical scales (mainly national and regional). This allows users to get a general overview of all the fire events occurring in their area of responsibility and of their evolution in time, but also to have an overview of the surrounded areas, which is relevant to improve resources and efficiency, to define attack priorities in case of fire simultaneity and to assign fire extinction resources to nearby countries/regions.

The service is currently based on the use of TERRA/MODIS & AQUA/MODIS and will be further extended to MERIS and MSG in 2007.



Figure 4. Hot spot map  
(© INSA, LATUV, 2006)

## 2.6. Flash Flood Early Warning

The Flash Flood Early Warning is a real-time service offered by RISK-EOS for a fast and reliable anticipation of flash floods. This Alert service is based on:

- structural basin parameters derived from satellite observation;
- real-time precipitation data retrieved from hydrological radars;

The Flash Flood Early Warning service delivers risks maps containing two levels of information:

- Overflow risk
- Extreme runoff risk

The risk is classified in three levels, according to the event return period (from 2 to 10 years / 10 to 50 years / over 50 year return period).

Based on the AIGA methodology, which is complementary to the one traditionally used in flood forecasting centres, this service allows the provision of early awareness information with high resolution mapping of the risk, and can be deployed very efficiently on large portions of territory.

## 2.7. Flood Risk Analysis

The Flood Risk Analysis services consist in the production and maintenance of geo-information to support decision making process in plain flood risk management duties. It produces and maintains geo-information about the risk-prone areas, i.e. these areas that are potentially subject to floods.

The Flood Risk Analysis services provide information about past and potential flood events as well as estimations of actual or potential damages and losses. By integrating these data into a risk management system ("Flood Information System"), an efficient and supportive use of information is enabled. This service is provided on user request and builds on EO data as well as on ancillary data sets and modeling techniques. The delivered geo-information is targeted to support flood prevention and post-crisis management.

The service package consists of four complementary services:

- *Mapping of past flood events*

This is a risk analysis service based on the analysis of archived satellite images. Within the framework of flood risk management, the mapping of past flood events allows a feedback from the past, which is important for the risk memory. This service uses EO data acquired during past events to provide geo-information products and damage assessment maps and reports to better support flood risk assessment.

- *Risk Maps and Flood Events simulation based on hydraulic modelling*

Simulation techniques provide essential information for Flood Risk Management and decision support. Complementing EO-based information, this service comprises information about flood risk zones and impact of specific flooding scenarios (e.g. extreme events, dam failure). The simulations also generate information like water depth, flowing velocity and flow direction which are of high value for civil protection forces.

- *Flood Damage Assessment*

Based on either Flood Risk Maps or Mapping of former Flood Events this service provides an assessment of estimated losses/damages of the an actual or potential flood event. Damage calculation is performed using well-established model algorithms and ancillary data (e.g. socio-economic).

- *Flood Information System,*

Information integration (EO-based data and user-supplied ancillary data) into a “flood database” Decision Making System.

This tool supports the access to and use of data & information relevant for efficient flood risk management and decision support. It enables the integration of various kinds of information related to flood risk (all RISK-EOS FRA products, further ancillary and user data, land cover information...) into a unique system for a comprehension data set on flood risk that will help a fast decision making.

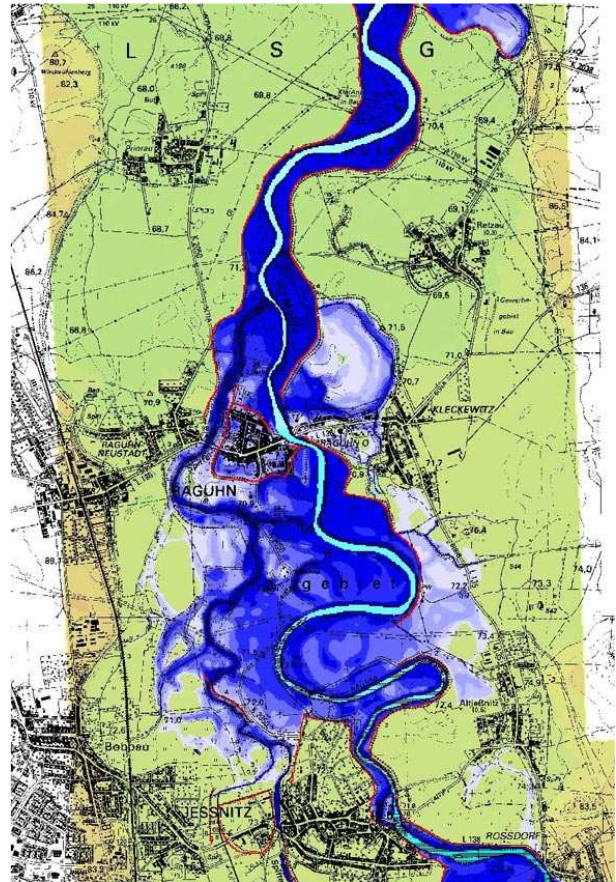


Figure 5. Example of flood damage assessment map  
(© Infoterra gmbh, GEOMER, 2006)