

PLATFORM FOR GEOINFORMATION IN SUPPORT OF DISASTER MANAGEMENT

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Abstract

Efficient analysis and interpretation of satellite imagery can contribute to rapid mapping for disaster management. Earth observation capabilities from national, European and international community actors are used to respond to major disasters around the world, for humanitarian aid and security. Satellite derived information needs to be used in combination with additional data to be presented in a proper geospatial context for the work of civil protection agencies and relief organizations. When disasters happen, reliance is placed on any type of geoinformation that might be available in a short period of time. The paper presents the main goal to be achieved by implementing the project Platform for GeoInformation in Support of Disaster Management (GEODIM) under the frame of PCCA 2012 Programme, coordinated by the National Meteorological Administration of Romania, University of Agronomical Sciences and Veterinary Medicine being a partner. The GEODIM project is focused to develop a downstream emergency response service for contributing to current disaster and risk management approach based on Earth observation data. The service will enable socioeconomic benefits for Romania in terms of future decisions on disaster and risk management policies by providing decision makers with better, more complete, timely and reliable information.

Keywords: downstream emergency response service, Earth observation, remote sensing, satellite image.

INTRODUCTION

According to the United Nations Office for Disaster Risk Reduction (UNISDR), more than 2.9 billion people were affected and more than 1.2 million people were killed around the world by disasters that occurred from 2000 to 2012 (UNISDR, 2013). At present, approximately 60% of the world's natural disasters are floods, but recent scientific studies show that, in the future, global climate changes might increase the incidence of this phenomenon (Niculescu et al., 2010). Europe is also facing severe floods almost every year. The European Commission (EC) decided to establish the European Flood Alert System (EFAS) in order to reduce the catastrophic effects of the floods. The system is developed by the Joint Research Center (JRC) together with national flood forecasting centers and meteorological services. EFAS provides not only flood warning information (covering up to 10 days in advance) but it also offers

useful information for disaster management during the ongoing flood events (EFAS, 2005). Directive 2007/60/EC represents an European initiative that aims to reduce and manage the risks that floods pose to humans, environment, and economic activity (Directive, 2007). Romania has been severely affected by floods many times in the recent past. According to the statistics, there are over one million hectares of floodplain and more than 900,000 people living in areas with high risk of flooding, while more than 88,000 households could be flooded at any time. Most frequently, the floods occurred on the Siret, Danube and Prut rivers (Dana et al., 2011). Starting with 2005, the floods have been monitored with the support of the International Charter "Space and Major Disasters" and the Copernicus Emergency Management Service (GMES EMS) developed by EC. In this context, a local emergency response service called GEODIM will be implemented in Romania. The service will contribute to the

current disaster and risk management approach, based on Earth observation data. It will use the current emergency response services provided by the International Charter, Copernicus EMS and UN-SPIDER, but it will complement them with a downstream component that offers value-added and validated products for each disaster management phase (GEODIM, 2013).

MATERIALS AND METHODS

All the emergency response services that are currently operational provide space-based vital information to the countries affected by natural or man-made disasters. All of them address emergency situations that occur at global level. Generally, the activation steps are quite similar. In the case of a disaster situation, the national authorized user contacts one of the emergency response services in order to trigger the service. Detailed information in terms of location, type of the disaster, extent, date of occurrence must be completed in the activation form. Further on, the emergency service identifies the most suitable satellite missions that are available and might acquire useful remote sensing data. In the same time, archive satellite images are also identified for the area of interest. The service processes all the data and delivers space-based products to the user that triggered the service. Presently, the International Charter "Space and Major Disasters" has more than 10 years of activity and more than 300 activations in case of different emergency situations (earthquakes, fires, floods, landslides, oil spill, tsunamis) that occurred in nearly 100 countries. The members of the International Charter are space agencies and space system operators (Charter, 2000). Copernicus – the European Earth Observation Programme (former called GMES - Global Monitoring for Environment and Security) is coordinated and managed by EC. It consists of three main components: services (land, marine and atmosphere monitoring, security, climate change emergency, management), the in-situ component and the space component (future Sentinel missions). The European Environment Agency (EEA) manages the in-situ component while the space component is operated by the European Space Agency (ESA). Presently, the Mapping component (rush mode and non-rush

mode) of the Emergency Management Service (EMS) is operational (GMES EMS, 2013).

The United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) has the following mission: "Ensure that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle". In addition to the other emergency management services, UN-SPIDER also focuses on capacity-building. The platform has several permanent offices and a network of Regional Support Offices - RSOs (UN-SPIDER, 2010). One of these offices is hosted by the Romanian Space Agency and it is managed in close cooperation with the National Meteorological Administration and also the University of Agronomic Science and Veterinary Medicine Bucharest (ROSA, 2013). GEODIM will be designed as a value-added service that covers all the phases of a disaster, namely preparedness, prevention, emergency response, and recovery. It will gather all the puzzle pieces consisting in services provided by the International Charter, GMES EMS, UN-SPIDER under a unique Romanian emergency response downstream service. GEODIM will strengthen the expertise of the Romanian experts both when operating specific actions for local disaster events and when assisting other countries as an UN-SPIDER Regional Support Office (GEODIM, 2013).

RESULTS AND DISCUSSIONS

A data center containing archive and newly acquired satellite imagery, in-situ data, and different types of useful ancillary data, all stored in geodatabases, will be established for the downstream service. Moreover, the center will also incorporate improved satellite image processing algorithms that will be adapted for each disaster type. The cartographic products will be created in the Romanian language for ensuring their use also by people who know only the mother tongue. This will broaden and facilitate the use of maps, especially in crisis situations where time is critical and rescue actions are required (GEODIM, 2013).

The analysis and modelling of the risks in order to enable the responsible authorities to take

precautions measures to reduce the incidence of a disaster and its amplitude are of particular importance because past experiences show that floods affect mostly the same areas. For example, the Piscu village was flooded

both in 2005 (Figure 1) and 2010 (Figure 2). The very high resolution satellite images allow the assessment of the damages at the level of the households. The maps are very useful for intervention and rescue actions.

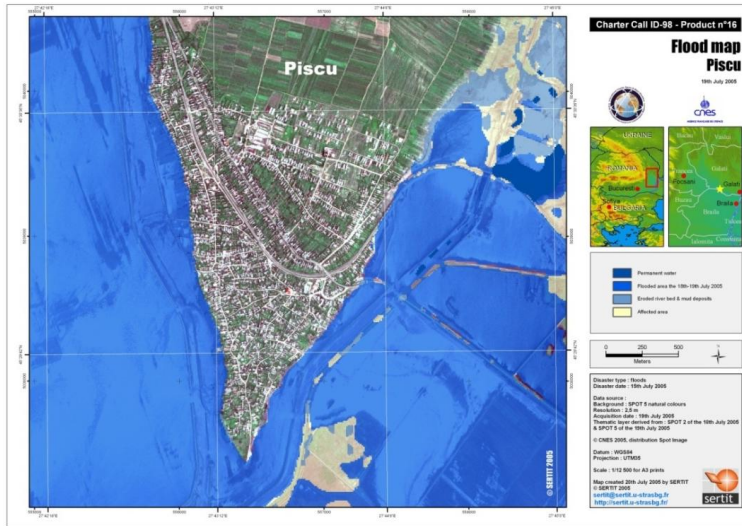


Figure 1. Floods on the Siret River, Piscu, Galati County. Disaster map derived from a satellite image acquired by SPOT 2 on July 19, 2005. International Charter Space and Major Disasters, © SERTIT 2005

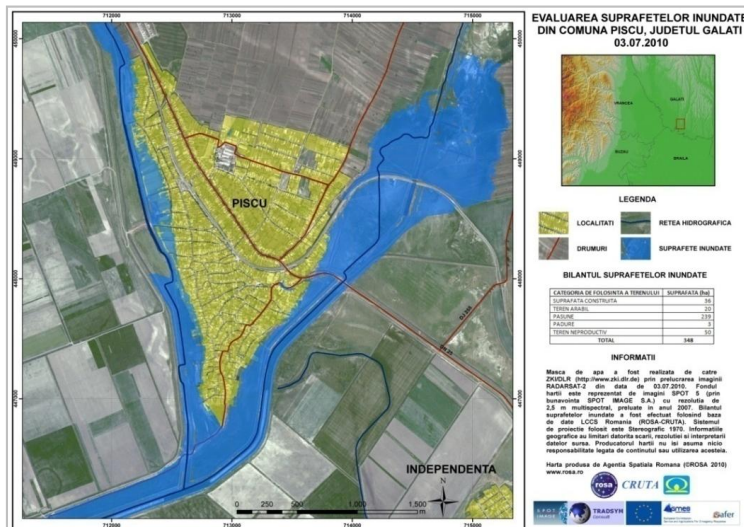


Figure 2. Floods on the Siret River, Piscu, Galati County. Disaster map derived from a satellite image acquired by RADARSAT-2 on July 3, 2010. GMES Emergency Response Service, © ROSA ANM 2010

CONCLUSIONS

The information obtained through the analysis and processing of satellite images is essential in

the management of the emergency situations. Moreover, the integration of in-situ collected data improves the quality and content of the disaster crisis maps.

The downstream emergency response service will target information products that are agreed by the user community and defined based on current technology and Earth Observation data based on users' requirements. Thus, GEODIM will provide value-added products through disaster maps (printed and electronic), graphics and written reports that offer a clear and objective perspective concerning the dimension of disasters and their effects on infrastructure, agriculture, human settlements, etc. The service will also incorporate improved and newly-developed algorithms in order to generate more accurate and complex products.

The service will enable socioeconomic benefits for Romania in terms of future decisions on disaster and risk management policies by providing decision makers with better, more complete, timely and reliable information.

GEODIM will enable a better coordination between the institutions involved in crisis management that in turn will increase the efficiency of the disaster management actions. Consequently, the service will lead to human and material losses reduction and in the same time to an improved protection of the citizens.

In the same time, Romania will significantly strengthen its capabilities in disaster and risk management and will offer high quality assistance as a Regional Support Office within the UN-SPIDER emergency response service.

In conclusion, GEODIM will provide an operational and validated service that will help the responsible authorities to use the space-based products during all stages of the crisis management cycle (preparedness, prevention, response, recovery), as a support for their decision-making actions. The establishment and implementation of this downstream service would represent an absolute first performance for Romania, fitting the current European policies and trends related to the Copernicus Downstream Services that are an extension of the Emergency Management Core Service.

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