INSIGHTS TO THE EMERGENCY MAPPING SERVICE WITHIN THE GMES PROJECT SAFER – HIGHLIGHTS, MAIN ACHIEVEMENTS AND CHALLENGES

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ABSTRACT

In the frame of the European Commission FP7 research programme the GMES project SAFER aims at developing the pre-operational version of the GMES Emergency Response Service (GERS). One part of this service is the rapid mapping component called Emergency Mapping. Within rapid mapping, satellite-based information products are generated and provided during natural or man-made disasters (e.g. fires in Greece or typhoons affecting the Philippines) to support disaster management.

1. STARTING POINT

The SAFER project started in January 2009 and is scheduled to last till December 2011. Based on the experience of precursor projects like RISK-EOS or RESPOND where rapid mapping was provided and from the cooperation with the International Charter Space and Major Disasters, it was predicted that within the next 3 years 30, 45 and 60 crisis activations per year will be requested by SAFER users. The rising numbers are due to increasing user awareness. These numbers are very challenging for a pre-operational service which aims to evolve the service environment for the future ERS on the one hand, and aims to provide nearly operational services for the users to benefit from the new technology on the other hand. One of the main challenges at the beginning of the project was to set up as quick as possible a robust operational model that ensures rapid service provision. From the precursor services the most positive aspects were combined and adapted to the new project environment. This was realized within the first 4 months and finally SAFER started to provide its first services at the end of April 2009. This enabled the project to gather precious experience to further develop the mechanisms. This is also true for the data supply mechanism, the GSCDA/GEST, which is a core element of future rapid mapping services and fundamental to the service's success.

2. BASIC WORK FLOW OF EMERGENCY MAPPING

The mechanism of the Emergency Mapping service combines the positive aspects of the precursor services and the Charter. SAFER implemented a central contact point called the "focal point" who receives the user requests for a SAFER activation, similar to the model of the Charter. This role is realized by the project leader SPOT IMAGE (formerly known as Infoterra France). Once the request is accepted all potentially involved projects partners, the Focal Point (FP), the Rapid Mapping Coordinator (RMC) and the Rapid Mapping Service Providers (RMSP), hold a telecon to exchange information, decide on open topics, divide the workload amongst the partners and fill in the data order form that is sent to GSCDA data procurement to initiate the data acquisition. The responsible Rapid Mapping Provider is identified and coordinates with the Focal Point, the user and GSCDA. During intensive work activations where several RMSPs cooperate to fulfil the user request, the RMC coordinates the work. This function was already part of the RESPOND service model, where it was called "job manager". The RMC role is shared between the two main RMSPs who were both involved in RESPOND and RISK-EOS and thus familiar with rapid mapping provision... The complete service model has been tested in more than 40 activations so far. It proved to be well structured and fit for purpose. Small aspects turned out to be redundant and were adjusted during the first year of the service provision, like over-documentation. The complete service model is shown in Figure 1 below.
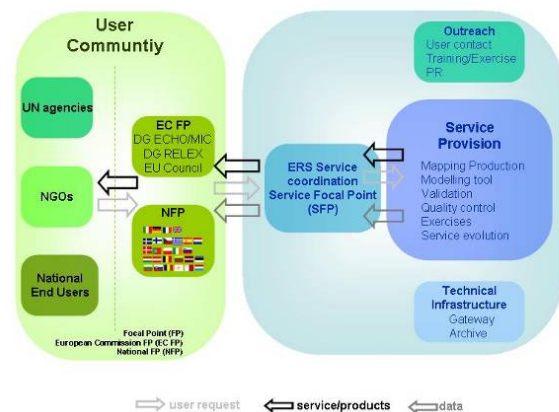

Figure 1: Basic operational model of the GMES Emergency Response Service (ERS) including the Rapid Mapping component (www.emergencyresponse.eu)

3. THE SERVICE PROVIDERS

Initially the group of RMSPs consists of the core providers of the precursor projects SERTIT and DLR, with EUSC completing the starting partners. The work package is led by DLR. In the course of the project, further Emergency Mapping Service Providers will join the service group and will be implemented in the operational model. New applicants have to proof their ability to satisfy the service requirements in a qualification procedure. This process checks all aspects of the service provision from knowledge about the operational model, the workflow, roles and responsibilities to the ability to serve the complete emergency portfolio and covers technical, functional as well as user validation. This procedure was evolved especially for the Rapid Mapping qualification and is harmonized with the other project tasks like validation and service evolution. The core competences that a RMSP has to fulfil and the selection criteria were defined with the expertise of the SAFER RMSPs. These were also provided as input to the general service evolution process within SAFER.

4. THE EVOLUTION MODEL OF SAFER

Besides the pre-operational component, SAFER aims at developing new elements that will be implemented step-by-step into service operations. The development of the pre-operational service is achieved by three consecutive service versions (V0, V1, V2), tailored to implement new developments on the way to the pre-operational service layout. V0 covers the first phase of the project starting in January 2009 until June 2010 (18 months duration). The second phase (V1) lasts from July 2010 to June 2011 (12 months), and the third phase covers the remaining project duration of 6 months until December 2011. In each phase, on the one hand, the pre-operational services are provided to the user group, and on the other hand, improvements for the next version are prepared for implementation. The current SAFER Version 0 is based on precursor GMES projects like RISK-EOS, RESPOND or PREVIEW and was adapted to the new project environment, while versions 1 and 2 will result from developments made in the framework of the project itself (2009-2011). The respective SAFER services and product portfolio aims at satisfying the needs of civil protection and humanitarian aid actors in the context of crisis response activities that have to be answered as fast as possible during emergency situations. The following chapter gives an introduction to the emergency mapping service portfolio which is part of the overall SAFER portfolio.

5. THE SAFER EMERGENCY MAPPING SERVICE SPECIFICATIONS

The evolution model ensures that the service evolves towards the aimed service specifications that are based on the user requirements gathered in the precursor projects and refined in the framework of the SAFER and linkER projects. The user requirements are reflected in the Service Level Specifications (SLA) that describes the main characteristics to be provided. Some of the most important specifications, like 24/7 availability, timeliness or standardization are described below:

5.1.　24/7 availability of the service

The complete service needs to be available 24/7. This is not only valid concerning the accessibility of the service but also the availability of the final products. The RMSPs showed their ability to perform such services already in the precursor services, but taking the increased demand into account the service provision reached a new level of intensity. Therefore, the RMSPs professionalized the map production continuously. An additional major challenge of SAFER is to work towards a complete 24/7 availability of all components that are needed to provide the service, including data supply, which is not necessarily directly controlled by the SAFER project.

5.2.　Timeliness

During a certain crisis the factor time is the most critical one. Time is the key element when crisis responders try to save lives. Therefore, the general user requirement is: the first reference maps within 8 hours after activation and first post-crisis products 24 hours after activating ERS. To deliver within these deadlines is the aim of the service. Unfortunately, some parts of the complete service chain, mainly data acquisition and delivery are not able to fulfil the requirements at the moment. It is envisaged to support those partners over the next few years to enable them to reach the general requirements. So far, ERS can ensure that the service provision after receiving the requested EO data is optimised and in line with the envisaged goals. At the moment the products are generally generated within 8 hours after data reception. In some cases/activations the products were already provided in less than 6 hours after EO data supply. The service must go forward ensuring increased timeliness and part of this is that the number of intermediaries must be kept to a minimum between the producer and the user, or the data provider and the Service Provider respectively.

5.3.　Quality assessment

Rapidity is not the only decisive factor for users, but also the quality of the products. This is one of the main challenges of the service: to balance speed vs. quality.

Within SAFER a major focus is given to validation and quality control. The emergency services are under continuous inspection by validation and quality control procedures. The complete spectrum ranges from consistency checks based on a commonly evolved quality control checklist that aims to ensure that each single product fulfils the agreed standards, to a deeper analysis of the products with respect to the geometric and thematic accuracy. At the same time a major endeavour is made to account for quality while not slowing down the system.

5.4. Standardization and harmonization

Besides the branding of the ERS products the service will be standardized to ensure that products from all service providers are of comparable quality and layout. Within the emergency mapping group an emergency mapping data model is currently evolved. The data model will be accompanied by an Extraction Guide which is a kind of guidance or "how-to-map"-document for emergency mapping. The input to the data model is discussed and agreed on with the Project User Board (PUB). All products will be provided with ISO and INSPIRE conform metadata. Such a metadata template is being currently worked on. Another aim is to establish a common SAFER symbology which is mandatory for all RMSPs and commonly with the Emergency Support Services, where applicable. An important aspect is, that the users are actively involved in all relevant process to ensure that the final service and the product fit to the real user needs. Here again a balance has to be found between the speed/cost of production and the implementation of these various procedures. They have to be shown to work efficiently before they are integrated into operational, high pressure environments such as rapid mapping.

5.5. Activation types

In SAFER there are 3 different types of activations. The basic activation is requested by a registered user after a certain disaster. Alternatively, the user can trigger the service in anticipation of a disaster or some dedicated project partners activate SAFER in anticipation of a user request or a disaster. These anticipative activations are foreseen to avoid time loss during the first phase of the activation ("mobilisation phase") where currently delays occur due to missing knowledge of the service or how to trigger it. To demonstrate ERS suitability to the user it is necessary to enable the user to integrate the information into their individual operational procedures. The last type of activation is the test activation. The test activation is an internal procedure that is applied if project processes, methods or procedures have to be tested before they are implemented in the ERS operational model. The emergency service is also open to user exercises where users wish to explore ways of integrating rapid mapping output into their operational procedures under "real life" conditions. Generally a fictive disaster is thought up to support exchanges and create map content.

6. THE ERS PRODUCT PORTFOLIO

Another challenging aim was to evolve an ERS service portfolio. Basically it was set up on the basis of the precursor service portfolios from Respond and RISK-EOS. Within SAFER an intensive discussion together with the users from the humanitarian as well as from the civil protection domain led to a new structure of the service which is more tailored to the user requirements. The nomenclature of the SAFER emergency mapping portfolio is as follows:

- Geographic Reference – Overview
- Geographic Reference – Detail
- Disaster Extent - Overview
- Disaster Extent – Detail
- Damage Assessment – Overview
- Damage Assessment – Detail

SAFER has defined products for the different phases of the disaster cycle. Emergency response is one of these phases which covers the products from disaster extent – overview to damage assessment – Detail. The geographic reference products are basically from the phase "Preparedness/Prevention" but can be provided at the request of the user under emergency mapping conditions.

These product types are then adapted to the pre-defined disaster types:

- flood,
- earthquake,
- landslide,
- severe storm/hurricane,
- fire,
- technical accident,
- volcanic eruption,
- humanitarian crisis,
- tsunami

For each disaster type the applicable product types are described in detail on so called "product datasheets".
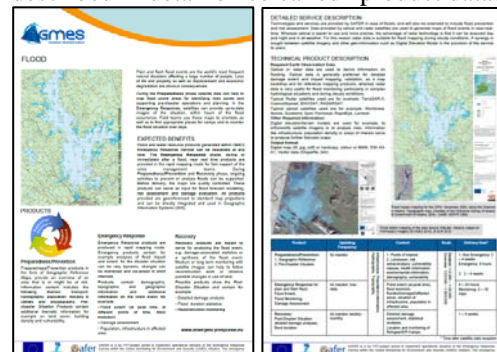

Figure 2: Example of a SAFER product datasheet for flood related ERS products.

7. EXAMPLES OF EMERGENCY MAPPING ACTIVATIONS

During the first 18 months of the project the emergency mapping team gathered great experience, shaping the future ERS services. After setting up the service SAFER provided Emergency Mapping services for more than 40 activations, some of them were very challenging and provided a lot of information to further adjust the recent service structure and the products. In this section some of the activations and the experiences are presented.

7.1. Haiti earthquake, January 2010

One of the worst crises within the last few years affected Haiti in January 2010 when an earthquake of magnitude 8.0 hit the country approx. 30 km southwest of the capital Port-au-Prince. In the course of this disaster more than 250.000 people lost their lives. SAFER cooperated with the International Charter Space and Major Disasters to provide support to the actors in the field. Several users requested the service and many additional relief actors were provided with the SAFER products in the course of the disaster. Within SAFER the Service Providers cooperated to generate harmonized and consistent emergency mapping products as soon as possible after the earthquake, and were the first to produce a detailed road map and damage assessment mapping over Port-au-Prince less than 36 hours after the earthquake.

The mapping products included information on infrastructure like a detailed road network, gathering points, or a damage assessment covering Port-au-Prince and several villages and towns surrounding the capital (see Figures 3 and 4 below).

Figure 3: SERTIT post-event map showing (gathering points, road network and other infrastructure information relevant for emergency relief logistics)
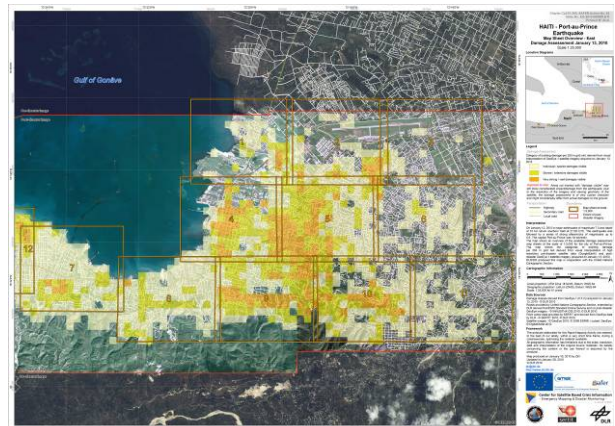

Figure 4: DLR damage assessment map of Port-au-Prince based on GeoEye-1 data (showing also the frames of the detailed maps)

7.2. Typhoons and floods in the Philippines, October 2009

Another challenging situation was the autumn 2009 typhoon season affecting the Philippines. A series of typhoons hit the northern region of the country. Besides the high work effort that was invested, the activation principle was tested to anticipate the landfall and to pro-actively initiate two data acquisitions on the predicted landfall date to overcome the short-comings of the data supply mechanism. SERTIT generated approx. 20 products for the 3 activations as several typhoons hit the same region within a short time period. Formally, for each typhoon a new activation was initiated in SAFER.

The following example compares the water extents of September 26 and 28 and of October, 2 2009. The analysis is based on ALOS PALSAR (26.9.2009), RADARSAT-2 (28.09.2009) and TerraSAR-X (02.10.2009) data (see Figure 5).
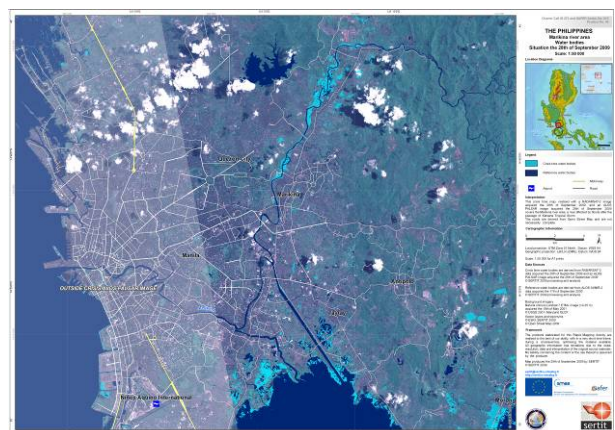

Figure 5: SERTIT water body monitoring map of Marikina River, Philippines

7.3. Flash floods on Madeira, February 2010

In February 2010 the Portuguese Island of Madeira faced a significant flash flood in various regions of the island. At least 48 people were reported dead and 120 injured, while some were still missing. The European Union Satellite Centre (EUSC) and DLR cooperated during this activation. It was a very good example how future cooperation models within an activation could look like. Different approaches were followed like sharing the work by dispatching the regions that have to be mapped, but also processing jobs were shared and the extracted information layers exchanged. The good communication and coordination led to highly aggregated products of high consistency. This showed also the fluent transfer of procedures that were tested in pre-cursor projects like REPSOND and now slightly adjusted to the new environment.

The following Figure 6 shows changes in vegetation and hydrography which were caused by the rainfall. Furthermore, the map shows landslides, damaged infrastructure and blocked roads. The analysis is based on GeoEye data.
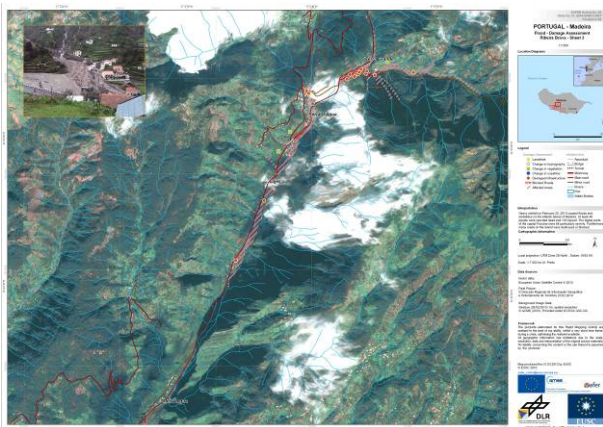

Figure 6: Funchal, Madeira, Damage Assessment Map; February 28, 2010; produced by EUSC (in cooperation with DLR/ZKI)

8. CONCLUSION

The first 18 months of GMES Emergency Response Services show that the project was able to establish a sophisticated operational model within a very short time period and to deliver services of high quality for more than 40 activations since then. The experiences gathered during this time period were analysed and the operational procedures adjusted, where needed, to optimise the service. The whole Emergency Mapping group is cooperating with a good team spirit and generating impressive services for the benefit of a growing and more diverse user base. SAFER has brought about acceleration in rapid mapping product coverage and provision. First feedback from users proves that the service is highly appreciated and provides pertinent support to disaster managers. Nevertheless, Emergency Mapping will further evolve especially concerning the time requirements, the user-driven product portfolio and the quality of the products. Even if there are still some challenges to tackle, especially the improvement of the data provision segment, the Emergency Mapping Service is on a good track to shape a highly effective mechanism for a future ERS.

9. REFERENCES

SAFER website:
http://www.emergencyresponse.eu

SERTIT website
http://sertit.u-strasbg.fr/

DLR ZKI website
http://www.zki.dlr.de