

ENVIMON disaster monitoring system

T. Veijonen, M. Louhisuo, J. Ahola, M. Timonen
*VTT Technical Research Centre of Finland, email: teppo.veijonen@vtt.fi,
machiko.louhisuo@vtt.fi, jussi.ahola@vtt.fi, mika.timonen@vtt.fi*

T. Morohoshi
*National Research Institute for Earth Science and Disaster Prevention (NIED), Japan,
email: moro@bosai.go.jp*

INTRODUCTION

Natural disaster management can be supported by using various information sources. The methods of mapping and image analysis make it possible to provide up-to-date and accurate satellite derived disaster information over the whole disaster area. Nevertheless, many disaster-prone countries have not yet established any operational information systems that would integrate earth observation data analysis and modern information technology including mobile communication and web technology into the operative disaster management process.

The objective of the Envimon Disaster Information and Monitoring System is to make use of remote sensing data in the operative process of early warning, mitigation and management of natural disasters. The system is aimed to be the base for future development of automated real-time disaster monitoring.

DISASTER MONITORING PROCESS

The Envimon system development outlines an operative disaster monitoring process that utilizes earth observation data. The framework for the system specification has been derived from this process. Four system user roles have been identified in the outlined disaster monitoring process (see Figure 1):

- 1) *Local authorities* operate near the disaster location, providing the initial disaster information and using the available satellite based disaster area maps to support the rescue and evacuation actions. For a new disaster and for disasters that are set to be periodically monitored, the system initiates data acquisition for the disaster site.
- 2) Prompted by the system, the *monitoring user* acquires and pre-processes data. With the tools provided by the system, the monitoring user provides the initial satellite-image based disaster area map. The map becomes available for local authorities and other users.
- 3) The disaster map is refined further into a high risk map by *disaster analysts*. Utilizing additional information sources such as rainfall map, geological data or disaster history, the analysts use their expertise to provide prognosis for the near future development of the disaster and to estimate the high risk area for the secondary disaster.
- 4) The largest user group is the *general public*, including the people in the affected areas as well as media and institution representatives. For this user group the system provides up-to-

date information about the ongoing disasters.

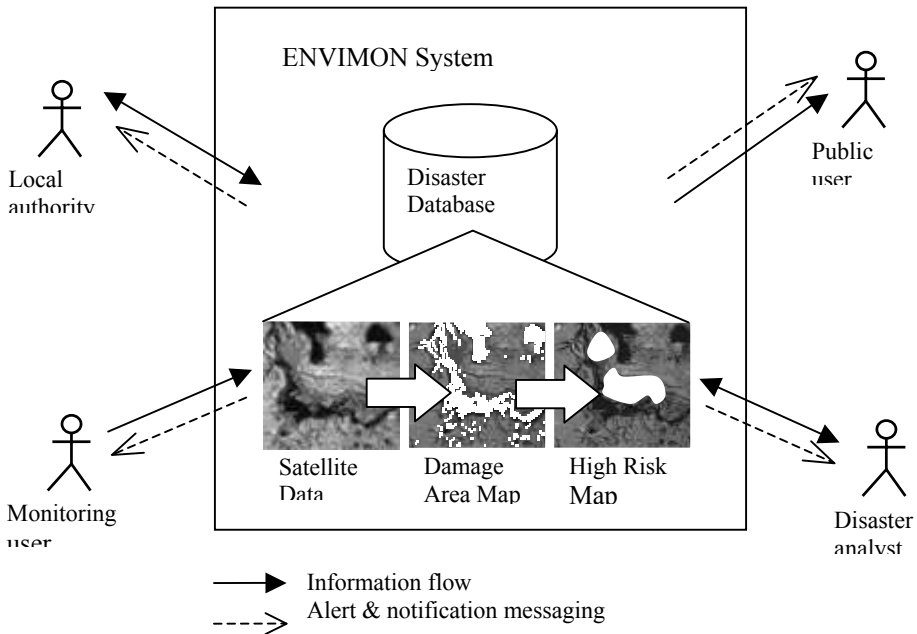


Figure 1. User roles and information flow in the disaster monitoring process

The information model and architecture of the system have been designed to support the presented disaster monitoring process. During this process the satellite based data gets refined into added value information.

The system is being implemented as a web application that provides the geographically spread clients with views to a shared disaster database. The communicational function of the Envimon system is two-fold. It serves as information channel between the involved authorities and experts in their task of producing and sharing up-to-date information and prognosis for the disaster circumstances. On the other hand the system serves as a web based information source for the general public, responding to their need for disaster information. In addition to disaster information web pages, the system can also use Google Earth viewer as an optional channel for publishing satellite based disaster maps.

The web based information is supported by mobile channels for sending alert messages. Cell-based broadcast messages can be sent to all mobile phones located on a specified area. Regular SMS messages are used for communication during the satellite data processing and map production process. Public users may also subscribe to disaster alert messages.

UTILISING SAR AND OTHER EARTH OBSERVATION DATA

Because of its observation capability regardless climate conditions and sun illumination,

Synthetic Aperture Radar (SAR) data have a great potential as a source of relevant and near real time information for the early warning, mitigation, and management of natural disasters. Using flooding and landslide disasters as pilot cases, the Envimon system provides tools for automatic SAR data pre-processing (by accessing proprietary SAR processor or SAR processing software) and analysis methods for refining the satellite data further into a damage area map. For example in case of flooding disaster the damage area map indicates the flooding water area. By analysing the histogram of a pre-processed SAR image the water analysis method extracts the presumable flooding area from the data. When combined with other map features like roads and buildings, this water area mask serves as a flooding map that can be used to support the local rescue planning.

Although the system currently supports processing and analysis of SAR data particularly, in the further development it will be extended to cover other data types, like optical satellite data and in situ measurement data. The system is also extendable to support analysis tools for a broader variety of disaster types.

CONCLUSION

Development of the Envimon system has been an effort to specify and establish an operative infrastructure for connecting satellite derived information to the end users such as rescue officers, disaster analysts and the people in the affected areas, as well as the general public. The system provides tools for SAR data processing and analysis methods, data management and distribution.

With the experiences on specifying and developing the Envimon system so far, and after deriving experiences from piloting the system, the further development would concern verifying the underlying operative disaster monitoring process and extending the system to cover more earth observation data types and providing analysis methods for supporting more disaster types.

References

- Louhisuo, M., Rauste, Y., Andersson, K., Häme, T., Ahola, J., Morohoshi, T., 2005. Use of SAR data for natural disaster mitigation in the mobile environment. Proceedings of the 2004 Envisat and ERS Symposium, Salzburg, AT, 6 - 10 Sept. 2004 European Space Agency, (Special Publication) ESA SP (2005) No: 572, 2013 - 2020