A NEW ARCHITECTURE FOR DISASTER MANAGEMENT

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1. INTRODUCTION

Radio communication and observation services are critical at all levels of disaster management. Radio communications are essential for sending and distributing alarm messages, exchanging information between different teams/groups [1], defining and coordinating relief activities, and disseminating information and instructions to public and private services as well as to the public [2]. Radio observation services (available 24h/24, whatever the weather conditions) are essential for assessing damages, detecting and tracking fast varying geophysical and hydro meteorological events (earthquakes, tsunamis, hurricanes, typhoons, etc.), and for providing information for planning and conducting relief activities.

The access to observation data is facilitated by the International Charter "Space and major Disasters" signed by major space agencies. This charter aims at providing a unified system of data acquisition and delivery to those affected by natural or man-made disasters through authorized users [3]. Several organizations of this type exist. In context GMES one can quote SAFER and ERCS. SPIDER was developed by the UNO/OSA. Sentinel Asia gathers about fifteen countries in Asia

When available, images from remote sensing satellites are the best sources of information for disaster management [4]. They can be acquired quickly and cover large geographical regions. Photo-interpreters use them to provide, as quickly as possible, maps summarizing the information which may be used by organisations in charge of disaster management (for major risks: ministries, civil defense, regional and local administrations, UNO, NGO, etc). At the time of a natural disaster in a populated zone, a fast and efficient organisation of disaster management is of primary importance for assisting the populations, reducing the number of victims and limiting economic damages [5], [6]. A lack of proper organisation induces delays in assistance operations, which may make operations more difficult, increase losses, and prevent potential return to a nominal situation. During a crisis, time is a critical factor.

New technological approaches are required to allow for a more efficient management of risk before, during and after a potential crisis. They must take into account the specificity of the actions to be taken at each phase of the crisis and thus of the specificity of the tools to be used. New methodologies are necessary to design systems combining the use of: telecommunication tools (communication, remote sensing [7], computer science, information technology, etc.), databases organised as a function of the points in space considered and of the time, and regulations relevant for each location [8].

Risk prevention and crisis management imply to transmitting the right information to the right person in the shortest possible time [9]. When risk becomes disaster, the crisis requires simultaneous access to numerous environmental and regulation databases. Structures and software used for the different databases, and for the transmission networks, may be different in terms of performance, architecture etc. A mapping of the facilities and of their operating conditions is therefore a crucial element, which has to be available to the rescue teams as soon as possible [10]. The implementation of such a system highlights two aspects of the evolution of risk. Firstly, the temporal aspect within which it is necessary to find an equilibrium between time scales to trigger alerts and other time scales to inform the population, set up assistance tools, close roads, etc. Secondly, the localisation of critical areas has to be clearly established.

In addition to the acquisition of the images, a system of this type uses four principal parts concerned with different scientific disciplines.

1. A part allowing the communication in conditions of crisis. The properties of this system are the facility of deployment, reliability, the robustness and interworking.
2. A part intended for the information management based on the databases and geographical information (SIG).
3. The extraction part of the information using mainly satellite images. It uses also other information sources: sensors, the Web, etc
4. The last part, which allows the fusion of multimode information to make of them syntheses, intended for the operating teams and help.

The objective of this article is to present a new approach based on an architecture adapted to the management of catastrophes [4], and to identify the scientific bolts. Examples in real conditions will be presented to illustrate the operation of the system..

2. REFERENCES

[1] Tanzi, T.J, Servigne S. "A Crisis Management Information System." Proceedings of the International Emergency Management and Engineering Society : TIEMEC'98, Washington D.C., May 19-22, 1998, pp 211-220.

[2] Iapichino, G., O. del Rio Herrero, C. Bonnet, C. Baudoin, I. Buret, "A Mobile Ad-hoc satellite and Wireless Mesh networking Approach for Public Safety Communications", Signal Processing for space Communications, SPC 2008. 10th International Workshop on, 1-6, 25 Nov 2008

[3] Rodriguez, J., V. Femke, R. Below, D. Gupar-Sapir, "Annual disaster statistical review 2008, the numbers and trends", Centre for Research on the Epidemiology of Disasters, 2009.

[4] F. Yamazaki. "Applications of remote sensing and GIS for damage assessment" , 2001,ICOSSAR. GSC (2000). Fast Damage Assessment after Major Disasters by Multitemporal Radar and Optical Analysis. Paris, France.

[5] R .S. Chatterjee, B.Fruneau, J.P. Rudant, P.S. Roy, Pierre Louis Frison, R.C. Lakhera, "Subsidence of Kolkata (Calcutta) City, India during the 1990s as observed from space by Differencial Synthetic Aperture Radar Interferometry (D-InSAR) technique ". Remote Sensing of Environment 102 (2006) 176-185

[6] Benedicte Fruneau,, Benoît Deffontaines , Jean-Paul Rudant ; "Monitoring vertical deformation due to water pumping in the city of Paris (France) with differential interferometry"; CRAS, Comptes Rendus Geosciences 337, 13(2005)117"-1183.

[7] Pampaloni, P. and K. Saranboni, "Microwave Remote Sensing of Land", Radio Science Bulletin, 308, 30-46, March 2004

[8] F. Barlier, "Galileo, a strategical, scientific and technical stake ", ed.Harmattan , Collection Strategical Perspectives, February 2008.

[9] T J Tanzi, P Perrot, "Télécoms pour l'ingénierie du risqué". Collection technique et scientifique des telecoms. Editions Hermes. Paris 2009.

[10] Hervé Trebossen , Benoît Deffontaines , Nicolas Classeau , Jacob Kouame, Jean-Paul Rudant "Monitoring Coastal Evolution and associated littoral hazards of french Guiana SHORELINE with RADAR images", CRAS, Comptes Rendus Geosciences 337, 13(2005)1140-1153.