

SATELLITE IMAGERY AND GIS FOR DISASTER RESPONSE & MANAGEMENT IN THE UNITED NATIONS

The UNOSAT approach

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Abstract: Remote sensing and Geographic Information Systems (GIS) have the potential to provide United Nations (UN) humanitarian agencies and their partners with much needed disaster related information and improved management of resources. However, the technical nature of these tools requires considerable expertise to fully benefit from satellite images and related geographic information. The UN Office for Project Services (UNOPS) is implementing the UNOSAT service on behalf of the UN Institute on Training and Research (UNITAR) together with several private actors. UNOSAT provides the UN and its partners with the expertise in Earth Observation (EO) and GIS applications.

As a crisis is part of a spectrum of disaster related events, UNOSAT provides services in all phases of humanitarian assistance, including planning, crisis response, relief and development. UNOSAT's objectives are to facilitate the territory planning and monitoring processes of local authorities, local technicians, development project managers and humanitarian field operators working in coordination with or within the framework of UN activities, on issues such as disaster management, risk prevention, peace keeping operations, post conflict reconstruction, environmental rehabilitation and social and economic development. A key part of this work is to accelerate and expand the use of accurate geographic information derived from EO-satellite imagery.

UNOSAT is also involved in several international initiatives aimed at improved crisis response and management, such as the International Charter "Space and Major Disasters", an important asset in providing timely information to relief personnel on the ground. By working closely with its UN sister agencies, UNOPS/UNOSAT offers a one-stop-shop for satellite imagery and GIS services related to disaster response & management within the United Nations..

1 INTRODUCTION

During a thorough review of United Nations (UN) peacekeeping missions (United Nations, 2000), the so-called Brahimi-report, the need to reinforce the use of Geographic Information Systems (GIS) and Earth Observation (EO) data for improved decision-making and cost-effective implementation of peacekeeping missions was clearly identified. This need was also recognized by other UN bodies and indeed, with the technology becoming more and more accessible through lower prices and improved software, desktop mapping and GIS databases have now become an integral part of

most UN organizations – at least in headquarters. Centrally located GIS and Mapping Units serve basic functions, such as producing mapping documents and maintaining statistical databases (Bjorgo, 2002). These headquarter based cells are very important when ensuring GIS is considered for decision making processes and effective management of disaster response within each institution. However, many central units are not equipped, nor do they have the manpower to take on extensive field support.

With the wide range of mandates dedicated to the various UN bodies, ranging from development, food access, agriculture monitoring, children rights, education, culture and health issues to refugee protection and co-ordination of humanitarian assistance, there is a clear need for systems that

allow for a common horizontal communications infrastructure to share information between the individual UN entities. Such interoperable conditions are indeed the key to improved humanitarian disaster response and management.

One of the best tools to ensure such a common language is GIS, as data are objectively recorded (ideally) and stored as separate geographically referenced layers, thus permitting analyses of a wide range of parameters to better take informed decisions and manage the range of activities being carried out during humanitarian disasters. Final map documents are also easy to understand and thus serves as a common language for the involved actors.

2 INTEROPERABILITY AND INFORMATION SHARING

Traditionally, interoperability has been used as a technical term to verify that two systems “speak” the same language, enabling the user to benefit from a range of software and hardware as long as these are interoperable with for example the operating system on a personal computer. Interoperability is then seen as an electronic “handshake”. Such technical interoperability has been, and is being addressed by the private sector with reasonable success, as for example seen with the popularity of the compact flash storage keys interoperable with USB ports, thanks to industry standards. In principle, problems related to technical interoperability can be solved through technical means. In humanitarian disaster and response, however, an even more important aspect of interoperability is the various institutional conditions that allow for, or obstruct, information sharing within the whole environment that constitutes the disaster relief community.

As recently reported by the US Institute of Peace (USIP) and its Virtual Diplomacy Initiative (Solomon and Brown, 2004), interoperability is about sharing a “common culture of communication”. Several key issues should be recognized by the United Nations and its implementing partners during disaster response and management:

- Communication must be continuous and flow in all directions. Lessons learned point out the need for communication within organizations, between organizations (bilaterally), among organizations (multilaterally), with local leaders, with and between

decision makers, with the media and among the parties in the conflict.

- Information structures need to be flexible and mainstreamed in the co-ordination of the humanitarian assistance. Mechanisms for sharing information, including collected field data, must be in place prior to the actual intervention, and funding for such activities need to be part of the regular appeals. The various Humanitarian Information Centres (HICs) have contributed to improved sharing of information between the actors in complex emergencies. Technical backstopping and facilitation of more advanced services than can be expected from the HICs should also be available to the humanitarian disaster relief community, for example the establishment of telecommunication systems, rapid mapping using satellite imagery and geographic data procurement services.
- Finally, the international community, both donors, co-ordinators and implementing agencies, need to actually learn from the lessons learned. In too many cases, the international community does not draw sufficiently on past experiences and experiments with which model should be applied. There are now numerous lessons learned and reviews published for a wide range of different disaster situations. The UN and its partners should be well educated to take on at least the basis of a common communication culture even in complex emergencies.

GIS and satellite imagery are practical tools that have the potential to considerably contribute to improved interoperability (Bjorgo, 2001). Final map products provide a common view of the disaster and can explain complex emergencies in a relatively straightforward manner, without having to read through thick reports, thus improving information flow in all directions. These tools are flexible and have been, and are, used with success in the above-mentioned humanitarian information centres. GIS databases and maps can be saved to constitute the organizational or disaster specific memory for lessons learned and facilitate important background information when new disasters strike. Sadly, many regions experience re-occurring disasters and properly stored historical data in a GIS, locally managed and updated with recent information, will

significantly improve disaster response and management if the actors choose to learn from previous events using the available GIS information.

3 THE UNOSAT APPROACH

Based on the need within the UN to have access to a service that can facilitate satellite imagery and GIS applications across the specific mandates dedicated to individual organizations, the UN Institute for Training and Research (UNITAR) initiated UNOSAT. The UNOSAT service is implemented by the UN Office for Project Services (UNOPS), who's mandate is to implement for an assist its UN sister organizations. Being part of the UN family, UNOPS knows where to focus the UNOSAT service in order to improve interoperability during disasters. UNOSAT is currently funded by the European Space Agency (ESA), the French Space Agency (CNES), as well as the French and Norwegian ministries of foreign affairs. In addition, a close partnership with the European Nuclear Research Organization (CERN) provides an unparalleled infrastructure for data transfer and technical backstopping. CERN also hosts the offices of the core UNOSAT team, located in Geneva, Switzerland, with close proximity to the other UN agencies and other international organization, such as the International Federation of Red Cross and Red Crescent Societies.

It should be noted, however, that UNOSAT was not created to replace existing GIS and mapping units within the UN system. Certain organizations, such as the Food and Agriculture Organization (FAO) has considerable experience in GIS and satellite imagery applications. What UNOSAT offers is the facilitation of satellite imagery and GIS applications to those organizations and field offices who do not have access to EO or GIS expertise or who do not have the man power or technical infrastructure to take on certain analyses. UNOSAT also assist organizations with considerable GIS expertise when these do not have the capacity to undertake all analyses in-house.

Before, such assessments were outsourced to the private industry, sometimes at a high cost and to companies with limited understanding of the specific requirements and infrastructure the UN operates under. As has been recommended by the Secretary-General of the United Nations, UNOSAT works in direct partnership with the private industry, and also closely with the donor community. This set-up allows for a scalable infrastructure for maximum cost-effectiveness. Should a certain organization be in need of a comprehensive study, the core

UNOSAT team draws on a circle of pre-qualified value adding companies for timely delivery and low-cost services. For smaller projects, the tasks can be handled within the core team. Hence, UNOSAT offers the UN to move from outsourcing to UN in-sourcing of GIS and EO value adding services, ensuring specific UN requirements are met through a not for profit service. Using UNOSAT is of course fully voluntarily within the UN.

A disaster event can be seen as a temporal part of a cycle of involvement at a given location by the international community. What is important to realize is that after the immediate emergency disaster assistance follows a phase of relief, which again in general is followed by longer term development, planning and risk prevention. UNOSAT's approach is to propose its services within all phases of this "disaster cycle", as imagery and data collected and analysed during the emergency disaster event can be used during the following phases. New imagery and more complex data, for example post-emergency environmental assessments, can later complement the initial acquisitions to constitute a broad base for informed risk prevention. UNOSAT assists with the in-field hand over of databases and trains local staff to maintain and further develop the GIS. This is crucial for a sustainable GIS in local communities and a proven methodology for local risk prevention decision-making. UNOSAT also hosts an advanced Internet portal where users can survey existing data and products and request technical assistance for planning projects as well as data purchase. UNOSAT has negotiated favourable discounts with main data providers, which all UN agencies can benefit from.

UNOSAT has been operational since 2002 and currently implements and assist with GIS projects and EO data purchase to several UN agencies, for example the UN Office for the Coordination of Humanitarian Affairs (UN OCHA), UN High Commissioner for Refugees (UNHCR), UN Environment Programme (UNEP), UN Office on Drugs and Crime (UNODC), UN Development Program (UNDP) and UN Institute for Training and Research (UNITAR). Figure 1 is an example of a humanitarian planning map for Sudan made by UNOSAT in close co-operation with UNHCR and the Norwegian Refugee Council NGO. Such products typically include a detailed map of the country in focus, as well as climatic data, population distribution, socio-economic indicators (when available) and administrative information, thus providing the humanitarian community with an easy to understand overview of the conditions in the

country they are preparing operations for. These maps are freely distributed over UNOSAT's website and also hosted at other humanitarian information platforms, such as UN OCHA's ReliefWeb and Reuter Foundation's AlertNet.

3.1 International Charter "Space and Major Disasters"

Since July 2003, the UN has had access to satellite imagery of major natural and technological disasters through the International Charter "Space and Major Disasters" (the Charter). This is an initiative by the world's main space agencies to work together in support to relief personnel on the ground whenever and wherever a major disaster strikes. The Charter members currently include ESA, CNES, the Canadian Space Agency (CSA), the National Oceanic and Atmospheric Administration (NOAA), the Indian Space Research Organization (ISRO) and the Argentine Space Agency (CONAE). The Charter works on a 24/7 basis and when triggered provides the most applicable raw satellite imagery accessible through the Charter members in the shortest timeframe possible. After reception of the raw data, these must be turned into value added products, such as damage assessment space maps, see figure 2, prior to distribution to disaster relief personnel on the ground. Currently the Charter does not cover man-made disasters such as refugee emergency operations. However, the UN is working towards trying to expand the Charter to also include such applications.

3.2 UN OCHA Virtual Operations On-Site Coordination Center (OSOCC)

UNOSAT has recently entered into close co-operation with the organization co-ordinating disaster relief personnel sent to the field during major natural disasters. UN OCHA's Virtual OSOCC provides the communication tool for disaster coordination as a dedicated web-forum where the various operational NGO's can receive quick notification on new disasters and a detailed overview on who is doing what throughout the process, greatly improving interoperability in such situations. The Disaster Assessment and

Coordination (DAC) Teams that are quickly disposed to the field also provide input to the Virtual OSOCC. Recently, UNOSAT was included in this forum and has already provided the latest maps available on the February 2004 Moroccan earthquake through live input from the DAC Teams in the field and a production turnaround time of hours to distribute maps of the specific areas of interest. Discussions are now ongoing on how UNOSAT can further strengthen the Virtual OSOCC, thus assisting the humanitarian community with an unprecedented Rapid Mapping capacity based on GIS and EO data from the Charter and other sources.

3.3 UN Geographic Information Working Group (UNGIWG)

The UNGIWG is a forum for the various UN organizations involved in GIS to inform about the activities going on in the respective agencies. This working group is among other things addressing issues such as data standards, a key issue for interoperability (King and Dille, 2001), common reference datasets, data sharing and promotion of common UN policies vis-à-vis other initiatives, such as the Charter. UNOPS is an active player in the UNGIWG, and is co-chairing the task force on remote sensing, which includes how the UN can make the best use of EO data for disaster management. Being part of the UNGIWG is another way UNOPS UNOSAT assists in the work towards ensuring interoperability through information flow in all directions, as previously discussed.

3.4 New Initiatives

In addition to the above operational services for the UN, UNOSAT is also involved in several UN-external initiatives that still fall within the framework of current and future UNOSAT services. The involvement in these activities will be of direct benefit to the UN once the proposed tools and methods have been developed into off-the-shelf applications. Two major new initiatives are mentioned here:

- Respond, and
- GMOSS Network of Excellence

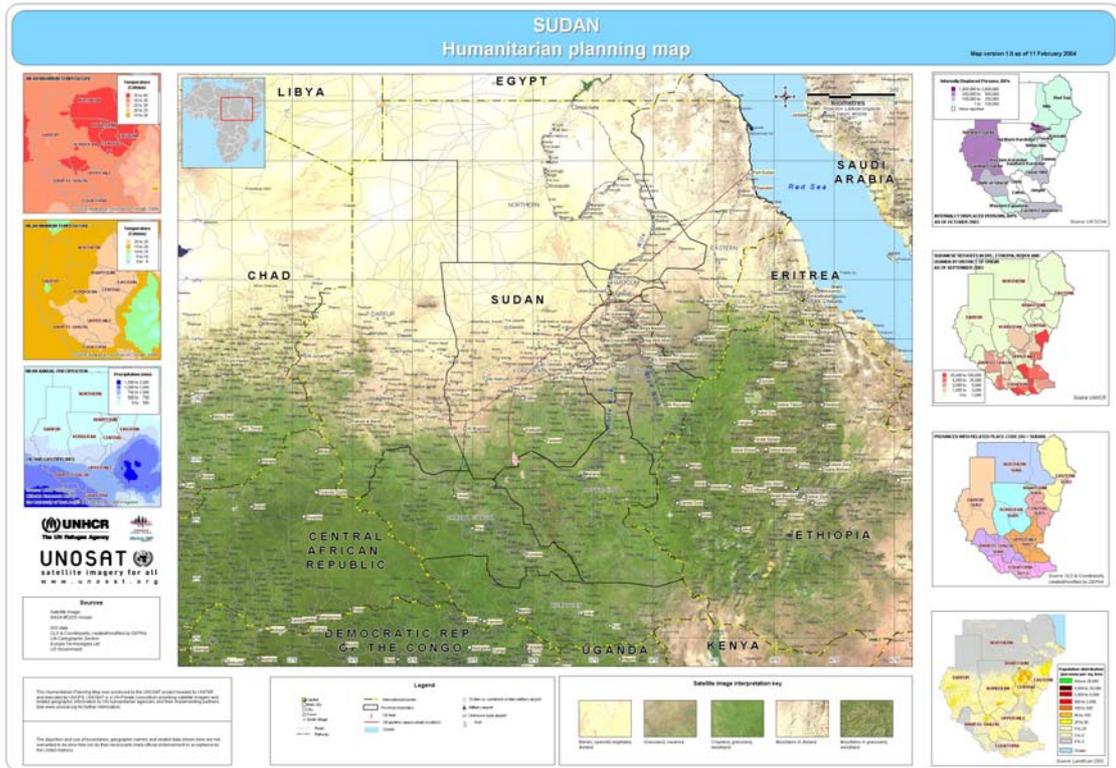


Figure 1: Example of humanitarian planning map - here Sudan.

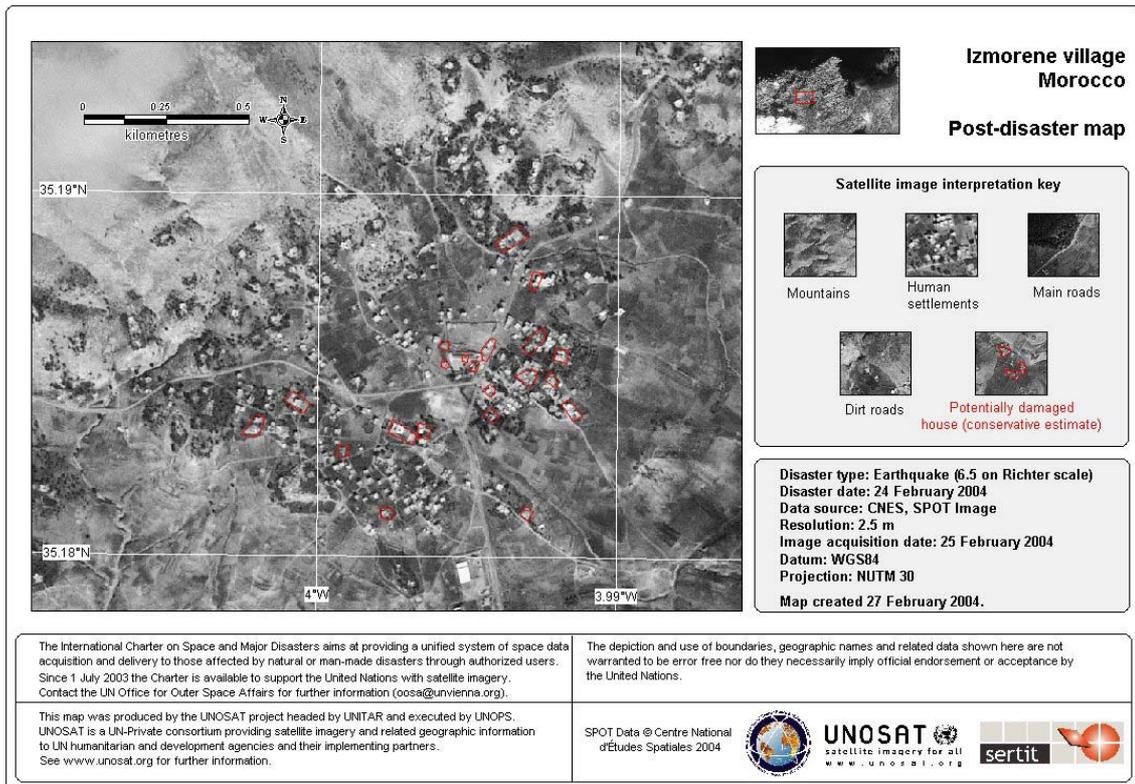


Figure 2: Example of Charter value added product - here earthquake damage assessment.

Respond is an ESA funded project kicked off in January 2004, with the aim to develop operational services to assist the whole humanitarian relief community with their requirements for geographic information. The foreseen services will be tailored to specific needs and targeted to the full range of humanitarian organizations, from the smallest NGO, to the donor community and international organizations, such as the UN and the IFRC. UNOSAT acts as the focal point towards the UN in Respond and brings to the table its experience in this type of services for the UN family.

The Global Monitoring for Stability and Security (GMOSS) Network of Excellence is funded by the European Commission and includes close to 30 top European-based public and private institutes and organizations with state of the art knowledge in specific civil security, EO and GIS applications. By facilitating close co-operation and methodological development between these organizations, it is expected that new and improved techniques will migrate quicker to implementation by the end-user community than what has been the case so far. The various GMOSS partners started their work in February 2004.

Both Respond and GMOSS support the Global Monitoring for Environment and Security (GMES) initiative. It should be noted that in this context "security" refers to humanitarian/civil security.

5 CONCLUSIONS

By working closely with its sister UN organizations, and at the same time incorporating the latest technological and methodological developments, UNOSAT aims to significantly improve the way disaster response and management is being carried out. An up to date map, often only available from satellite imagery, is the first step towards improved interoperability through informed decision making and a common view of the disaster situations by all humanitarian actors.

By offering discounted satellite imagery, pre-qualified value adding companies and technical support using state of the art Internet technologies to all UN organizations and their implementing partners, UNOSAT is filling a gap for such services previously not available to the international community on a not for profit basis. Being part of the UN, UNOSAT has the benefit of knowing in details how the services should be structured for cost-effective use of EO data and GIS for United Nations disaster response and management.

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