DAMAGE ASSESSMENT FOR POST CONFLICT SITUATIONS
SERVICE CHAIN

SERVICES FOR SECURITY APPLICATIONS GMES

AREAS OF INTEREST (AOI)

World map representing the areas of interest (AOI) analysed up to now by the service. The work will be extended to new AOI if a crisis occurs and a user requests information.

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MORE INFORMATION AT
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*The service "Damage assessment for post conflict situations" is coordinated by the German Aerospace Center (DLR) with the efforts of other partners inside the G-MOSAIC project: JRC, TNO, PLUS-Z_GIS. As a coordinator of the service, DLR organises the production, ensures the quality of the product and the suitability to user needs. The crisis room at **DG RELEX** monitors conflicts all over the world. In the case of major conflicts that may have an impact on EU policies, they are interested in a detailed damage assessment. Up to now the damage information is derived after visual interpretation of pre- and post-conflict satellite data. The United Nations Environment Programme (**UNEP**) seeks to minimise environmental threats to human well being from environmental causes and consequences of conflicts and disasters. In response to increased global awareness of the environmental dimensions of crises, and to growing demand for services that address them, UNEP has identified "disasters and conflicts" as one of six priority areas of work.*

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INTRODUCTION

Directly after a crisis or catastrophe fast information about damages to infrastructure and affected areas is required for immediate relief and general situation assessment. This analysis is expected rapidly, tolerating a higher error margin. A more detailed analysis with much higher accuracy is required for needs assessment and recovery planning.
The damage to buildings and infrastructure is only one example; the categories to be monitored need to be reviewed on a case-by-case basis.
Damaged infrastructure (e.g. houses, bridges) hinders the normal life of the population for a long period, even after the crisis. A qualified damage assessment, which can be achieved with remote sensing technologies, also using information from local authorities, will lead to better knowledge about the actual state within the affected region.

Pre-conflict panchromatic QuickBird image from 26th July 2007 showing parts of Tskhinvali, Georgia

Post-event panchromatic WorldView image from 19th August 2008 showing the same subset

CORE PRODUCTS: DAMAGE ASSESSMENT MAPS & REPORTS

The damage assessment map should allow the user to assess the damage caused by a conflict, both in terms of the location of damages and the total number of damaged features.
Damage assessment maps are core information for the overall assessment of the severity of a conflict and its consequences.

The product consists of two components:

> A map indicating the location and the total amount of damages

> A report describing briefly how to interpret the map and summarising the major results

The map also includes additional features that are important within the overall context such as topographic and administrative information. Together with the background information provided with the enclosed report, the maps provide a comprehensive overview about the situation in a crisis area. The categories to be presented in the map need to be reviewed on a case-by-case basis.

STRUCTURE OF PRODUCT

DAMAGE ASSESSMENT MAPS
RASTER LAYERS: SATELLITE IMAGERY (BACKGROUND)
VECTOR LAYERS: LOCATION OF DAMAGES, ADDITIONAL TOPOGRAPHIC AND ADMINISTRATIVE INFORMATION
REPORTS

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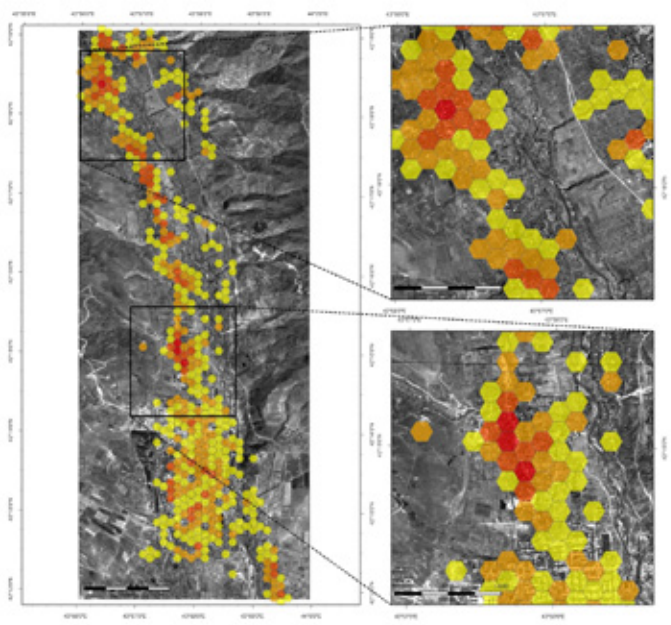
BENCHMARKING IN TSKHINVALI, GEORGIA

This product is the damage assessment for the area of Tskhinvali, Georgia using pre-conflict and post-conflict satellite imagery. The map shows the density of the damaged buildings based on automated feature extraction of single buildings and automated change detection methods. The detected buildings are aggregated into hexagonal units. The approach was initially developed during a rapid mapping exercise, and has since been re-used and developed further to cope with co-registration problems, implementing an object-linking approach.



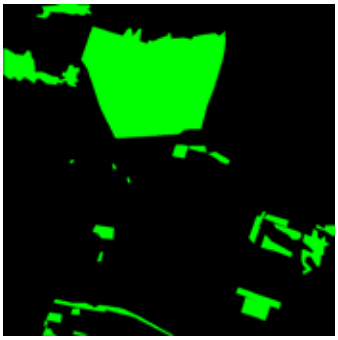
EARTHQUAKE IN PORT-AU-PRINCE, HAITI
2D CHANGE DETECTION IN OPTICAL DATA

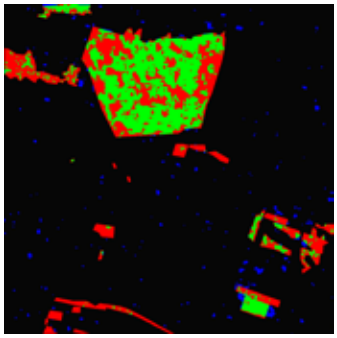
With the availability of the benchmarking data, service development could start before the emergence of a real crisis

Another automatic change detection method uses a combination of texture information and Iteratively Reweighted Multivariate Alteration Detection (IR-MAD). The method produces good results when applied to small areas (see right image), but is currently not applicable onto the whole scene.

GeoEye-1 imagery, 50 cm ground sampling distance of Port-au-Prince, Haiti, after the severe earthquake on 10 January 2010

Reference Data / Automatic Method	Change	No change
Change	True Positive (TP)	False Positive (FP)
No change	False Negative (FN)	True Negative (TN)





January 2010 (4 days after earthquake) *August 2010 (7 months after crisis)* *Manual measurement of changes (green)* *Comparison*

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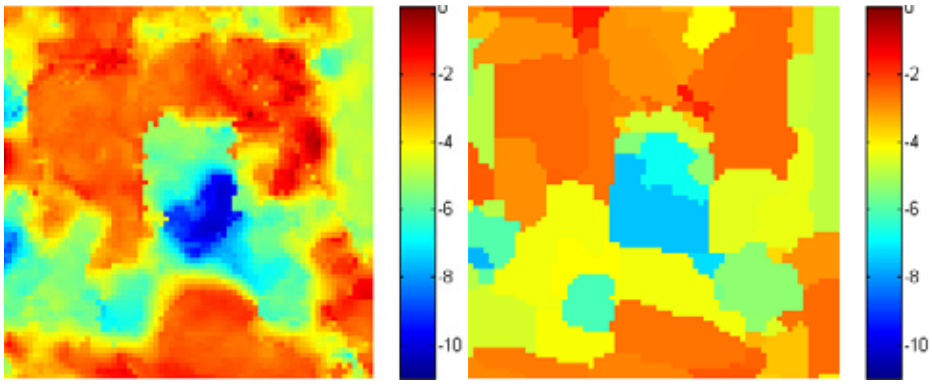
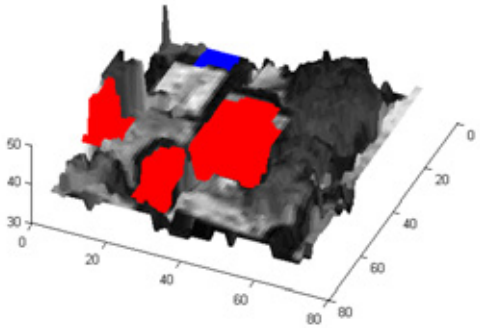
EARTHQUAKE IN PORT-AU-PRINCE, HAITI
3D CHANGE DETECTION IN OPTICAL DATA

A 3D change detection algorithm is developed in this project. Two DSM are generated from stereo imagery based on semi-global matching. The original height differences by using our DSM are shown in the upper diagram, a segmentation-based height difference map is generated to display building changes more clearly (lower diagram). Local land cover information is also adopted to enhance the changed building shapes and location.



Using this service reduces the amount of manual work since it provides automatic change detection results

Right Detail in Port-au-Prince, Haiti GeoEye-1 stereo imagery Top: January 2010 Bottom: August 2010
Far right: © UN Photo/Logan Abassi 2010



Result of the automatic 3D change detection algorithm. BLUE: Positive height changes (new building) RED: Negative height changes (buildings removed)

2D CHANGE DETECTION IN SAR DATA

Damage assessment was also performed by applying change detection algorithms to Cosmo-SkyMed and TerraSAR-X data. The change map of Port-au-Prince shows damages sustained during the 2010 earthquake. Changes in red represent increased radar backscatter caused by debris and improvised IDP camps in parks and squares. Changes in cyan represent decreased radar backscatter caused by demolished wall-ground structures.

Change detection map showing a change overlay over a single Cosmo SkyMed Stripmap image (15/01/2010)

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