World Bank / GFDRR / ImageCat / RIT
Remote Sensing and Damage Assessment Mission
Haiti, January 2010

Summary

World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) are working with ImageCat and the Rochester Institute of Technology (RIT) to produce high precision aerial imagery of Port-au-Prince, Haiti, and the surrounding areas following the 12 January 2010 M7.0 earthquake. This data was initially used to support relief efforts and is now being used to support damage analysis. The imagery produced will support the data gathering exercise required before official Post Disaster Needs Assessment (PDNA) is undertaken by the United Nations (UN), European Commission (EC) and World Bank. A global damage analysis network - the Global Earth Observation Catastrophe Assessment Network (GEO-CAN) - was coordinated by ImageCat, to generate damage maps for collapsed and heavily damaged buildings, using pre- and post-event satellite and aerial optical imagery. An aerial remote sensing mission was completed by RIT covering 620 km^2, capturing 15 cm color and thermal infrared imagery and LIDAR. LIDAR coverage was also collected along the fault line, in collaboration with USGS.

THE GEO-CAN COMMUNITY

The Global Earth Observation Catastrophe Assessment Network (GEO-CAN) was created in response to the Haiti Earthquake and the subsequent WB-GFDRR Damage Analysis Project. This global community was brought together and coordinated by ImageCat to speed up damage assessment using pre- and post-event aerial imagery: An area of some 300 square kilometers was divided up into squares, and numbers of squares allocated for damage assessment to each GEO-CAN expert. This phase of the WB-GFDRR project was completed within 96 hours of the launch of GEO-CAN.

Participants represent 131 organizations (60 universities; 18 government and non-profit organizations; 53 private companies), from 23 countries around the world. It currently has over 600 individuals and is still growing. Key partners in this initiative include the earthquake engineering research institute (EERI) and the earthquake engineering field investigation team (EEFIT), and additional global partners are being sought (e.g. JRC, ITHACA, DLR).

The damage assessment utilized experts' experience in image analysis, earthquake engineering and other disciplines using the method described in figure 1. The study area was split into a grid of squares, with volunteers using the online virtual disaster viewer to *check-out* a square for analysis, and *check-in* the completed square, along with damage information for the building stock within the square

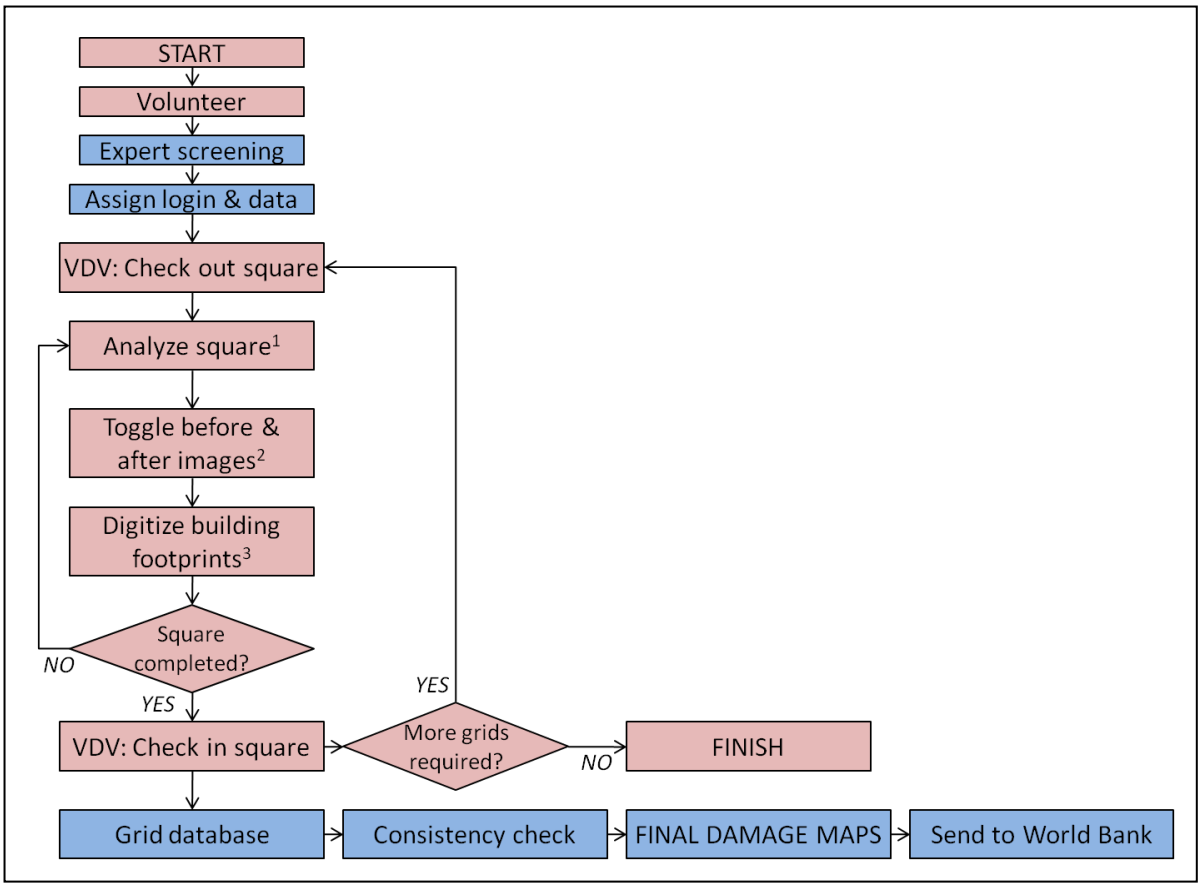

Figure 1. Workflow for each GEO-CAN volunteer (in pink)

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DAMAGE ASSESSMENT

Table 1: Phased damage assessment

	Data Used	Duration	Product
Phase 1	• 50 cm satellite imagery (GeoEye-1) • Before imagery • Gridded area: 133.75 km^2	48 hours	Damage map – point location of every collapsed building (>5000)
Phase 2a	• 15 cm aerial imagery (Google & WB-IC-RIT) • Before imagery • Gridded area: 346 km^2	96 hours	Damage map – polygon footprint of collapsed or heavily damaged buildings Estimate of square footage requiring reconstruction
Phase 2b	• 15 cm aerial imagery (Google & WB-IC-RIT) • Before imagery • Gridded area: 1024.75 km^2	ongoing	
Phase 3	• Thermal IR & LIDAR	ongoing	Presence of debris, geological investigation, thermal anomalies. For use by wider scientific community

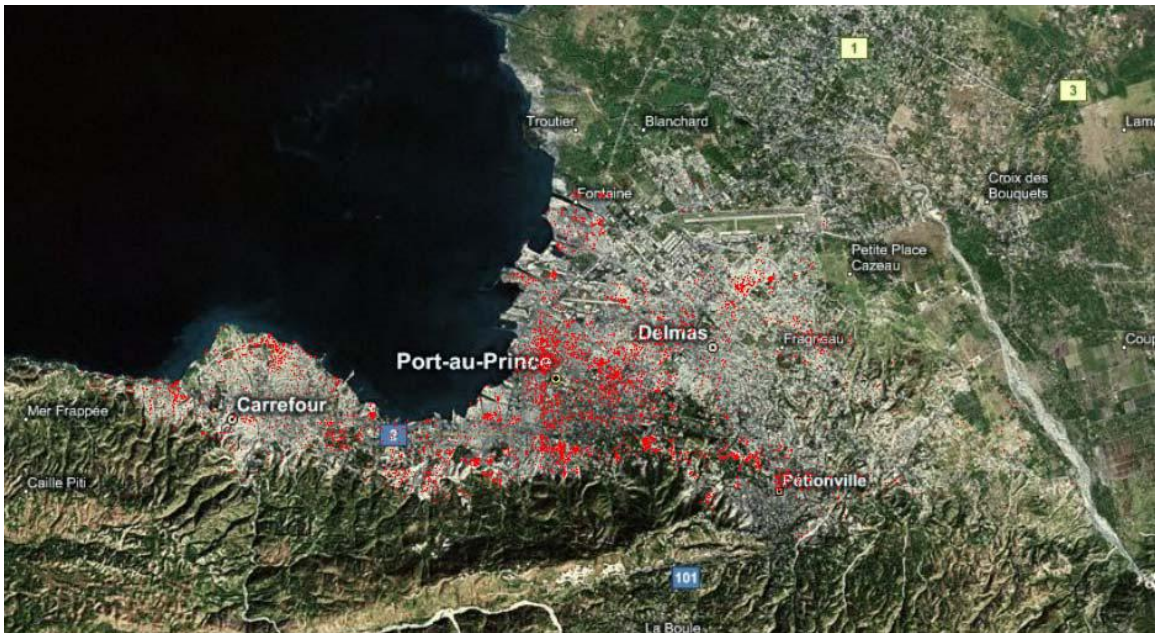


Figure 2: Point locations of collapsed structures (Phase 1)

Phase 1

The first set of damage maps for the city of Port-au-Prince was produced in 48 hours of the project commencing. The online Virtual Disaster Viewer system (VDV: www.virtualdisasterviewer.com) was customized by ImageCat to manage over 500 squares for distributed analysis by remote sensing professionals. A check-out/check-in system assigned each volunteer with squares to analyze and identify the collapsed buildings, using imagery captured by the GeoEye-1 satellite sensor on 13 January. All squares were rigorously validated by ImageCat scientists and the final maps sent to World Bank/GFDRR, and displayed in VDV.

Phase 2a

Phase 2 saw the study area extended to encompass areas to the north, east and southwest of Port-au-Prince. A total of 1384 500m squares were distributed to the newly-formed GEO-CAN community which grew throughout the phase to incorporate over 500 individuals. Volunteers gave their weekend for the analysis, and results were provided to WB-GFDRR within 96 hours of commencement, showing the building footprints of all collapsed or heavily damaged buildings (Figure 3). Newly acquired aerial imagery supplied by Google and the World Bank-ImageCat-RIT (WB-IC-RIT) remote sensing mission were used for this analysis, providing increased detail form phase 1 for the analysts. A total area of 346 km^2 was assessed for building damage.

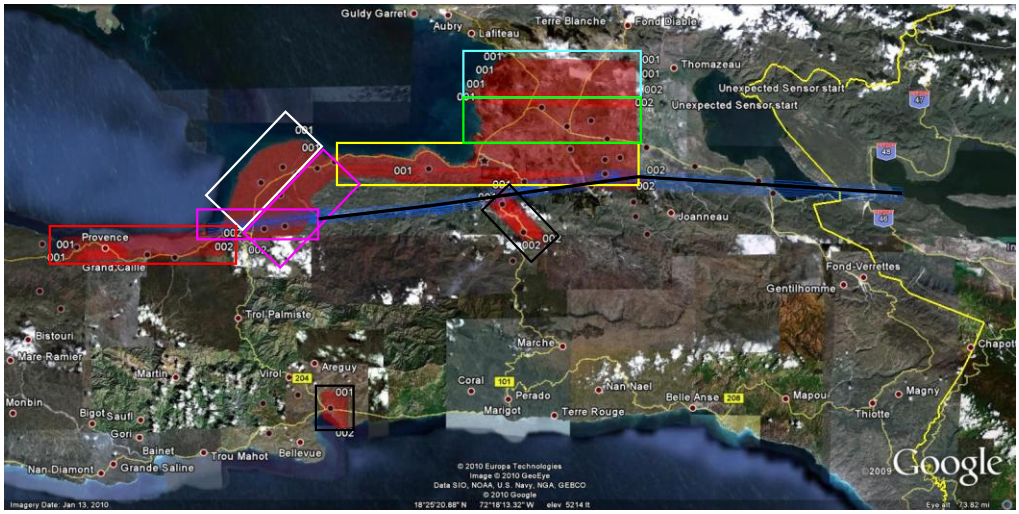
Figure 2: Building footprints for heavily damaged and collapsed structures

Phase 2b

An extension of 2a, this phase saw delivery of the remainder of the World Bank-ImageCat-RIT (WB-IC-RIT) 15cm aerial imagery, used to map damage to areas to the southwest of Port-au-Prince (including Carrefour, Leogane, Jacmel and Petite Goave; figure 4). This current phase is ongoing (as of 29 January), and VDV is being used for check-in/check-out of grids, with the total area coverage rising to over 1000 km^2.

Phase 3

Non-optical data captured by WB-IC-RIT will be made available for the wider scientific community to study surface information using LIDAR data of both urban areas and the fault line where the rupture occurred. Thermal infrared imagery will also be available for improved classifications, fire and thermal anomaly mapping.



Day 1 – 1/21/2010: Southern Port-au-Prince and coast
Day 2 – 1/22/2010: Central Port-au-Prince
Day 3 – 1/23/2010: Northern Port-au-Prince
Day 4 – 1/24/2010: Western Leogane
Day 5 – 1/25/2010: Eastern Leogane & western fault line section
Day 6 – 1/26/2010: Petite Guave & Grand Guave
Day 7 – 1/27/2010: Fermate & Jacmel & Central fault line (east of Leogane)

Figure 3: Data collected by the World Bank-ImageCat-RIT remote sensing mission

PROJECT PARTNERS

- ImageCat – US and UK
- Rochester Institute of Technology (RIT)
- Earthquake Engineering Research Institute (EERI)
- Earthquake Engineering Field Investigation Team (EEFIT)
- State University of New York at Buffalo
- Georgia Tech University
- University of North Carolina, Charlotte
- BQE Engineering
- GEO-CAN partners

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