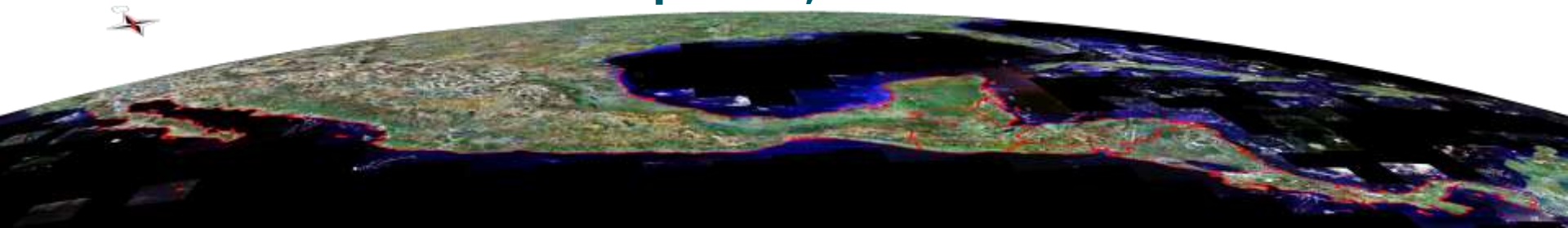
Community Remote Sensing and The URISA GISCorps

short term, volunteer remote sensing and GIS services for quick response disaster analysis

Scott Madry, Ph.D.
International Space University
Chapel Hill, NC USA



Community Remote Sensing

- **Community remote sensing** is a new field that combines remote sensing and GIS with citizen science, social networks, and crowd-sourcing to enhance the data obtained from traditional sources.
- It includes the collection, calibration, analysis, communication, or application of remotely sensed information by these community means.

Related Areas

- **Community remote sensing** is closely related to several other fields receiving considerable attention today, including citizen science, citizens as sensors, volunteered geographic information, community mapping, and more.
- In some cases these fields are distinct but related; in others there is clear overlap.

Community Remote Sensing

- The information needs of our society are great and growing
- We have relied on a few government-sponsored systems and organizations as the foundation for this information
- The rapid emergence of social networks and new tools introduces an exciting new means for augmenting this knowledge
- Similar in some ways to cloud computing
- Good and bad aspects of this

Dedicated Sessions

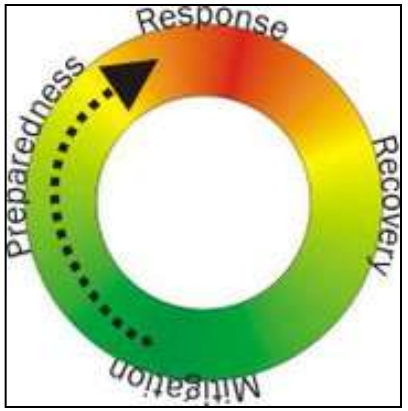
- **2010 IEEE International Geoscience and Remote Sensing Symposium (IGARSS) Honolulu July 25-30, 2010**
  - **Identified 19 programs/activities**
  - **http://www.igarss2010.org/CommunityRemoteSensing.asp**

- **Geological Society of America, Denver Nov. 2010**
  - **Dedicated paper session, 13 papers**
  - **Community Remote Sensing: A New Approach for Geoscience Applications**

THE GEOLOGICAL SOCIETY OF AMERICA®

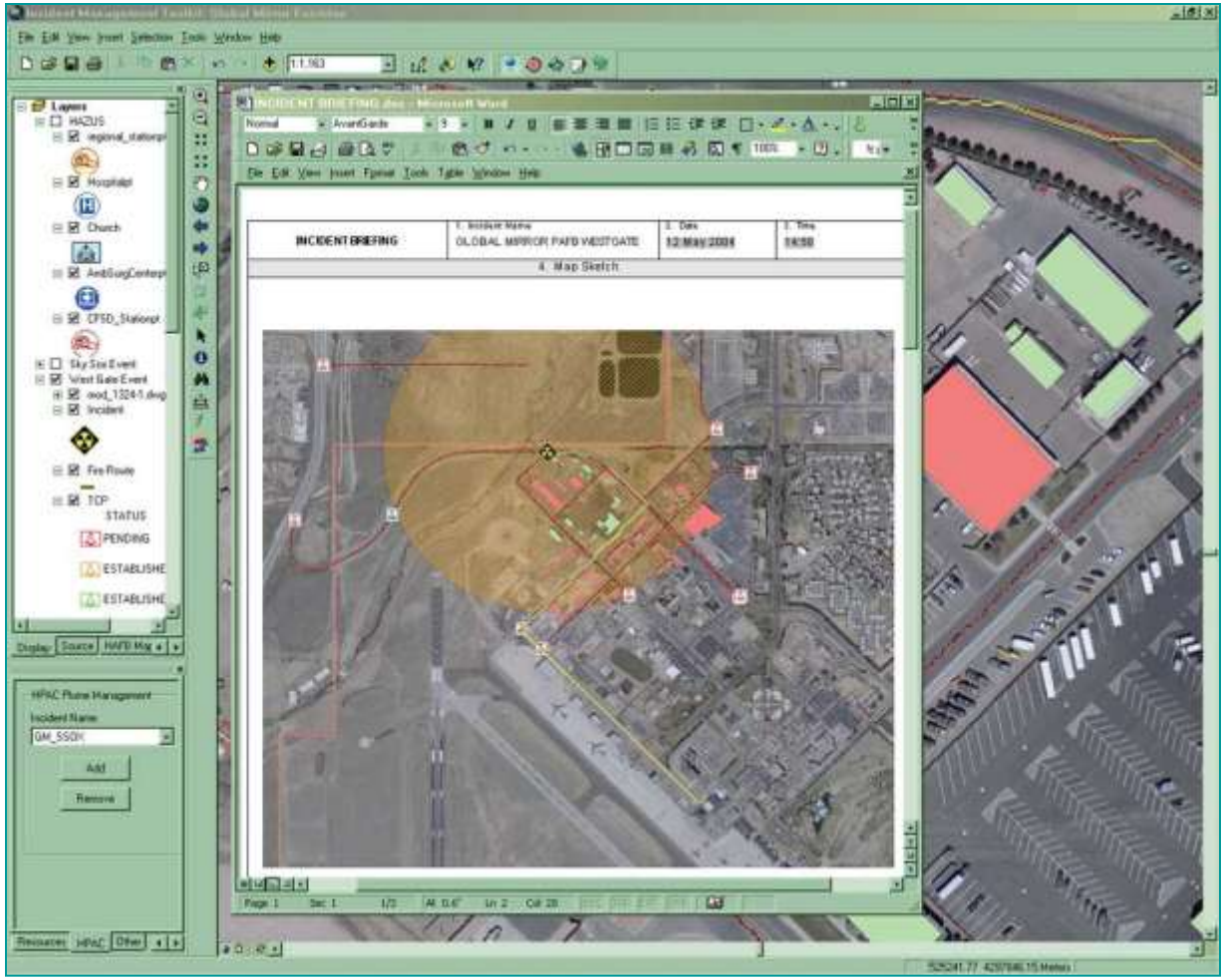
Role of Space Technologies

- **Preparedness and Mitigation**
  - **Telecom, Weather sats, GIS modeling, In situ GPS**
- **Response and Recovery**
  - **Telecom, Moderate and Hi res imagery, GIS, mobile telecom, GPS, mapping**

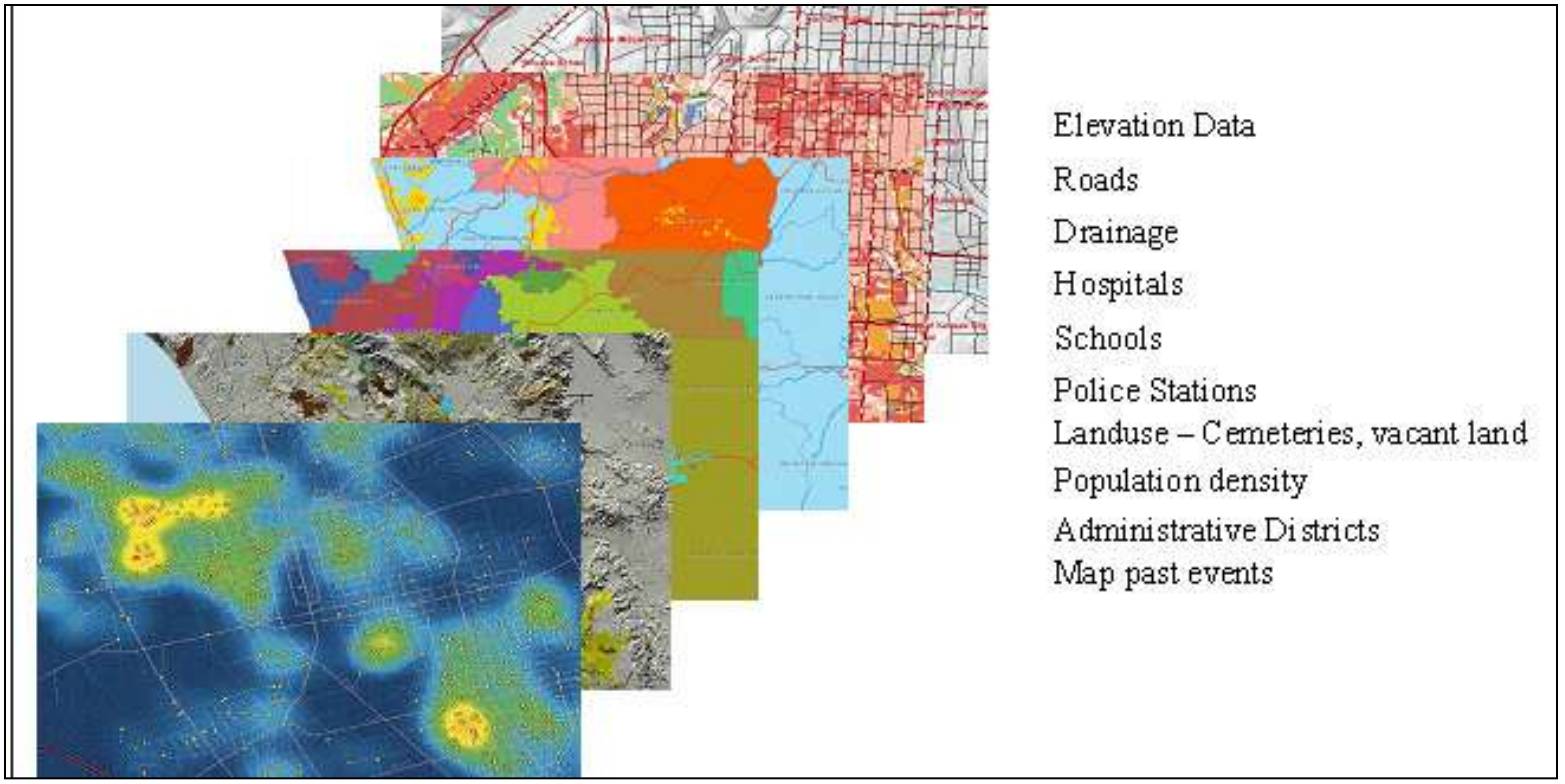


Spatial Awareness Command and Control

- Who
- What
- When
- Where
- Why
- How



Appropriate data at appropriate scales and dates delivered in a timely fashion to who needs it



Technologies

- **Satellite Imagery and weather data**
- **Oblique Photography**
- **Daily Web Updates**
- **Infrastructure Integration**
- **Data Integration**
- **GIS maps produced daily and special needs maps on demand**
- **Telecom**
- **Portable GPS**
- **Robotic GPS**
- **Wireless Handheld**
- **Thermal Sensing**
- **LIDAR**
- **Ground Penetrating Radar**
- **3D Modeling**

International Charter on Space and Disasters 1999

- To coordinate satellite data providers response to major disasters
- ESA, Argentina, Britain, Canada, China, Frnace, India, Japan and the United States
- Has been activated 175 times
- Timely delivery is still a problem, as is smaller disasters and limited budget
- http://www.disasterscharter.org/

Introduction

• GISCorps Mission: Operating under the auspices of Urban and Regional Information System Association (URISA), GISCorps coordinates short-term volunteer GIS services to under-served communities worldwide

• GISCorps was endorsed by URISA Board of Directors in October 2003

• Currently has over 1,300 volunteers from all sectors and in 63 countries worldwide

• Has completed +37 missions and deployed 121 volunteers to 22 countries

•There are two kinds of missions; Remote (from home or office) and On-site

www.giscorps.org

Email: info@giscorps.org

Vision and Goals

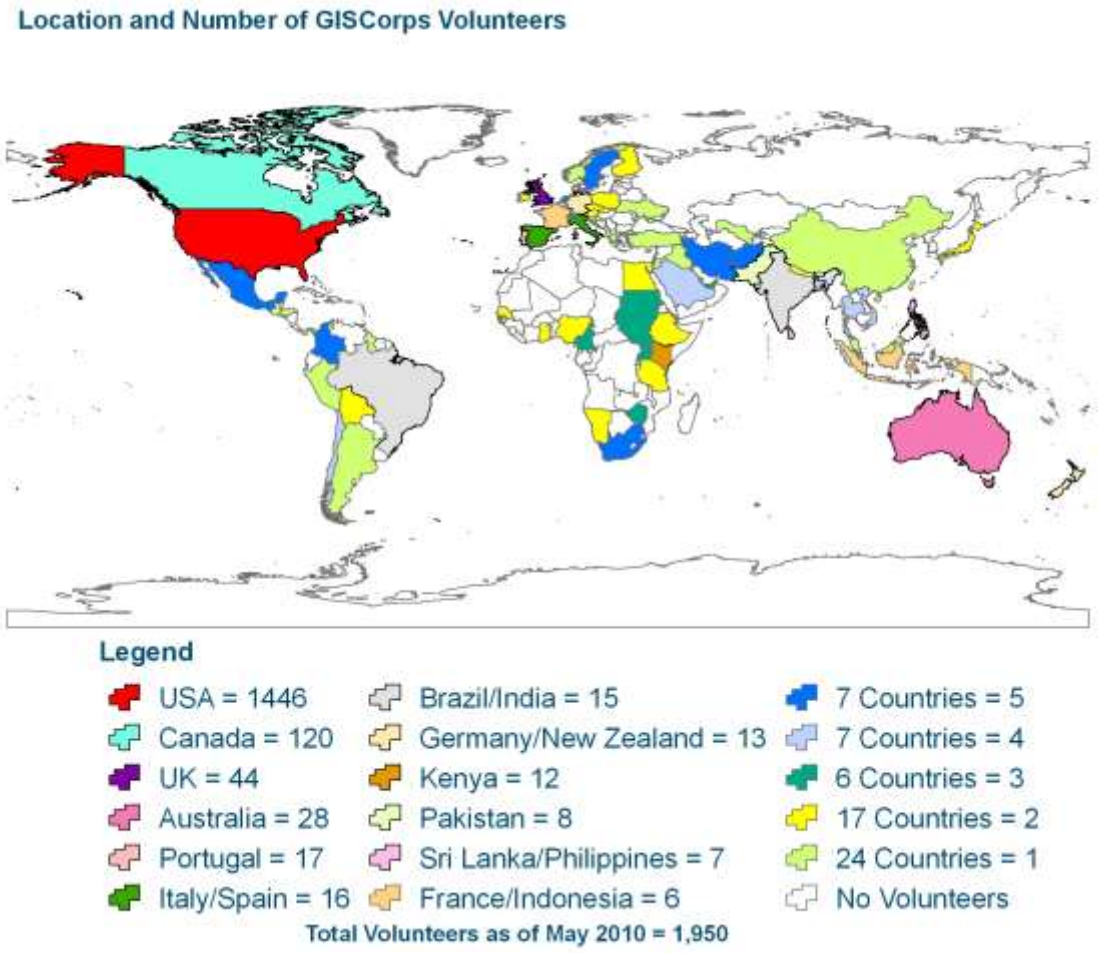
- **GISCorps volunteers' services will help to improve the quality of life by:**
  - **Supporting humanitarian relief**
  - **Enhancing environmental analysis**
  - **Encouraging/fostering economic development**
  - **Supporting community planning and development**
  - **Strengthening local capacity by adopting and using information technology**
  - **Supporting health and education related activities**

Volunteers' Profile

- Total registered volunteers:
  - In October 2003 = 41
  - In October 2004 = 70
  - In August 2005 = 270 (Indian Ocean tsunami)
  - In October 2005 = 930 (Katrina)
  - In April 2008 = 1,215
  - In September 2009 = 1,650+
  - In Aug 2010 = **2,100+** (Haiti earthquake & BP Oil Spill)
- Volunteers have an average of more than 8 years GIS experience
- Over 35% of them teach or have taught GIS

Volunteers' Locations

- 2,100+ volunteers reside in 77 countries (born in 82 countries) & in all continents
- 81% of them reside in the US and Canada



Missions 2004-2010

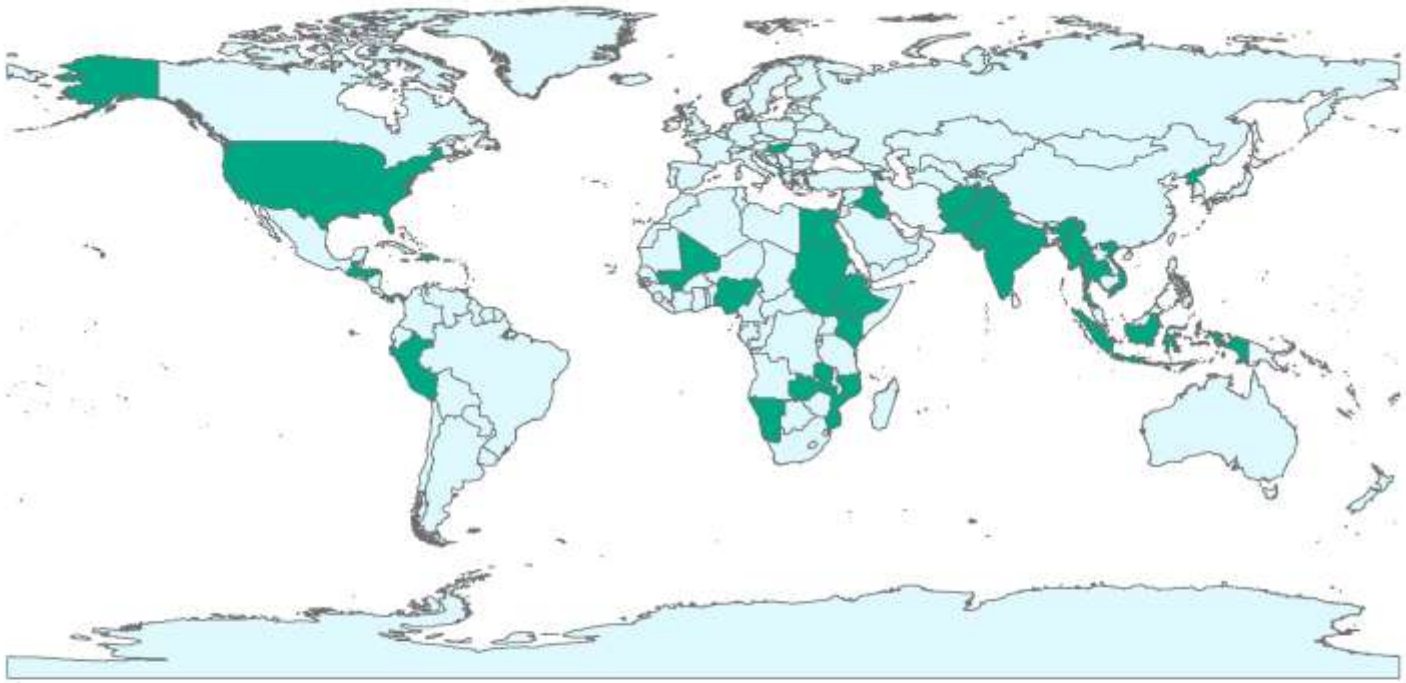
As of August 2010, Engaged in 61 missions; deployed 183 volunteers:

- 23 on-site missions; deployed 62 volunteers
- 38 remote missions; deployed 121 volunteers

Deployments are to emergency as well as non emergency missions

Missions' Locations

GISCorps Missions



As of May 2010:

- Total Number of Projects: 60 missions in 30 Countries; 37 projects remote and 23 projects on-site
- Total Number of Hours contributed: +/- 7,400
- Countries/States: Afghanistan, Armenia, Chad, Dominican Republic, Egypt, Ethiopia, Guatemala, Haiti, Honduras, Hungary, India, Indonesia, Iowa, Iraq, Kenya, Louisiana, Mali, Marshall Islands, Mississippi, Missouri, Mozambique, Myanmar (Burma), Namibia, Nigeria, North Korea, Ohio, Panama, Peru, Sudan, Tennessee, Thailand, Vermont, Vietnam, Zambia.
- Type of Services: GIS Database Design and Collection, Web Application Design, Training, Needs Assessment, Disaster Response, GPS Data Collection, Image Processing, Geo-coding, etc.

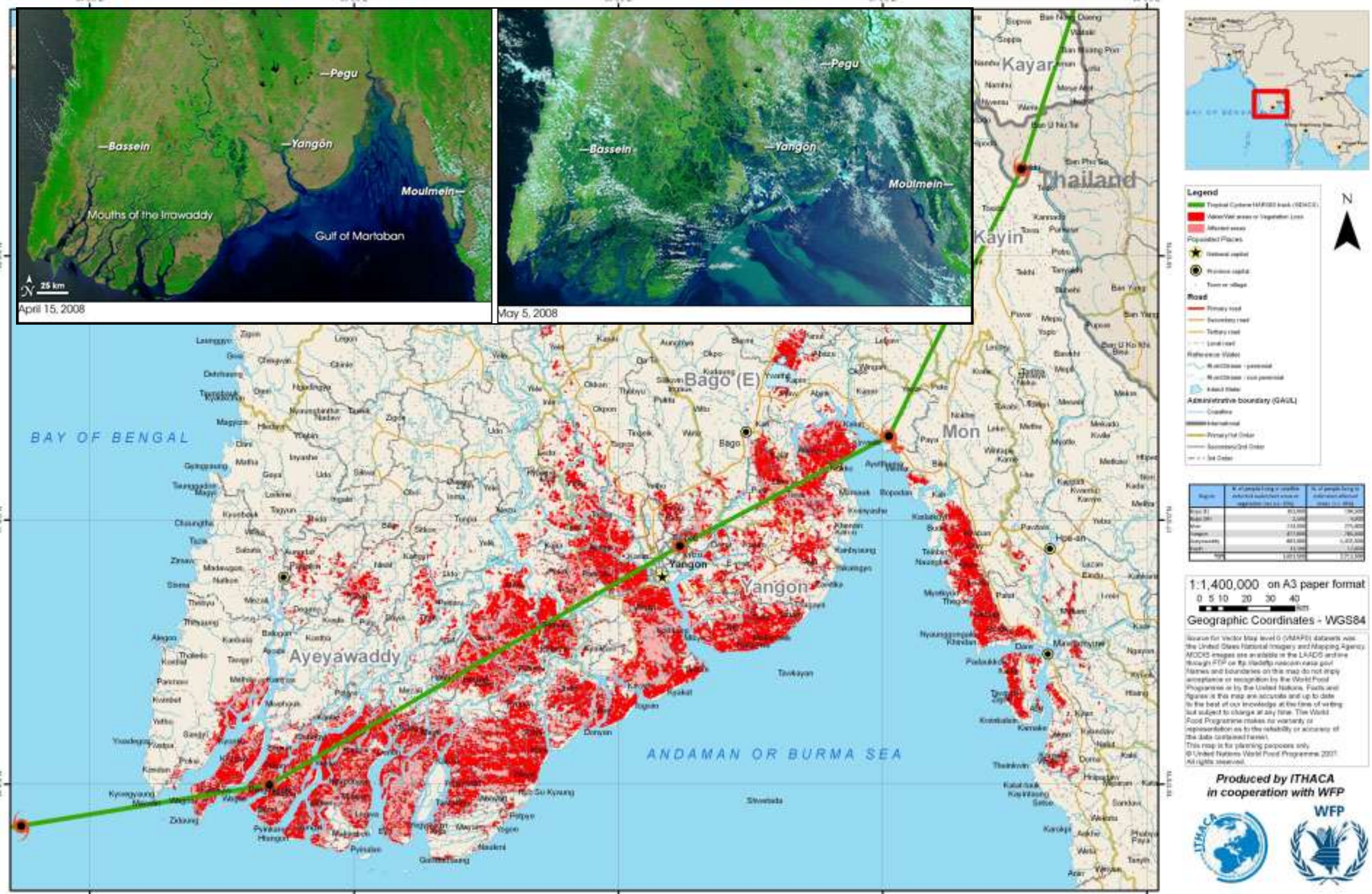
Myanmar GISCorps work

- A few days after the Cyclone Nargis hit various areas of Myanmar (Burma), Einar Bjorgo, the Head of Rapid Mapping, Applications and User Relations of UNOSAT, the UN Institute for Training and Research (UNITAR) Operational Satellite Applications Programme, contacted GISCorps and shortly after that, submitted a request for 20 volunteers.

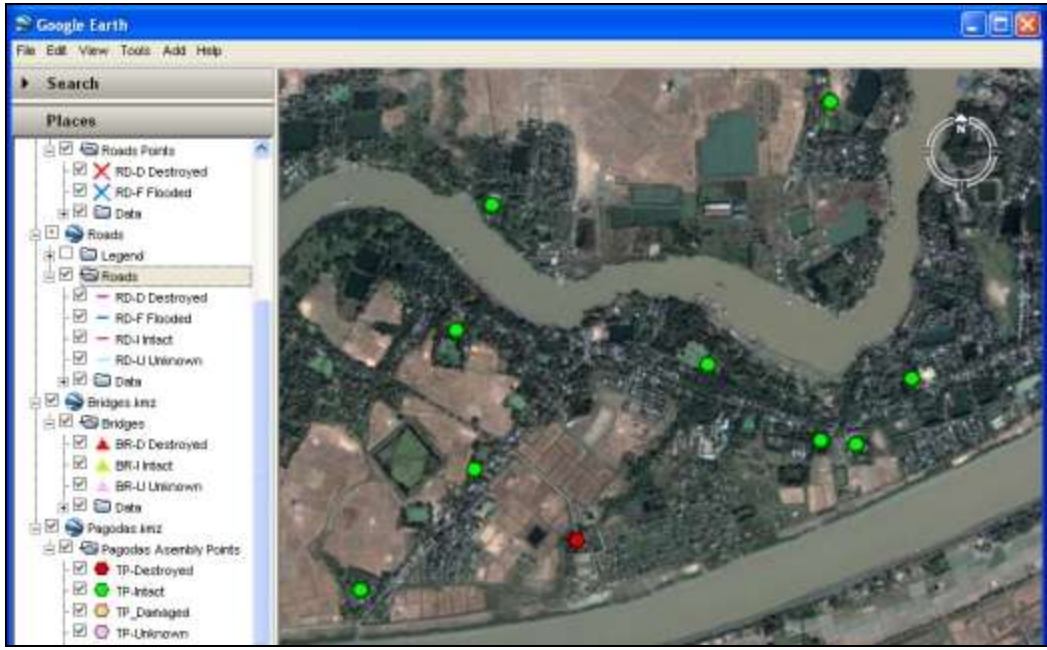
•The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite acquired this image at 4:40 UTC (10:40 a.m. local time) on May 2, 2008.

MYANMAR - Tropical Cyclone NARGIS estimated affected areas

Modis Satellite Imagery change detection analysis (21.04 - 05.05.2008)



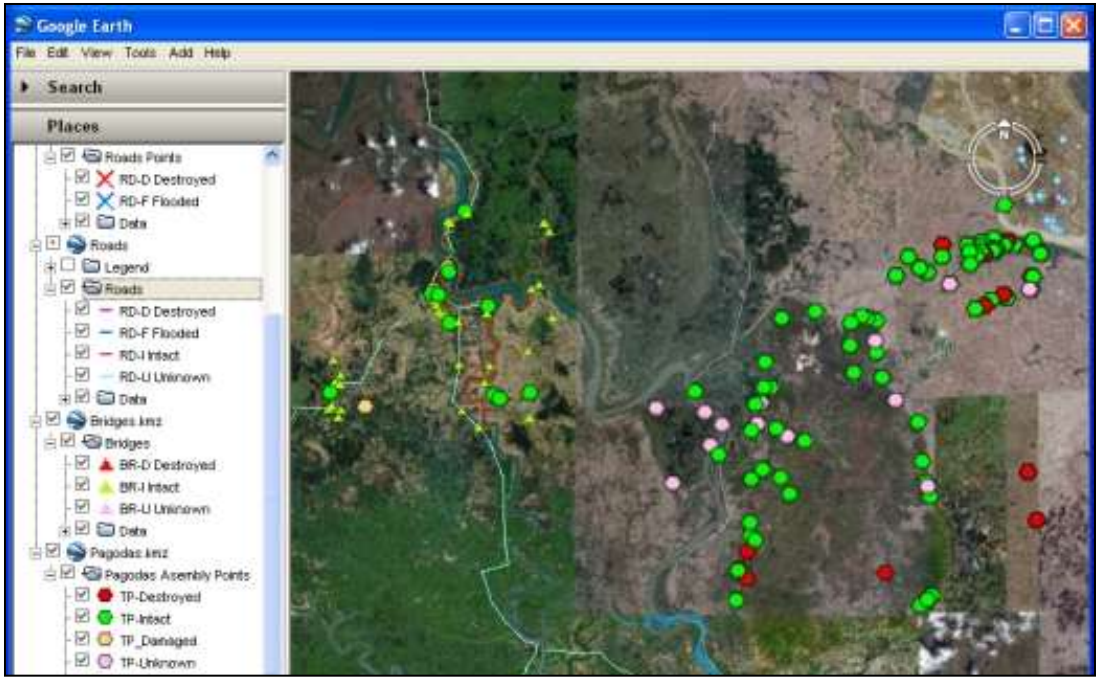
- Based on the request, a job description was developed and on May 9th, 2008, a call for GISCorps volunteers was sent out to various groups and list serves.
- Shortly after the notice went out, emails from volunteers started pouring in and in less than 48 hours 20 selected volunteers were ready to work on the project.



Zoomed in an area with several Pagodas (Monasteries) in various conditions

UNOSAT- Myanmar Project

- Four Feature types collected by GISCorps volunteers during the first 48 hours:
  - Road points,
  - Roads,
  - Bridges, and
  - Pagodas or Monasteries

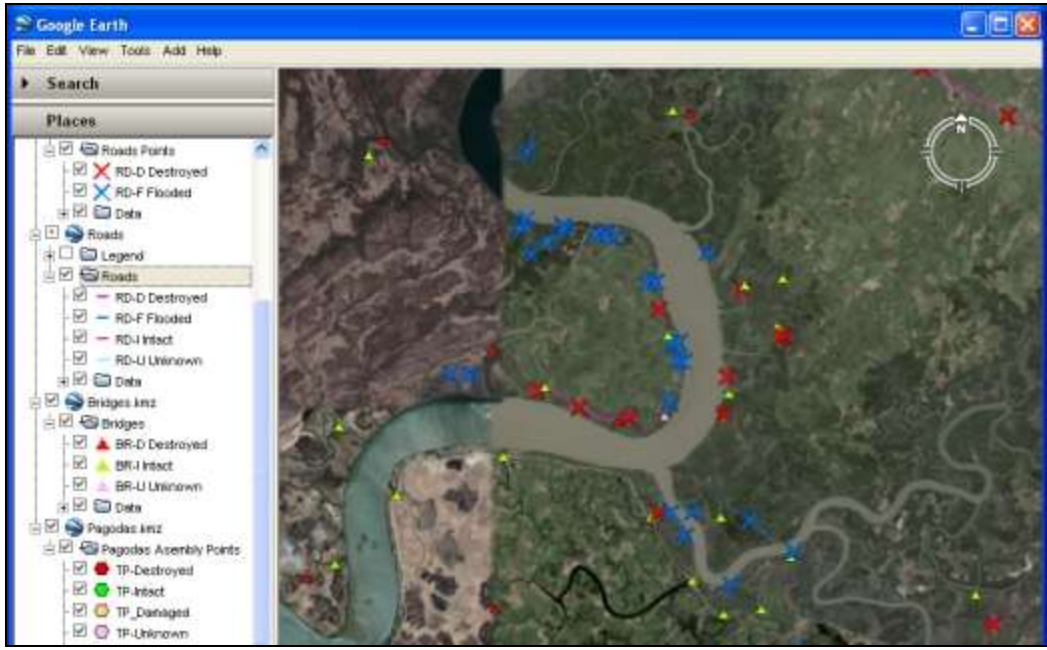


Temples

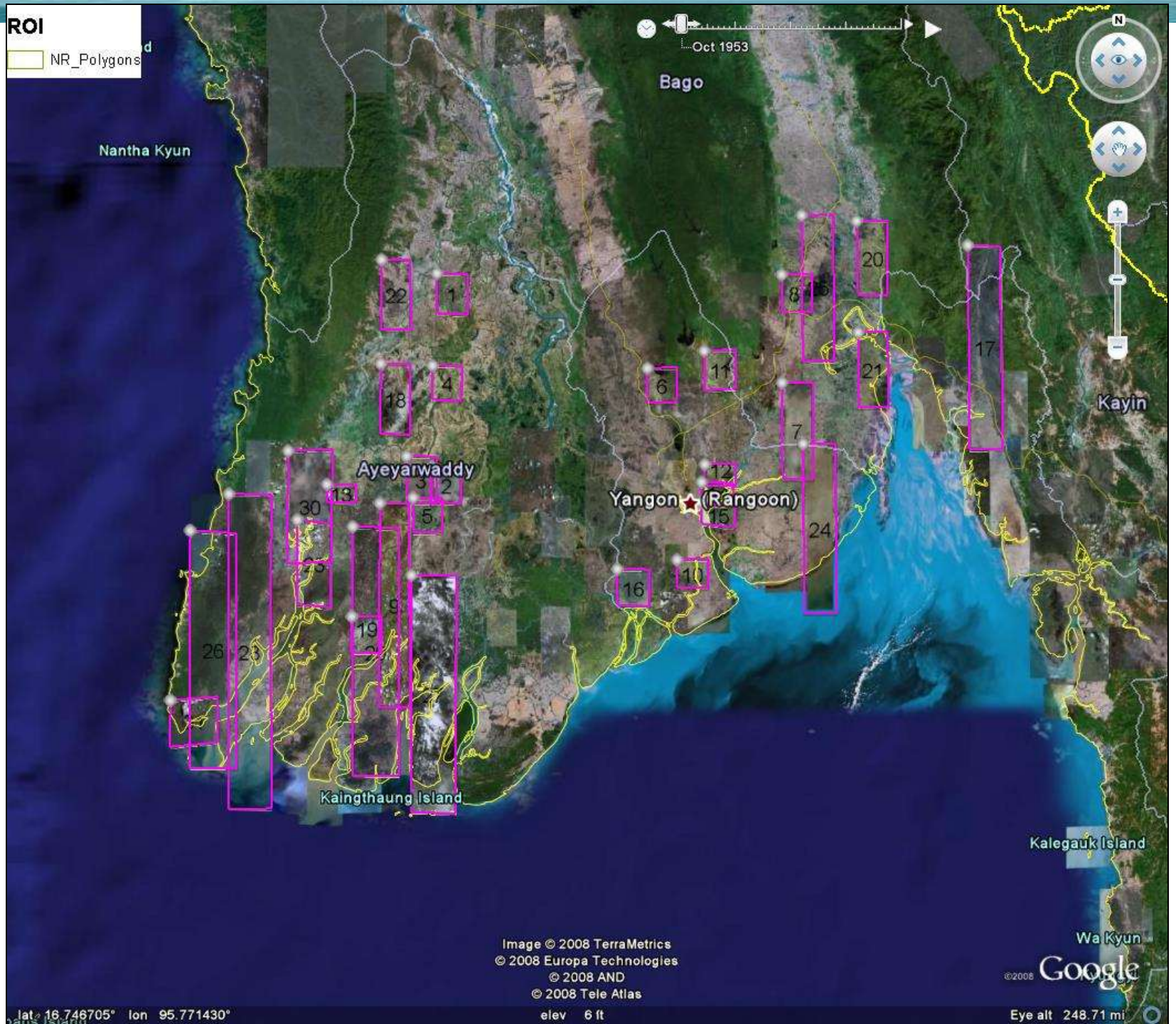

© PA


Oct 1953
N
TP
© 2008 Europa Technologies
Image © 2008 DigitalGlobe
lat 16.490504° lon 96.205800°
elev 25 ft
Google
Eye alt 976 ft

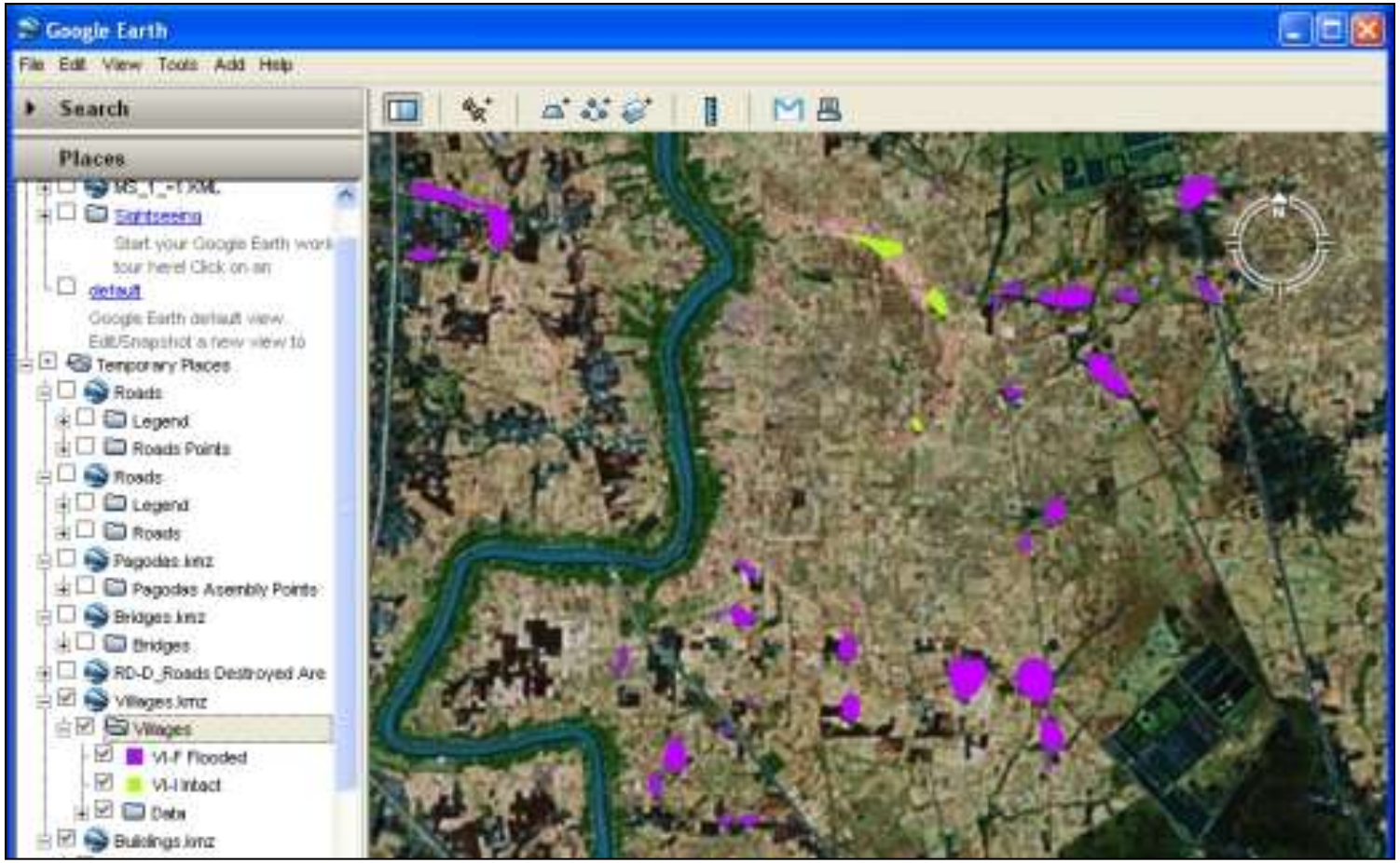
- Out of 20 volunteers, 12 of them who had remote expertise began working remotely
- They were tasked with performing change detection analysis for various features such as: roads, buildings, bridges, monasteries, and etc. from Google Earth environment.



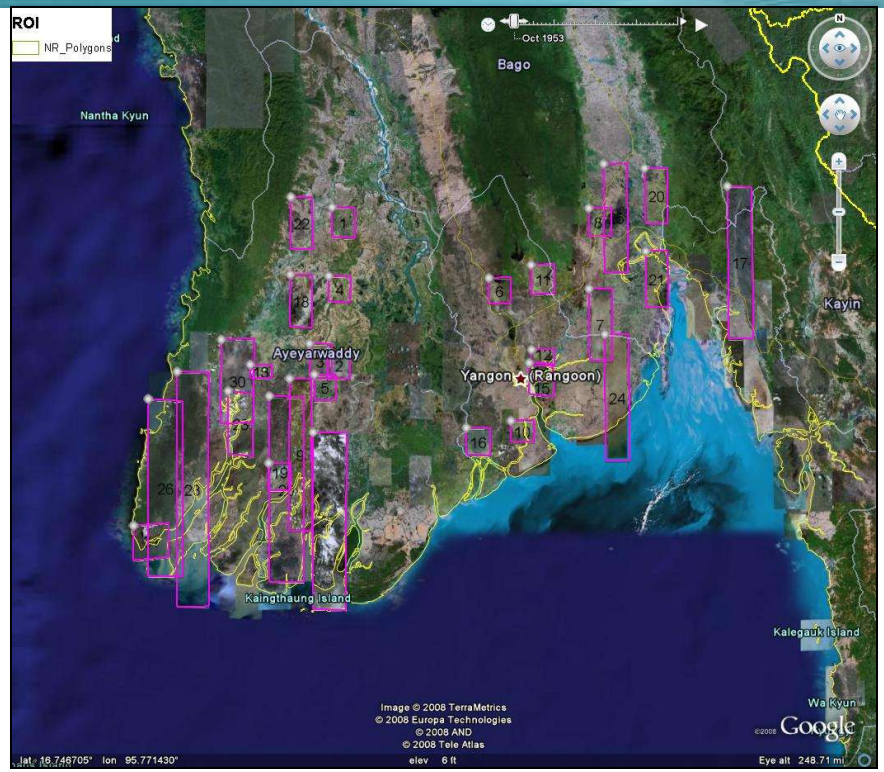
Zoomed in an area with multiple destroyed or flooded roads

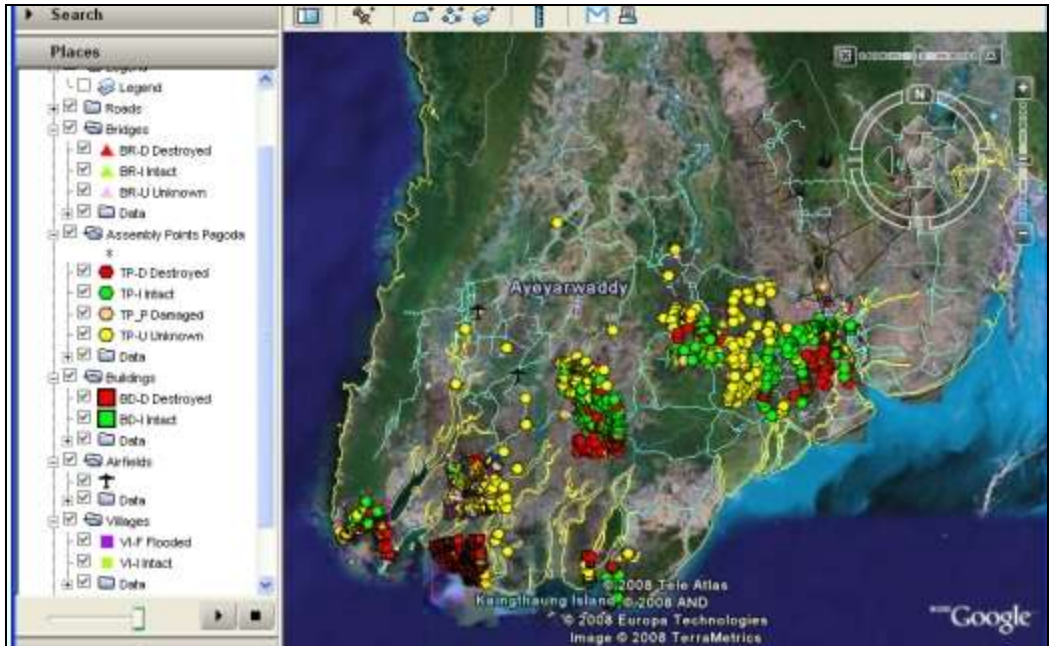

ROI
NR_Polygons
Oct 1953
Bago
Nantha Kyun
Kayin
Ayeyarwaddy
Yangon (Rangoon)
Kaingthaung Island
Kalegauk Island
Wa Kyun
Image © 2008 TerraMetrics
© 2008 Europa Technologies
© 2008 AND
© 2008 Tele Atlas
Google
lat 16.746705° lon 95.771430°
elev 6 ft
Eye alt 248.71 mi

Destroyed Villages



- 20 GISCorps volunteers had collected thousands of features using Google Earth at their own locations around the world.
- Most of these features were collected from pre-disaster imagery.
- The second phase of the project was to collect all the buildings in the delta region as they existed prior to the cyclone and from pre-disaster imagery.

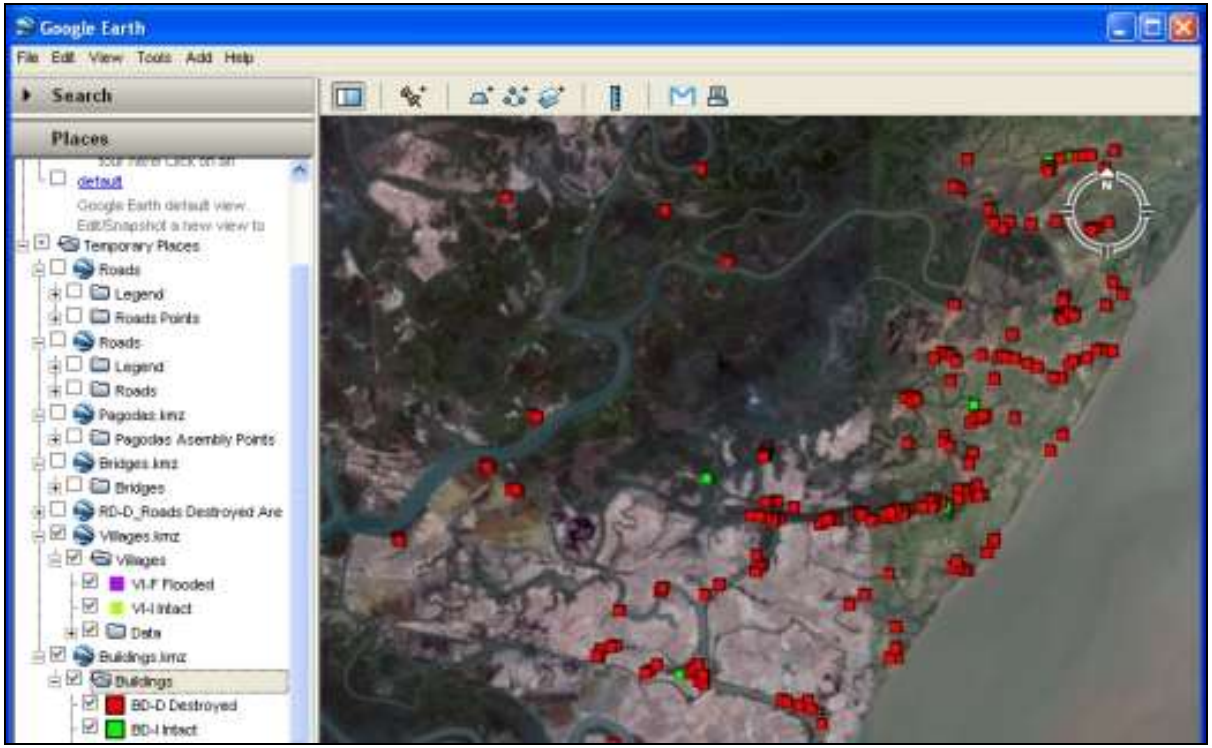


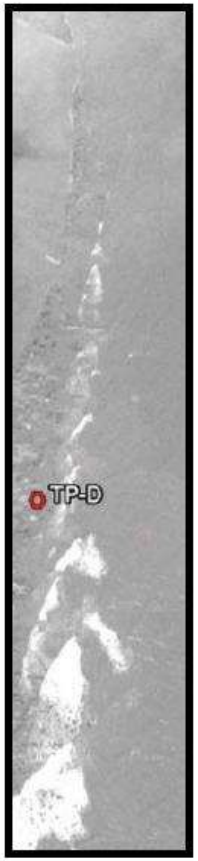


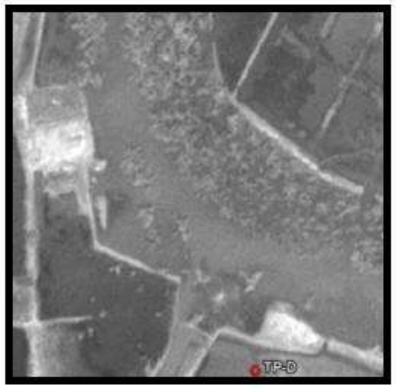

Oct 1953
BD
M
© 2008 Europa Technologies
Image © 2008 DigitalGlobe
elev 20 ft
Google
Eye alt 4647 ft

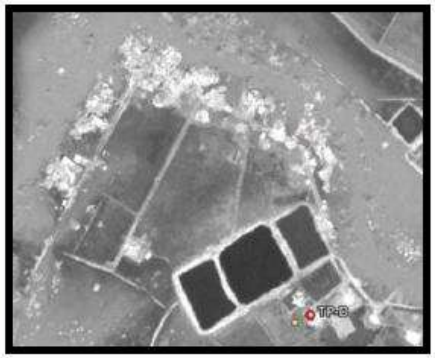
Two new feature types collected by GISCorps Volunteers;

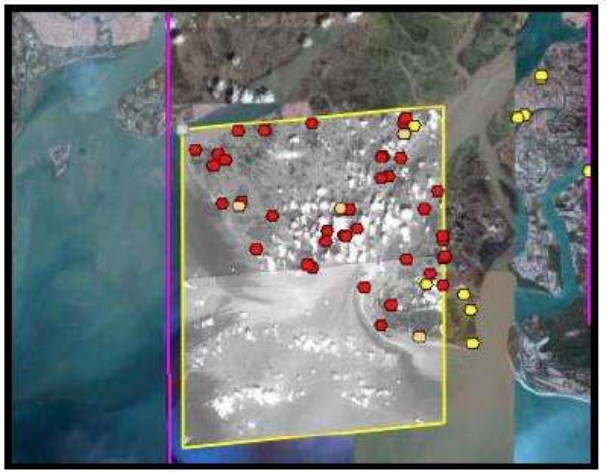
Destroyed Buildings and Villages











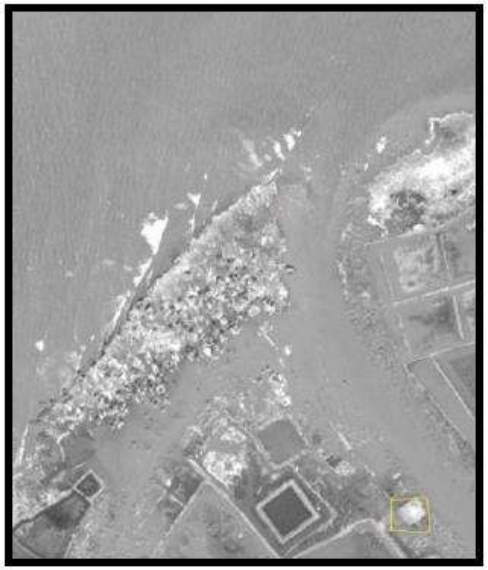
Source: Google Earth image

GISCorps focus area (RS-2)

Destroyed pagodas and assembly points (TP-D)

Located pagodas and assembly points before the cyclone (TP-U)

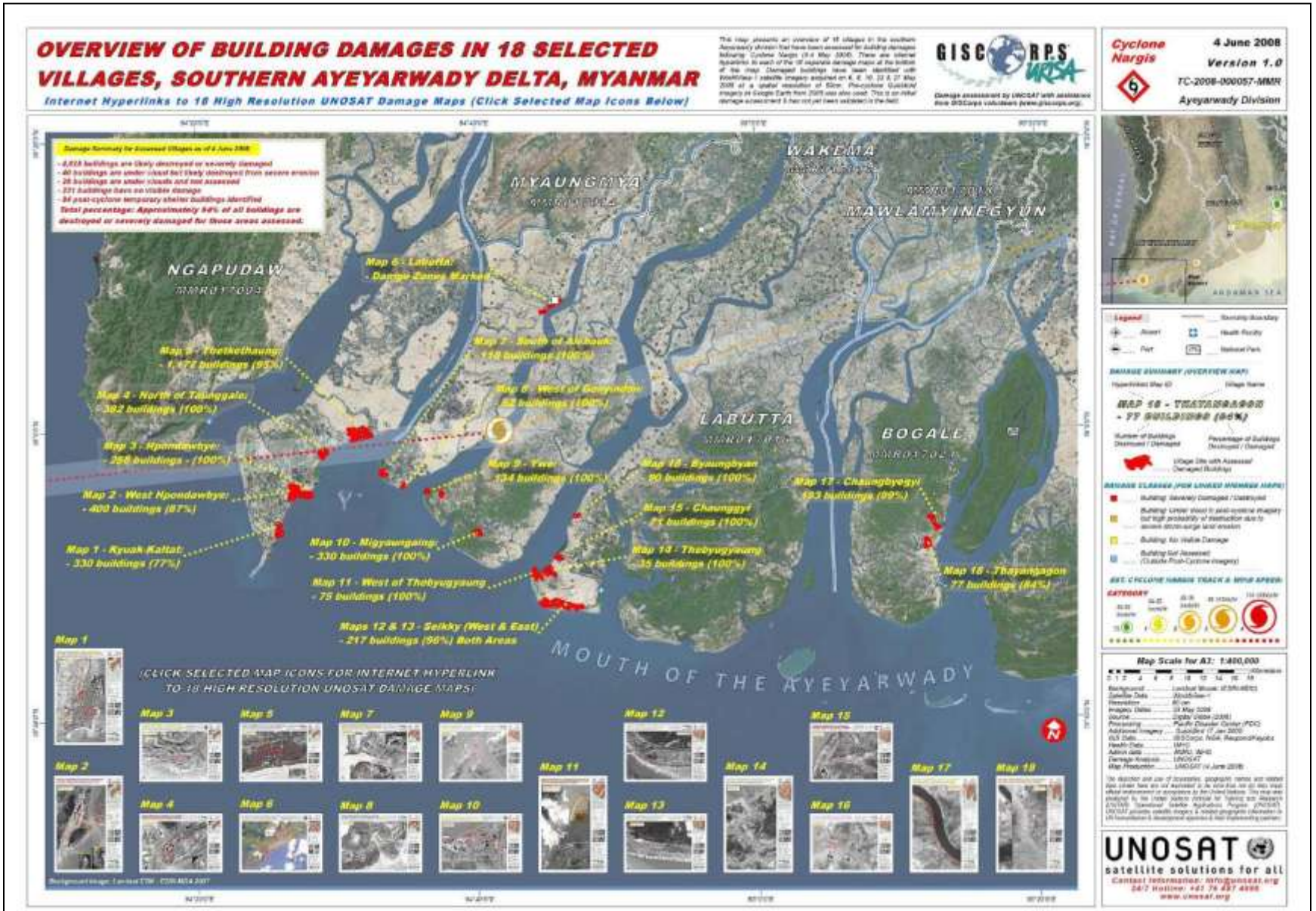
Before and after comparison of villages around Pyan-ma-law river mouth (RS-2)



Fishing villages that were totally wiped out and in some parts, submerged after the storm.

uwin/052308

Web Delivery



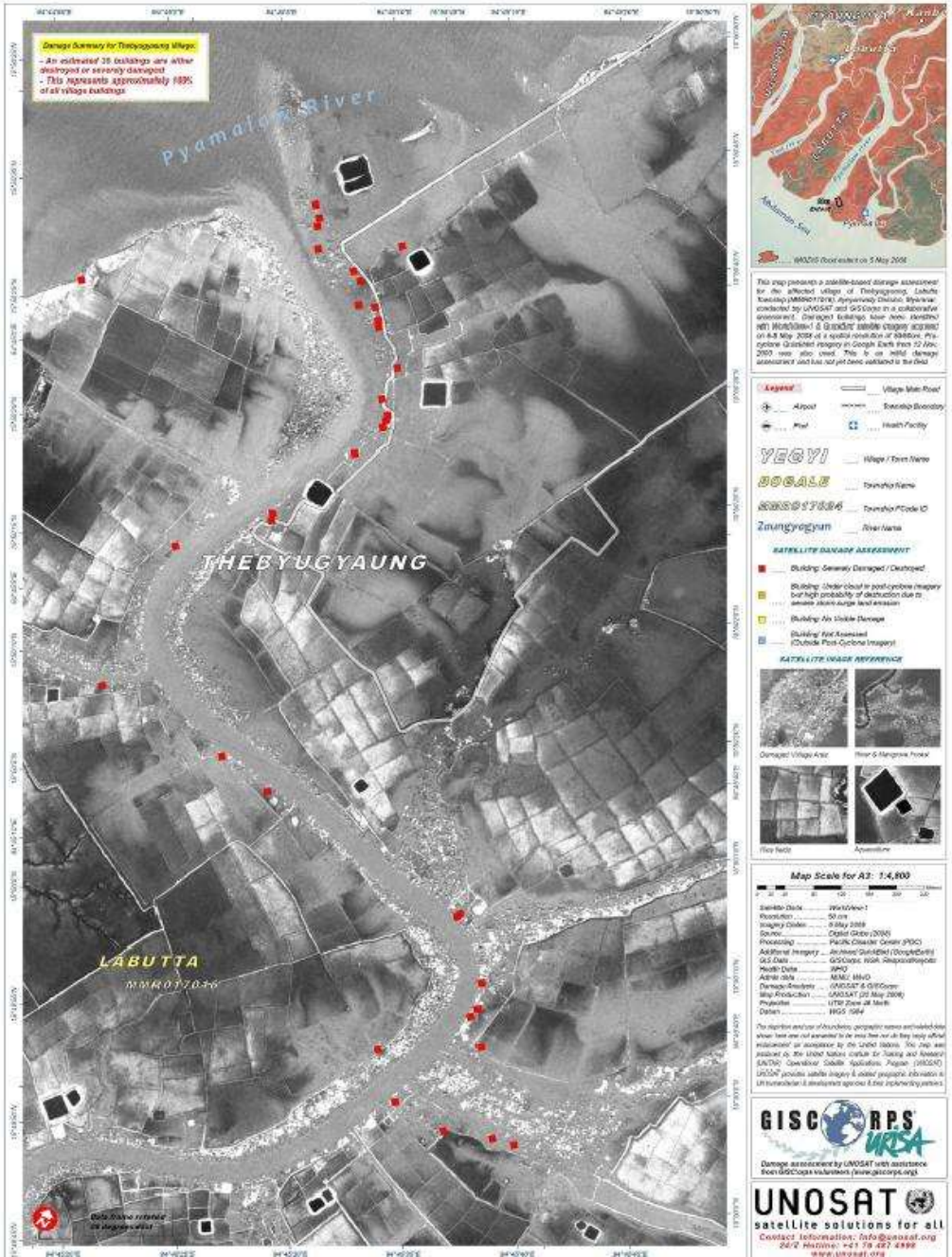
GISC RPS URISA

DAMAGE ASSESSMENT FOR THEBYUGYAUNG VILLAGE, LABUTTA TOWNSHIP, MYANMAR

Damage Assessment with WorldView-1 Satellite Imagery Recorded 6 May 2008

Cyclone Nargis

22 May 2008
Version 1.0
TC-2008-000057-MMR
Township ID: MMR017016



This map presents a satellite-based damage assessment for the affected village of Thebyugyaung, Labutta Township (MMR017016), Ayeyarwady Division, Myanmar, conducted by UNOSAT and GISCorps in a collaborative environment. Damaged buildings have been identified with WorldView-1 © DigitalGlobe satellite imagery acquired on 6-8 May 2008 at a spatial resolution of 50cm. Pre-cyclone Quickbird imagery in Google Earth from 12 Nov. 2003 was also used. This is an initial damage assessment and has not yet been validated in the field.

Legend

- Village Main Road
- Airport
- Township Boundary
- Port
- Health Facility

YEGYI — Village / Town Name
BOGALE — Township Name
MMR017016 — Township PCode ID
Zmungyegyun — River Name

SATELLITE DAMAGE ASSESSMENT

- Building: Severely Damaged / Destroyed
- Building: Under cloud in post-cyclone imagery but high probability of destruction due to severe storm surge and erosion
- Building: No Visible Damage
- Building: Not Assessed (Outside Post-Cyclone Imagery)

SATELLITE IMAGE REFERENCE

Map Scale for A3: 1:4,800

Satellite Data	WorldView-1
Resolution	50 cm
Imagery Dates	6 May 2008
Source	Digital Globe (2008)
Processing	Pacific Disaster Center (PDC)
Additional Imagery	Pre-Event QuickBird (DigitalGlobe)
GIS Data	GISCorps, NGA, ReliefWeb/OCHA
Health Data	WHO
Admin data	MIMU, MNO
Damage Analysis	UNOSAT & GISCorps
Map Production	UNOSAT (20 May 2008)
Projection	UTM Zone 46 North
Datum	WGS 1984

The depiction and use of boundaries, geographic names and related data shown here are not warranted to be error free nor do they imply official endorsement or acceptance by the United Nations. This map was produced by the United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Program (UNOSAT). UNOSAT provides satellite imagery & related geographic information to UN humanitarian & development agencies & their implementing partners.

GISC RPS URISA

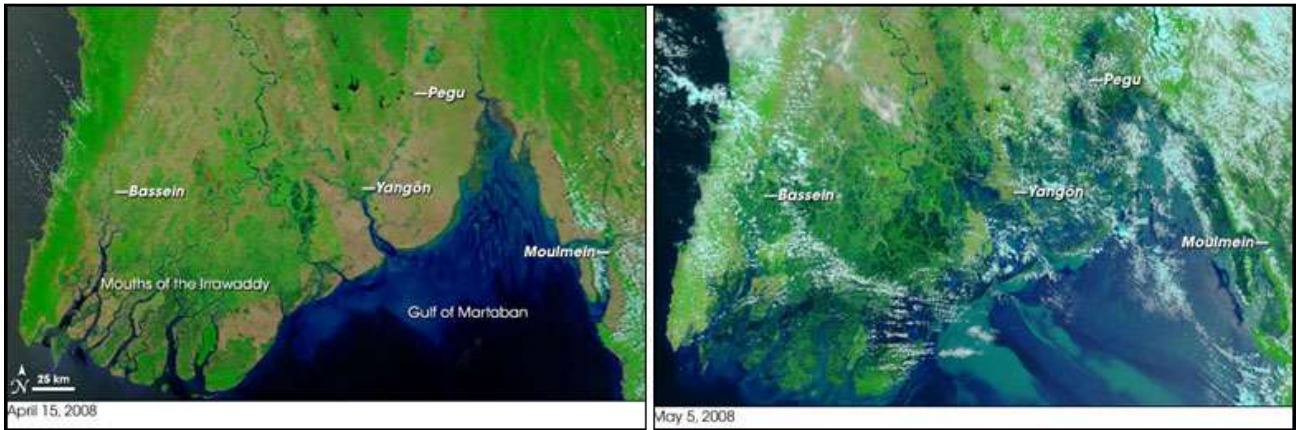
Damage assessment by UNOSAT with assistance from GISCorps volunteers (www.giscorps.org)

UNOSAT
satellite solutions for all
Contact Information: info@unosat.org
24/7 Hotline: +41 79 482 4998
www.unosat.org

A map created by UNOSAT based on GISCorps Volunteers' work

A New Approach GISCorps

- **Emphasis on *speed, consistency and efficiency***
- **33 Volunteers from throughout North America, Asia and Europe worked over 1,300 hours and digitized over 60,000 features between May 9 and May 21, 2008**
- **Harness many skilled Image and GIS analysts from around the world quickly**
  - **All use Google Earth and their own computers and internet**
  - **Each given a small area to work on**
  - **Produce standardized products quickly**
  - **Independent quality check**
  - **Combine data and send to UN for analysis and mapping**
- **Groups working across time zones is a new idea to try**
  - **(Euro>N.Amer>Asia>Euro with the same data over 24 hours)**
- **Get the data there in time to actually make a difference**



World-wide Work

- **Volunteers on this project worked from:**
  - **US – CA 9, NC 3, WS, Fl, CO, NJ, KY, LA, OR**
  - **Canada (5 BC, 2 AL,), Taiwan, Norway, Cyprus, and Germany**

Lessons Learned

- ***By Einar Bjorgo, UNOSAT & Tom Ponte and Karl Tiller, GISCorps Volunteers:***

- **1. In a remote project, high speed internet is a must for every volunteer.**
- **2. There needs to be one person, in addition to the project manager, keeping on top of activities of other agencies and the latest available data and imagery.**
- **3. For some tasks, being available all day is more important than experience level.**
- **4. Rules must be established upfront and be as simple and understandable as possible.**
- **5. Clarify project's objective and final product definition from the start.**
- **6. Preparation of digitizing instructions is critical.**
- **7. Well documented processes and workflows is a must.**
- **8. Encourage use of VoIP- communication tools such as Skype to motivate volunteers.**
- **9. Installation of wiki as a central documentation and communication tool is essential.**
- **10. Develop procedure for exporting data from GE and further populating in other applications such as ArcGIS.**
- **11. Provide secondary data to help in understanding cultural background.**

- At the conclusion of the first phase, the UNOSAT Project Manager, Einar Bjorgo, expressed their organization's appreciation as follows:

  "GISCorps is really helping towards making a difference here."

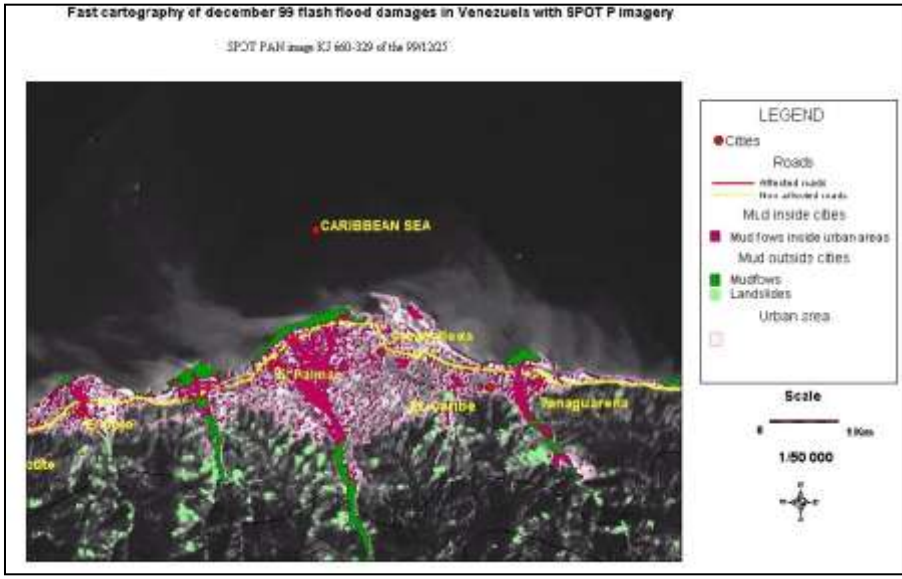
  Einar Bjorgo, UNOSAT Head, Rapid Mapping, Applications and User Relations

Time is the Enemy

- In the end, all disasters are local events with local response
- Most casualties arrive at hospital within the first 1.5 hours
- Most survivors are rescued by responders and civilian volunteers within the first 24 hours
- Chances of survival past this decreases rapidly
- Time is critical
- Accurate information and communications are critical in the first hours and days of response

Imagery used in several disasters

- Nevado Sabancaya volcano eruption, Peru (1988)
- Landslides in Colombia (1989)
- Mount Pinatubo volcano eruption, Philippines (1991)
- Aigion earthquake, Greece, (1995)
- Nyiragongo volcano eruption, Zaire (1994)
- Soufrière volcano eruption in Montserrat Island (1996-1998)
- Tsunami on north coast of Papua New-Guinea (August 1998)
- Izmit earthquake, Turkey (1999)
- Floods in SE of France (Nov. 1999)
- Hurricane and floods in Mozambique (February 2000)



http://earth.esa.int/applications/dm/GSP/venezuel.htm

Problems

- Most all work was done after the fact
- Weeks passed before products were available
- Problems in getting data to end users in the impact areas
- Useful as a test of resolution capabilities, not useful in actual disaster response
- We MUST be able to do near real time data acquisition, analysis, and dissemination to end users