UNOSAT Satellite Imagery and GIS Solutions for DRR and Emergency Management

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Introduction to UNOSAT

About UNOSAT

- UNOSAT is the Operational Satellite Applications Programme of UNITAR – entirely dedicated to researching and applying solutions in geospatial information, satellite data/imagery analysis, and integrated systems (GIS, navigation, geopositioning)

- Launched in 2000 as a project, it has evolved into a mature UN service with global outreach supported by a network of partners worldwide

- UNOSAT means over 1500 maps/analyses since 2000, taskings in over 260 emergencies & conflicts; professional training; research & methodology
UNOSAT - AREAS OF OUTPUT

Humanitarian Aid and Relief Coordination

- Crisis & Situational Mapping
- Damage assessment

Human Security

Monitoring

Human Rights

Safety and Security

Territorial Planning and Monitoring

Capacity Development & Technical Assistance

In-country project development
WHAT WE DO

RESEARCH

SERVICES

TRAINING
How does UNOSAT make use of satellites?

1. Activation / Request

2. Satellites collect data over area of interest

3. UNOSAT Staff analyze satellite data

4. UNOSAT Staff Produce maps, reports & databases for field workers, practitioners in training sessions
SATELLITE IMAGERY

SATELLITE BASED ANALYSIS
THE POWER OF IMAGERY

1960 (Corona)

SAME LOCATION, 2010, Commercial (GeoEye-1)
15 m resolution
<table>
<thead>
<tr>
<th>Satellite</th>
<th>Resolution (m)</th>
<th>Bands</th>
<th>Swath width (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeoEye-1</td>
<td>0.5 (pan), 2 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>15</td>
</tr>
<tr>
<td>QuickBird</td>
<td>0.6 (pan), 2.4 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>16</td>
</tr>
<tr>
<td>WorldView-1</td>
<td>0.5 (pan)</td>
<td>Panchromatic</td>
<td>16</td>
</tr>
<tr>
<td>WorldView-2</td>
<td>0.5 (pan), 2 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>16</td>
</tr>
<tr>
<td>Pleiades-1</td>
<td>0.5 (pan), 2 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>20</td>
</tr>
<tr>
<td>Ikonos</td>
<td>1 (pan), 4 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>11</td>
</tr>
<tr>
<td>TerraSAR-X</td>
<td>1-18</td>
<td>X-band radar</td>
<td>10-200</td>
</tr>
<tr>
<td>COSMO-SkyMed</td>
<td>1-100</td>
<td>X-band radar</td>
<td>5-150</td>
</tr>
<tr>
<td>Radarsat-1</td>
<td>8-100</td>
<td>C-band radar</td>
<td>50-500</td>
</tr>
<tr>
<td>Radarsat-2</td>
<td>3-100</td>
<td>C-band radar</td>
<td>18-500</td>
</tr>
<tr>
<td>ENVISAT ASAR</td>
<td>12.5-150</td>
<td>C-band radar</td>
<td>58-110</td>
</tr>
<tr>
<td>ERS-2 SAR</td>
<td>30</td>
<td>C-band radar</td>
<td>100</td>
</tr>
<tr>
<td>SPOT 5</td>
<td>2.5 (pan), 10 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>60</td>
</tr>
<tr>
<td>SPOT 4</td>
<td>10 (pan), 20 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>60</td>
</tr>
<tr>
<td>SPOT 3</td>
<td>10 (pan), 20 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>60</td>
</tr>
<tr>
<td>SPOT 2</td>
<td>10 (pan), 20 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>60</td>
</tr>
<tr>
<td>SPOT 1</td>
<td>10 (pan), 20 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>60</td>
</tr>
<tr>
<td>EROS A</td>
<td>1.9 (pan)</td>
<td>Panchromatic</td>
<td>14</td>
</tr>
<tr>
<td>EROS B</td>
<td>0.7 (pan)</td>
<td>Panchromatic</td>
<td>14</td>
</tr>
<tr>
<td>Landsat ETM+</td>
<td>8 (pan), 30 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>180</td>
</tr>
<tr>
<td>Landsat ETM+</td>
<td>60 (IR thermal)</td>
<td>Panchromatic + MultiSpectral</td>
<td>180</td>
</tr>
<tr>
<td>IRS-P5 (Cartosat-1)</td>
<td>2.5 (pan)</td>
<td>Panchromatic</td>
<td>30</td>
</tr>
<tr>
<td>Cartosat-2</td>
<td>1 (pan)</td>
<td>Panchromatic</td>
<td>10</td>
</tr>
<tr>
<td>Resoucesat-1</td>
<td>5.8 (pan), 23 (MS),</td>
<td>Panchromatic + MultiSpectral</td>
<td>70-740</td>
</tr>
<tr>
<td>EO-1 ALI</td>
<td>10 (pan), 30 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>37</td>
</tr>
<tr>
<td>RapidEye</td>
<td>5 (MS)</td>
<td>Multispectral</td>
<td>77</td>
</tr>
<tr>
<td>DMC constellation</td>
<td>2.5 (pan), 22 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>80-660</td>
</tr>
<tr>
<td>Kompsat-2</td>
<td>1 (pan), 4 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>15</td>
</tr>
<tr>
<td>FORMOSAT-2</td>
<td>2 (pan), 8 (MS)</td>
<td>Panchromatic + MultiSpectral</td>
<td>24</td>
</tr>
</tbody>
</table>
Overview of UAV Benefits – Why in-situ remote sensing is the next phase for field data collection

What are the main strengths of UAVs vs. satellites:

1. **(Almost) Weather Independent**: UAVs fly below clouds

2. **Super High Resolution**: UAVs can acquire imagery at an unprecedented spatial resolution of less than 4cm, for true urban-scale mapping

3. **Frequency and cost**: small UAVs can be deployed within hours at very low operating cost
GIS

THE POWER OF WHERE
By using a GIS a simplified world can be visualised in a dynamic way to simplify decision making.
GIS integrates a variety of data layers (spatial datasets) from different sources and digital formats (e.g. satellite images, topographic maps, spreadsheets, etc.).

Condition for data integration within a GIS is that all data are geo-referenced in a given coordinate system with a known datum.
UN Geographic Data BEFORE Google Map Maker
UN Geographic Data AFTER Google Map Maker
• Volunteers & Participatory Mapping
RAPID MAPPING

for

EMERGENCY MANAGEMENT
UNOSAT integrated response model for humanitarian relief and development

- No crisis signals
- Emerging risk
- Imminent risk
- Crisis
- Post-crisis Recovery
- Development planning

Demand for geo-information:
- Rush demand of basemap
- Complex info with added value
Baseline geographic data + satellite analysis

Google Map Maker Data for Pakistan + UNOSAT Flood extent analysis

Impact: Detailed and comprehensive preliminary damage analysis, monitoring, into DRR
DENSITY OF FIRE EVENTS IN NORTHERN ALGERIA BETWEEN 1 JUNE - 23 AUGUST 2012

Analysis with data collected by the NASA Moderate Resolution Imaging Spectroradiometer, accessed via NASA FIRMS.
Large Cities like Jacobabad are affected

Flood prognosis for the next day

Flooding further downstream

Progress within 10 days
120 – 150km

Start of Water Overflow

Sukkur Barrage causes retaining water further upstream
MAKING BETTER DECISIONS
GIS to support Strategic territorial planning

<table>
<thead>
<tr>
<th>awareness phase</th>
<th>analytical phase</th>
<th>implementation and good governance phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREPAREDNES</td>
<td>DIAGNOSTIC</td>
<td>IMPLEMENTATION AND FOLLOW UP</td>
</tr>
<tr>
<td>knowledge of the territory (information gathering)</td>
<td>identification and assessment of the current situation and trends (SWOT analysis)</td>
<td>definition of a local development strategy according to the diagnostic plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>implementation and evaluation and monitoring</td>
</tr>
</tbody>
</table>

Where are things located?  
Where should they be?  
How to move them?

Geographic Information System
India and WHO polio eradication campaign planning as collaborative approach, Bihar, India.

Satellite imagery provided by UNOSAT through NSPO.

No polio cases since vaccine campaign in Bihar!
Planning and Risk Reduction maps: Cite Soleil

- Obstacles in Bridges and Canals
- Open Landfill
- Drinking Water and Possible Risk of Contamination
- Hospital: Status and Access
- Schools: Status and Access
- Evacuation Plan
WORKING WITH PEOPLE

- Social Media
- Crowd Sourcing
- and the power of collaborative thinking
Mapping risks in Schools: UNOSAT & UNICEF + Kids

- Into school curricula
- Mapping school location and relevant school data
- Identifying risk areas for DRR targeted to children
A volunteer indicates that both photos have a shared visual landmark (red boxes). Do you agree?

Yes  No
Task: recommend a more accurate area

At this stage of the investigation, the task is difficult. We have to recommend a more accurate area than the proposed one. You can also contribute to another task (Next task button at the top).

I like challenge, let me try!

Approved: Tripoli street in Misrata (the whole street)

from the User page publishing the photo – 2 days ago

Search area: or

Create/Draw area

Justification: This is the area displayed on the map #34

From the User page publishing the photo
Automatic geo-positioning and mapping of photos, videos, text, voice (Android+)
Cost-efficient solutions (smart compression)
Tested in exercises, used in Haiti, Nigeria, Pakistan, Thailand
GPS cameras, mobile phones (Android, iPhone)
My home town flood effect
Record Date: 2011-11-07T12:01:27
Training & Capacity Development

SHARING OUR KNOWLEDGE
RESEARCH

SERVICES

TRAINING
Training and capacity building portfolio of activities

**Humanitarian Aid and Relief Coordination**
- Basic course on the use of satellite imagery for emergency response.
- Advanced course on the use of satellite imagery for emergency response.
- Master level Course on the use of satellite imagery for emergency response mapping.

**Human Security**
- Basic course on the use of satellite imagery for human security.
- Advanced course on the use of satellite imagery for human security.

**Territorial Planning/DRR**
- Basic course on the use of satellite imagery for territorial planning.
- Advanced course on the use of satellite imagery for territorial planning.
- In-country capacity building programmes to strengthen local capacities on the use of satellite imagery for territorial planning.

- e-learning training course in the area of geospatial information technology
- Workshops and information sharing sessions on the use of geospatial information technology for decision makers
Agriculture | Transport
Water Resource | Education
Environment | Health
Housing | Works
Land and Survey | Urban Development
Information | Others..

Thematic Data

Situation Room

Aerial/Satellite Data

Field Data

Maps Analysis

Communication Web

Decision Making
Planning
Evaluation Monitoring
Thank you

www.unitar.org/unosat