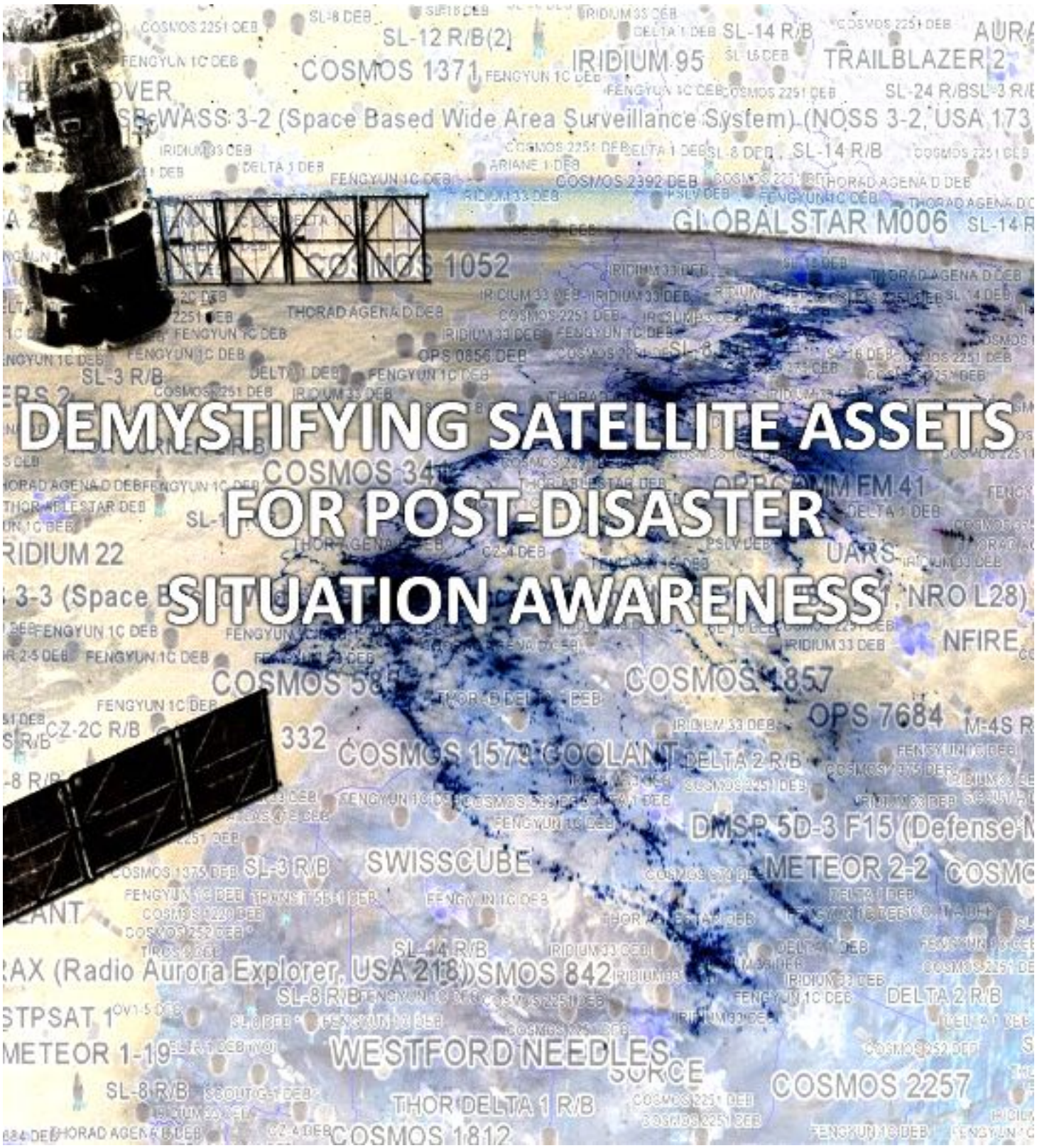
DEMYSTIFYING SATELLITE ASSETS
FOR POST-DISASTER
SITUATION AWARENESS

Project:
Demystifying Satellite Assets for Post-Disaster Situation Awareness

Requirement

Until now, there has never been an easily accessed, up-to-date summary of all satellite imagery and remote sensing analysis assets available to the emergency response community (including government disaster management agencies and related ministries; intergovernmental bodies; non-governmental organizations; local experts; scientists and academics; and the public). This simple disconnect has, in many cases, hindered the effective use of earth observation (EO) for crisis response. A useful ‘one-stop-shop’ would include all the available services (sensors, analysis capacity, time frames, etc), specifics of the activation protocol as well as the relevant user request forms and contact details including 24/7/365 duty office phone, fax and email. This would enable end-users reliable and efficient access to the source providers rather than redirects to outdated and sometimes difficult to navigate websites.

The ideal satellite imagery provision service (including derived products) should be free, available 24/7/365, able to respond within a reasonably rapid time frame, provide easy access to required imagery/analysis and, most importantly, focus on added-value of the deliverables to the emergency response through a robust user-feedback mechanism.

Background

Of the 1,419 operational satellites currently orbiting the earth, only 374 are used for earth observation (according to the Union of Concerned Scientists). This number is expected to increase significantly over the next ten years. The 200 or so planned remote sensing satellites have a value of over 27 billion USD (Forecast International). This estimate does not include the burgeoning fleets of smallsats as well as micro, nano and even smaller satellites that have already started to further crowd the rapidly diminishing orbital atmosphere. All this enthusiasm has, not unexpectedly, led to a veritable fire-hose of remotely sensed data which is becoming difficult to navigate even for seasoned experts.

Although governments are the primary producers and users of remotely sensed imagery (for everything ranging from military planning to land use and resource management), the plethora of earth observation data is uniquely positioned to assist in guiding humanitarian preparedness, response and development activities across boundaries.

The appeal of real-time strategic and tactical information has proven to be convincing to emergency managers and donors alike. Using remote sensing assets to provide evidence-based situational awareness to the humanitarian community throughout the phases of the disaster cycle from mitigation to recovery is a compelling argument for closer collaboration

with satellite data providers as well as increased funding for using remotely sensed analysis as an operational planning tool.

The timely use of remotely sensed information is heavily-underutilized by emergency response decision makers at the ground level. One reason for this is the lack of information pertaining to what imagery/analysis is available where and when, and how to get it into the right hands at the right time to have a significant impact on the outcome of emergency or development operations.

This report aims to fill that gap and increase the efficiency and efficacy of use of satellite remote sensing data and analysis in all stages of post-disaster situational awareness.

Current Agreements – Freely available information: ACTIVE Assets (set up to receive direct requests for specific tasking)

1. The International Charter Space and Major Disasters (ICSMD)

https://www.disasterscharter.org/

Summary:
This curiously named entity is a global consortium comprised of 22 charter members (including space agencies of the US, UK, Europe, Japan, Canada, China, Germany and Russia alongside the major commercial providers such as Digital Globe and Airbus). This group has been involved in around 500 activations since the year 2000 and is dedicated to providing a 'unified system of space data acquisition and delivery to those affected by natural disasters (such as a cyclone, tornado, earthquake, volcanic eruption, flood, forest fire) or manmade emergencies (such as a technological accident involving toxic or radioactive substances)'. Depending on the scale of the emergency event, this international collaboration between owners and operators of earth observation missions can provide imagery as well as data analysis and interpretation.

Access Point:
Direct tasking is reserved for Authorized Users which are usually a national disaster management authority or its delegated agency. UNOSAT and UNOOSA act as authorized users on behalf of the UN and humanitarian communities.

Requests from non-Authorized Users can be made via UNOSAT (emergencymapping@unosat.org) or UNOOSA (Lorant Czaran at Czaran@unoosa.org, tel: +43 1 26060 4158, mobile: +43 699 1459 4158).

The list of activations are publicly available and all available maps can be downloaded via the ICSMD website at https://www.disasterscharter.org/web/guest/activations/charter-activations.

Limitations:
The request can only be for fast-onset natural or technological disasters. The request can only be made within the emergency response phase up to 10 days following the disaster. The Charter cannot be activated for slow-onset events such as drought.

Also, the Charter can only be activated post-event. There is no accommodation available for mitigation, planning or preparedness activities.

Given the number of entities involved and resulting political/bureaucratic complexities and the somewhat convoluted tasking process, the response is usually too slow or haphazard for immediate post-event ground level operational guidance. Case in point would be the April 2015 earthquake in Nepal (https://www.disasterscharter.org/web/guest/-/landslide-in-nep-2).

Pros: Free, 24/7/365, access to the most advanced EO systems, global coverage

Cons: Unclear activation requirements, Unclear internal mechanisms, unclear data restrictions, unexplained delays, no raw imagery available to end user, no analysis data available to end user.

Recommendation: The Charter is mostly activated during large scale emergencies but the deliverables are usually not tailored to end user requirements and the convoluted mechanism leads to inevitable delays in delivery of the final maps products to users at the ground level. Sufficient as a backup, it is hoped that this service evolves into something more agile and efficient.

2. Copernicus

http://emergency.copernicus.eu/

Summary:
Copernicus was previously known as the European Commission's Global Monitoring for Environment and Security (GMES) program. The Copernicus Emergency Management Service (EMS) has been active since April 2012. EMS has a 'rush' mode component for immediate support to emergencies and a 'non-rush' mode which supports emergency management activities not related to rapid response such as disaster risk reduction and recovery phases of the emergency management cycle.

The three SENTINEL Satellite missions are supported by around thirty contributing missions from ESA Member States, EUMETSAT, Canada and third parties including SPOT-5 of CNES, TerraSAR-X of DLR/EADS Astrium, COSMO-SkyMed of ASI, RADARSAT-2 of CSA/MDA, Pleiades of CNES, Jason-2 of EUMETSAT/CNES/NOAA/NASA, MSG (Meteosat Second Generation) spacecraft of EUMETSAT, MetOp of EUMETSAT, DMC (Disaster Monitoring

Constellation) of SSTL: AlSAT-1, BILSAT-1, NigeriaSat-1, UK-DMC, and Beijing-1, RapidEye of RapidEye AG and EnMAP (Environmental Mapping and Analysis Program) of DLR.

The Copernicus EMS is advertised to provide rush mode imagery and analysis within 6-24 hours post-event. In most cases, the delivery of usable grading and delineation maps occurs after several days. The inclusion of the analysis vector zip package alongside various print resolution map formats is very useful for GIS end users.

Copernicus EMS has been triggered 168 times for rapid response (rush mode) tasking and 29 times for risk and recovery (on rush mode) activities since 2012.

Access Point:
The EMS can only be triggered by Authorized Users which are usually National Focal Points from the EU Member States and within the National Civil Protection Mechanisms. Associated Users including Intergovernmental Organizations (e.g. UN agencies, World Bank), and National & International Non-Governmental Organizations have to go through an Authorized User in order to trigger an EMS activation.

For Associated Users not familiar with the EMS and not having a focal point contact from amongst the Authorized Users, a Standard Request Form (SRF- attached) can be sent to UNOOSA (Lorant Czaran at Czaran@unoosa.org, tel: +43 1 26060 4158, mobile: +43 699 1459 4158) who will forward on behalf of the requestor to the European Response Coordination Centre (ERCC) (echo-ercc@ec.europa.eu , tel: +32-2-29-21112).

The list of activations are publicly available and all available maps and data can be downloaded at http://emergency.copernicus.eu/mapping/list-of-activations-rapid (for rush mode activations) and at http://emergency.copernicus.eu/mapping/list-of-activations-risk-and-recovery (for non-rush mode activations).

Limitations:
Rush mode response usually takes longer than the advertised 9 hours for reference maps and 12 hours for delineation and grading maps. It seems that much effort is expended on the reference maps as end users wait for analysis products. Not unlike the other services, Copernicus has a weak understanding of end user operational requirements and hence the products are not tailored for maximum added value towards the emergency response. There are gaps in coordination among satellite data providers during major emergencies which lead to end user confusion regarding imagery/analysis in the pipeline.

Pros: There are now 6 entities providing round the clock coverage (ITHACA, e-GEOS, GAF, SIRS, SERTIT and DLR) and this translates into stronger capacity over the next 2 years. Vector and raster analysis products are included with the delineation and grading maps.

Cons: Only authorized users can trigger activations which lead to delays by non-authorized users having to go through agencies like UNSpider who do not have 24//7/365 desk officers available. Low level of user feedback has weakened the evolution of added value deliverables. Non-rush mode service can take an inordinately long period of time.

Recommendation: The stronger capacity and provision of raw data as well as analysis products make this a viable first choice for end users who need high resolution analysis within a week or so post-event.

3. UNOSAT

https://unitar.org/unosat/

Summary:

The UN Operational Satellite Applications Programme (UNOSAT) has been providing rapid crisis mapping and impact assessments to the humanitarian community since 2003. UNOSAT is part of the UN Institute for Training and Research (UNITAR) and is housed at the CERN complex in Geneva, giving it a distinct advantage in terms of computing and storage capacity.

UNOSAT has produced more than 2,300 publicly available maps covering a broad range of crises (natural and manmade disasters including refugee camp mapping, conflict damage assessments and situation analysis) in 107 countries since its inception.
The service is available 24/7/365 and is free for all UN agencies, government bodies, international and regional organizations as well as for humanitarian non-governmental organizations (NGOs).

Interestingly, the UNOSAT mission statement to " deliver integrated satellite-based solutions for human security, peace and socio-economic development with a focus entirely based on a professional commitment to producing concrete, tangible and usable results…" stems from the UNITAR mandate dating back to 1963. Again, it is not within the scope of this document to discuss how 54 years of experience leads to the current gaps between the provision of earth observation data for crisis response and the resulting operational reaction.

Access Point:
The activation protocol is quite straightforward with no specific forms required other than some basic information via an email to emergencymapping@unosat.org
The basic information would include: type of event, geographic location (ideally with gps lat/long position) with at least a place name, contact information including e-mail and phone.
Requests can also be via phone to the 24/7 hotline at +41 75 411 4998

Limitations:

Capacity remains the major issue. UNOSAT has a relatively small team that quickly reaches limits in terms of how much analysis can be delivered.

Pros: Very significant level of experience in training and capacity building. Simple activation protocol. Affiliations with multiple commercial providers allow access to very high quality data very quickly. Vector analysis provided alongside map products. Good experience with preparedness and modeling activities. Good connections with ground level field operators and line ministries. Apolitical.

Cons: Limited capacity to handle large requests. Unclear coordination with other entities such as Copernicus during large-scale disasters.

Recommendation: Another good first choice if requirement covers smaller area of interest. Initiatives such as the flood portal and digital pre-stocking of imagery show an impressive vision for agile evolution.

4. Sentinel Asia

https://sentinel.tksc.jaxa.jp/sentinel2/topControl.jsp

Summary:
Sentinel Asia (SA) is a collaborative effort between 89 agencies in 27 countries alongside 15 International Organizations. Led by the Asia-Pacific Regional Space Agency Forum (APRSAF) and established in 2005, the aim is to use combined remote sensing resources and technology to support disaster management efforts in the Asia Pacific region (for major disasters and flood monitoring in particular).

SA provides a 'regional enhancement' to the International Charter and is comprised of Data Provider Nodes (DPNs), Data Analysis Nodes (DANs) and Technical Working Groups (TWG).

DPN members include Japan's JAXA, the India Space Research Organisation (ISRO), the Korea Aerospace Research Institute (KARI), the Thailand Geo-Informatics and Space Technology Development Agency (GISTDA), the Taiwan National Applied Research Laboratories (NARL), and the Singapore Center for Remote Imaging, Sensing and Processing (CRISP). The combined satellites from each of these DPNs are referred to as the Sentinel Asia Constellation.

In contrast to the 6 DPNs, there are 35 DANs that focus on the production of value-added disaster information products.

The TWGs focus on improving delivery of information on specific disasters such as wildfires, floods, glacial lake outburst floods (GLOFs), and tsunamis.

Access Point:
Requestors are required to be either part of the Joint Project Team (JPT) or a member of the Asian Disaster Reduction Centre (ADRC). The JPT is open to all members of the APRSAF (612 organizations from 45 countries and 28 international organizations).

Authorized users should send a completed Emergency Observation Request Form (need to get the latest format…) by email or fax to the Sentinel Asia Project Office at the Satellite Applications and Operations Center (SAOC) of the Japan Aerospace Exploration Agency (JAXA) at mailto:z-sentinel.asia@jaxa.jp or Fax: +81-3-5777-1580 (Tel: +81-3-6435-6785).

Non-authorized users can activate SA tasking via the UNOOSA/UNSpider contact (Lorant.Czaran@unoosa.org).

Raw imagery and derived map products are available for download by the public at: https://sentinel.tksc.jaxa.jp/sentinel2/emobSelect.jsp . SA has had around 225 emergency activations since 2007.

Limitations:
The lofty rhetoric has not been able to match the lackadaisical service. It is unclear why the webservice remains so dated and with extremely slow access by modern standards. Many times emails to the contact point go unanswered.

Pros: This grass-roots and voluntary effort has recognized, very early-on, some of the key bottlenecks to effective added-value delivery to emergency responders: 1.) limited bandwidth, 2.) need for customized information tailored for end user requirements, 3.) need for a robust information-sharing and user friendly infrastructure available 24/7/365 and 4.) focus on developing the strength of the human network between the space and disaster management communities. In addition, SA has instituted a very valuable 'success stories' component which details case studies.

Cons: The SA website remains dated and somewhat difficult to navigate. The service sounds very good on paper but predictable delivery is a weakpoint. Connection via UNSpider adds to the delayed response. Data analysis products (vectors/rasters) are not available to end users.

Recommendation: Not recommended for tasking unless all other free options are unavailable.

5. US State Department Humanitarian Information Unit (HIU)

https://hiu.state.gov/

Summary:

Under the terms of their Digital Globe NextView license, U.S. Government (USG) agencies can share high-resolution satellite imagery with international organizations, non-government organizations, and national governments on a case-by-case basis.

A clearly defined request for access to imagery can generally be approved or denied within 24 hours, and if satisfactory imagery has already been collected, it can be made available within 12 hours to the requesting party.

Sensors available under the NextView license include the very high resolution (0.3 to 0.5 meter) Worldview and GeoEye constellation (available for new tasking) as well as archives from the now-decommissioned Quickbird and IKONOS satellites (also > 1 meter resolution).

This resource is particularly useful in cases where the International Charter has not been activated.

Access Point:
Requests for access to commercial imagery for disaster response should be relayed via the State Department Humanitarian Information Unit (HIU) at HIU_DATA@state.gov with answers to the following questions:

General

- What is the purpose of your imagery request?
- What sort of analysis do you intend to conduct using the requested imagery?
- What sort of data do you intend to create?
- What sort of products do you intend to generate using the imagery or imagery-derived data, and how will they be disseminated?

Geographic Extent

- What are the specific points and/or bounding coordinates for your area(s) of interest? Please include a geographic file containing your area of interest(s). A GeoJSON (.json or .geojson), Google Earth file (.kml), or ESRI Shapefile (.shp) format are preferred.

Temporal Bounds

- What is timeframe (specific date, range of dates, and/or pre-event and post-event dates) required for the requested coverage?

Imagery Specifications

- Do you require panchromatic, multispectral, or both?
- Do you require ortho-rectified imagery?

- What file format is required for receipt of the imagery? (NITF, GeoTiff, Erdas Imagine, .img, etc)

In situations where internet connection speeds and bandwidth are viable, a limited number of scenes can be provided via ftp download link. Larger amounts of coverage may require the creation of a web-hosting service account at evwhs.digitalglobe.com, with appropriate facilitation by the USG. Access to imagery through such an account may be limited to the immediate response and recovery phases.

Coordination with both Washington D.C. and country offices (embassies, consulates, or USAID missions) is recommended to ensure consistent communication and responsiveness. In the event that the requesting agency has pre-existing contact with a USG representative from the State Department or USAID relevant to disaster response, contacting this individual is recommended, in order to advise of the intent to request access to commercial imagery. This individual should also be cc'd in email communications sent to the HIU.

Limitations:
Determination for new tasking or retrieval of archived imagery is on a case-by-case basis. The sharing of data has to be in the interests of the USG and therefore can preclude many situations where foreign policy sensitivities take precedence.

Pros: Highest resolution commercial imagery available for free. Raw imagery available. Quick response time by the HIU as the facilitator.

Cons: USG interests are prioritized. No analysis products available. Requester needs resources and capacity to analyze very high resolution (vhr) data. Imagery not open for public dissemination amongst the humanitarian community.

Recommendation: This is a very good option if the following conditions are met: the area of concern and end user requirement fit into USG interests. The area of concern is a known location (village, port, airfield, etc). The end user has the bandwidth to download and the know-how and resources to analyze the raw data.

PASSIVE Assets (data streams available to the public via webservice)

1. MODIS Near Real-Time (NRT) Global Flood Mapping Project
http://oas.gsfc.nasa.gov/floodmap/index.html

NASA's MODIS instrument onboard the Terra and Aqua Satellites provides twice daily near-global flood monitoring at 250 meter resolution. There are currently no other instruments

that provide daily global coverage. The information is available for download (via a very intuitive and user friendly interface) in shapefile format in 1 day, 2 day, 3 day or 14 day composites.

Despite the potential usefulness of this unique resource, there are some serious limitations:

- MODIS does not see through clouds and many times during major flood emergencies, the system has no information.
- The 250 meter resolution limits the scale at which flood monitoring occurs.
- Areas of extreme terrain variation, volcanic material or cloud shadows can have false positive results (ie indicate floods on dry ground) and areas with cloud cover, flooded vegetation and flash floods can have false negative results.
- There are known inconsistencies in georeferencing which can lead to inaccurate identification of affected areas

2. NASA FIRMS Active Fire Data (https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/active-fire-data)

NASA's Fire Information for Resource Management System (FIRMS) provides real time active fire locations. In addition to monitoring active wildfires, this service has a unique capacity to identify hotspots around active volcanoes. Specifically the extent and direction of lava flow.

Active fire products from MODIS (1 km resolution) and the Visible Infrared Imaging Radiometer Suite (VIIRS - 375 meter resolution) sensor VIIRS satellite images are available for the last 24hrs , 48hrs and 7 days in shapefile format.

3. NASA EOSDIS Worldview (https://worldview.earthdata.nasa.gov/)

This online service allows open access to more than 150 near-real time (within 3 hours of observation) satellite derived products and imagery. The data is available for download. There is a feature called 'events' which highlights all current natural hazards. Although much more intuitive than the other passive services, the information is most useful to emergency responders and field GIS officers with experience in satellite imagery and remote sensing analysis.

4. NASA Reverb ECHO (https://reverb.echo.nasa.gov/reverb/)

Reverb is the front-end to the massive NASA ECHO (Earth Observing System Clearinghouse) earth science metadata catalogue. Reverb provides a very intuitive and user friendly interface with access to more than 3,000 collections and 840 platforms including Aqua, Terra, Aura, Landsat, NOAA, TRMM, ENVISAT, GOES, GPS, SMAP, RADARSAT, Calipso, METEOSAT, JASON, ALOS, ICESAT, etc.

This would be a valuable resource for humanitarian uses if complemented by devoted resources translating the complex science into easily interpreted added-value situational awareness (i.e. tailored to end user operational requirements).

5. The Copernicus Open Access Hub (https://scihub.copernicus.eu/)

Formerly known as the Sentinels Scientific Data Hub, this webservice provides completely full and open access to the latest Sentinel-1, Sentinel-2 and Sentinel-3 imagery as per the European Space Agency's (ESA) free data distribution policy.

Sentinel-1 is a twin radar satellite constellation providing global coverage with a revisit time of 12 days at 5 meter resolution. The Sentinel 1 mission has been operational since April 2016. The synthetic aperture radar (SAR) provides day and night coverage through all weather conditions.

Sentinel-2 is a twin optical satellite constellation providing global coverage (except Antarctica) with a revisit time of 5 days at 10 meter resolution. Sentinel-2A was launched in June 2015 and Sentinel-2B is due for launch in March 2017. Sentinel 2 has a 290 km swath and, with 13 spectral channels and 10 meter resolution, collects and disseminates 1.6 TB of data per orbit. This is also the first civil optical mission that includes three bands in the 'red edge' which provide critical information on vegetation health and thereby able to detect early food security risks.

Sentinel-3A is the first of a triplet constellation that is designed to provide optical, radar and altimetry data for marine and land services. Sentinel-3B and 3C are planned for launch in 2017 and 2020 respectively.

As promising as all this sounds for humanitarian response requirements, there is a critical need for devoted resources that are proficient at accessing and processing the complex and very cumbersome datasets into products that are easily interpreted by end-users. There are some unclear issues around licensing, data distribution approaches and open source processing beyond Level-1C as well as data projection artifacts and faulty geolocation data that are only well understood by experts and this adds to the time and effort required to get usable maps and products into the disaster theatre.

6. USGS Earth Explorer (https://earthexplorer.usgs.gov/)

The Earth Explorer allows downloads of a variety of digital elevation model data, imagery as well as land cover and vegetation data (including Landsat 8, ASTER, SRTM, Hyperion, MODIS and AVHRR).

The latest Landsat imagery can be downloaded via various sources:

- Earth Explorer
- Global Visualization Viewer (GloVis)
- LandsatLook Viewer
- or viewed via Google Earth

Registration is required for download. Navigation, accessing and downloading will remain a challenge for humanitarian end users without some form of dedicated processing support, acceptable downloading speeds and expert knowledge.

7. Digital Globe Open Data https://www.digitalglobe.com/opendata

In partnership with UNOOSA, World Bank GFDRR, Open Street Map and several others groups, DG has committed to releasing open imagery for select emergencies including a crowdsourced damage assessment.

So far the service only has a single event (Oct 2016 Hurricane Matthew in Haiti) and many of the hardest hit areas were not covered. Hopefully future releases will be more useful.

Other sites with Satellite imagery and derived products that are either too hard to navigate, are buggy, have limited coverage, are difficult to register with or too slow for efficient operational humanitarian use:

- NOAA CLASS https://www.class.ngdc.noaa.gov/saa/products/welcome
- ESA EOLi https://earth.esa.int/web/guest/eoli
- National Institute for Space Research (INPE) **http://www.dgi.inpe.br/CDSR/**
- Proba V NRT data **http://www.vito-eodata.be/PDF/portal/Application.html - Home**
- Indian ISRO Geoplatform **http://bhuvan.nrsc.gov.in/data/download/index.php**

Comrercially available imagery

There are many commercial sources in addition to 150 or so certified imagery resellers. The prices can range from a few dollars per sqkm for archival imagery to more than 50 dollars per sqkm for new tasking of multispectral imagery. There is usually a minimum area requirement such as 25 sqkm or 100 sqkm. The costs can therefore add up quite quickly so there is a need to be very precise in identifying the area of concern as well ensuring that capable resources are on hand to download and process the raw data into derived products that are useful for disaster management.

Some of the primary data providers are listed below:

1. Planet Labs https://www.planet.com/products/planet-imagery/
2. Digital Globe https://www.digitalglobe.com/

3. Mapbox https://www.mapbox.com/pricing/
4. Urthecast https://www.urthecast.com/
5. Google Terrabella - https://terrabella.google.com/ (recently bought by Planet)
6. Blacksky Global - https://www.blacksky.com/
7. Airbus - http://www.intelligence-airbusds.com/en/122-price-lists
8. Imagesat - http://www.imagesatintl.com/
9. MDA - http://mdacorporation.com/corporate/surveillance-and-intelligence
10. AGILSPACE- http://www.agilspace.com/
11. Disaster Monitoring Constellation for International Imaging - http://www.dmcii.com/
12. eGEOS - http://www.e-geos.it/satellite-data.html

The Way Forward

This report provides a preliminary overview of predictable satellite resources that can be used to support the various phases of the disaster cycle. Despite some of these resources having served the disaster response community for more than a decade, there remain some major hurdles to the efficient use of earth observation products for ground-level operational guidance.

The first of these barriers arises from the ever-growing, and hard-to-navigate plethora of instruments, sensors and services available for earth observation. This is compounded by the assurances of technical groups and international agreements, emphasizing a focus on targeted assistance to disaster response efforts, materializing at best as empty rhetoric fueled by politics, internal mandates and the pursuit of funding.

Even a cursory study of the major disasters of the past decade will reveal serious gaps which could have been easily filled by well-organized access to earth observation assets. The situation is not improving, as evidenced by the lack of coordination of satellite providers during the recent hurricane Matthew in Haiti and 2015 earthquake in Nepal.

Satellite providers must sit much more closely with their counterparts, competitors, and especially with their end users; only then can they deliver cohesive coordination during disasters and understand the critical importance of providing *only* data and analysis that will add value immediately post-event. There should be a clear understanding of end user requirements as well as the exact capabilities of the providers and analysts for all disaster types.

Increased efforts at capacity building (and capacity sustaining) at the national and community levels should be at the forefront of every mandate. Most importantly, there needs to be a robust feedback mechanism which allows unbiased measurement of actual ground level impacts of the provided imagery and derived products.

It is hoped that this overview helps to direct the conversation towards an honest assessment of current earth observation impacts on disaster preparedness and response to better utilize a

resource with incredible potential to positively influence the lives and livelihoods of millions of people.