

Discovery of Imagery and Geospatial Data Sources for Disaster Response and Recovery

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History / Background

- The **2005 Atlantic hurricane season** was the most active Atlantic hurricane season in recorded history.
- Started to create an internal USDA document so that National, State and County offices knew how to access disaster imagery.
- Realized that all agencies need the same information so have been creating a consolidated disaster data sources document ever since.



Data Sources Document

- Documents meaningful sources of imagery and geospatial information during disaster response and recovery.
- Many sources of unclassified public domain or licensed imagery are acquired during disasters.



FEMA



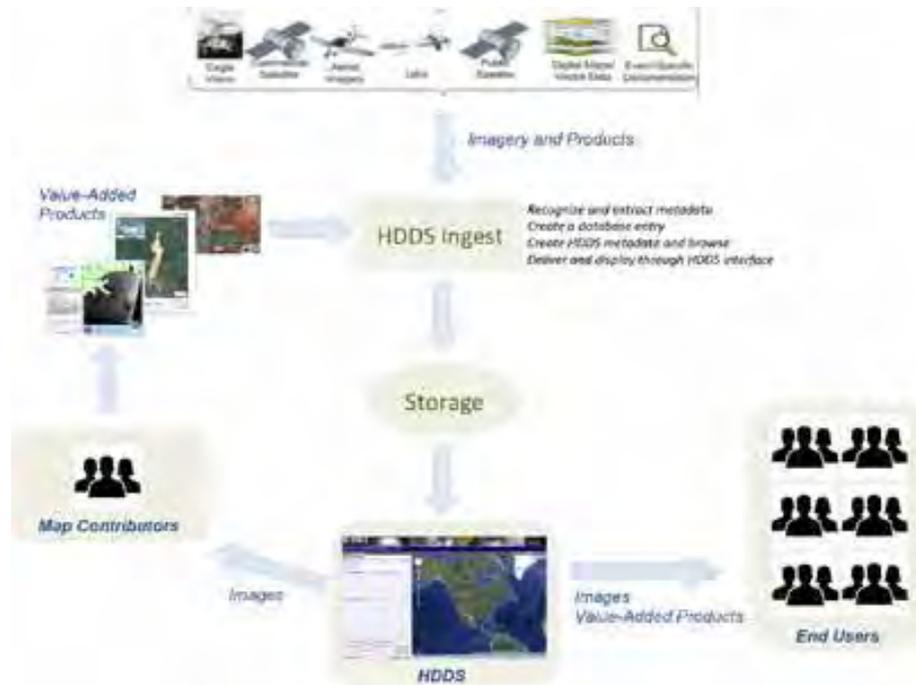
Goals



- Provide data that can be mashed-up with data from your agency.
 - Passing data not maps
- Documenting best available data
- Providing a place that people can expose data and products to the disaster community
- Update as appropriate for disaster
- Provide the link between people that need data with people that have the data.
 - I know that XXXX has been working on products but have not seen any. Do you know where they are?

Scope

- Useful information regardless of source.
- HDDS / USGS is the main consolidator of imagery
 - Lead by Brenda Jones and Rynn Lamb
 - Working with Rynn, Brenda and Beverly Friesen on project to improve web-enabled visualization and access of value-added disaster products.



Information Cooperators

Providers of information and Push Information to impacted State and local Agencies

- HIFLD
- NISGIC
- ESRI Disaster Team

Federal

- USGS
- FEMA
- NOAA
- NGA
- U.S. Air Force
- Forest Service (Fire)
- Red Cross

Check all links that people send to make sure they work and contain useful information.

Major Sources of Imagery

- **Hazards Data Distribution System (USGS)**
 - Public Domain and Licensed Imagery
 - Most diverse holdings
- **Digital Globe Enhanced View Web Service**
 - Daily take, available to .mil and .gov
- **U.S. Air Force Eagle Vision Disaster Relief Imagery**
 - Licensed imagery with a “disaster relief” license



Data Sources Document

- Viewers (e.g. ArcGIS online products)
 - e.g. **FEMA GeoPlatform**
- Rest and WMS Services
- Damage shapefiles
- Baseline shapefiles
- Social Media
- Documents
 - Reporting, Maps...
- Anything else that is useful...
- Eliminate information links that are not useful or dead.

- Document length
 - 43 pages for Super Storm Sandy
 - 28 pages for Earthquake in Haiti
 - 18 pages for Super Typhoon Yolanda
 - 16 pages for Earthquake in Nepal
 - 17 pages for floods in Texas...

Information Cooperators / Sources

USGS: The Majority of imagery used for disasters is hosted by HDDS.

Point of contact for activation of International Charter for Disasters

NASA: Satellite Imagery and analysis

NOAA: Acquisition of Aerial Imagery and provider of weather information

Civil Air Patrol: Acquisition of Aerial Imagery

NGA: Tasking of Digital Globe Imagery and provider of Damage Shapefiles.

FEMA: Tasking of NGA, Civil Air Patrol, Information Consolidator. Creator of Rest services

Forest Service: Requestor and provider of imagery for Wildland Fire

U.S. Air Force (USAF) Eagle Vision: Acquires Disaster Relief Imagery

Digital Globe: Imagery. Tomnod Crowd sourced damage assessments

ESRI: Consolidator, creator of Rest Services

Google: Consolidator, may acquire post-event imagery

States: Task Civil Air Patrol, State GIS data and Operations Centers.

Providers of information and Push Information to impacted State and local Agencies

- **Homeland Infrastructure Foundation (HiFld)**
- **National States Geographic Information Council (NSGIC)**



Community / Top 3 Users by Domain

- **.gov**

- 236 Subscribers (USDA, DHS, DOI)
- 29 Agencies total
- 27 from NPS



- **.mil**

- 96 Subscribers (U.S. Army, NGA, U.S. Air Force)
- 7 organizations



- **.com**

- 59 Subscribers (Booze Allen Hamilton, ERSI, NY Times)

Booz | Allen | Hamilton



esri

The New York Times

- 17 State Governments
- 14 Universities

470+ Subscribers Total

- Anyone can ask to be on list by sending email to glenn.bethel@usda.gov
- Community can also download from HDDS by disaster
 - <https://hdds.usgs.gov/>

Where is the best available pre-event imagery?

- National Agricultural Imagery Program (NAIP)
 - 1 or 2 years old.
 - Often the most current
- State imagery holdings.
 - Usually the best spatial resolution
 - Can be difficult to track down
- Digital Globe

Satellites Used for Disaster Response/Recovery

← Relative Ground Swath →

VIIRS 🇺🇸

spatial resolution: 375m, 750m



3000 km swath



MODIS 🇺🇸

spatial resolution: 250m, 500m, 1000m



2300 km swath



DMC-2, Deimos-1 🇬🇧 🇪🇸

spatial resolution: 22 m

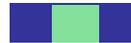


737 km swath



Landsat 🇺🇸

spatial resolution: 15m, 30m



183 km swath



Spot 5/6 🇫🇷

spatial resolution: 5m, 20m



60 km swath



EO1 ALI 🇺🇸

spatial resolution: 10m, 30m



37 km swath



Commercial High Resolution Systems 🇺🇸 🇫🇷

spatial resolution: .3 - 1m



10 – 20 km swath



Who Pays for Disaster Imagery?

- NGA acquires Commercial High Resolution
 - NextView Contract for DigitalGlobe imagery
- U.S. Air Force Eagle Vision
 - Spot
 - RapidEye
- FEMA and/or states
 - Civil Air Patrol (CAP)
 - Contracted Aerial
- NOAA
 - NOAA Aerial
- International Charter on Space and Major Disasters
 - Providers donate imagery
- Google and Microsoft
 - Aerial for a very select group of disasters

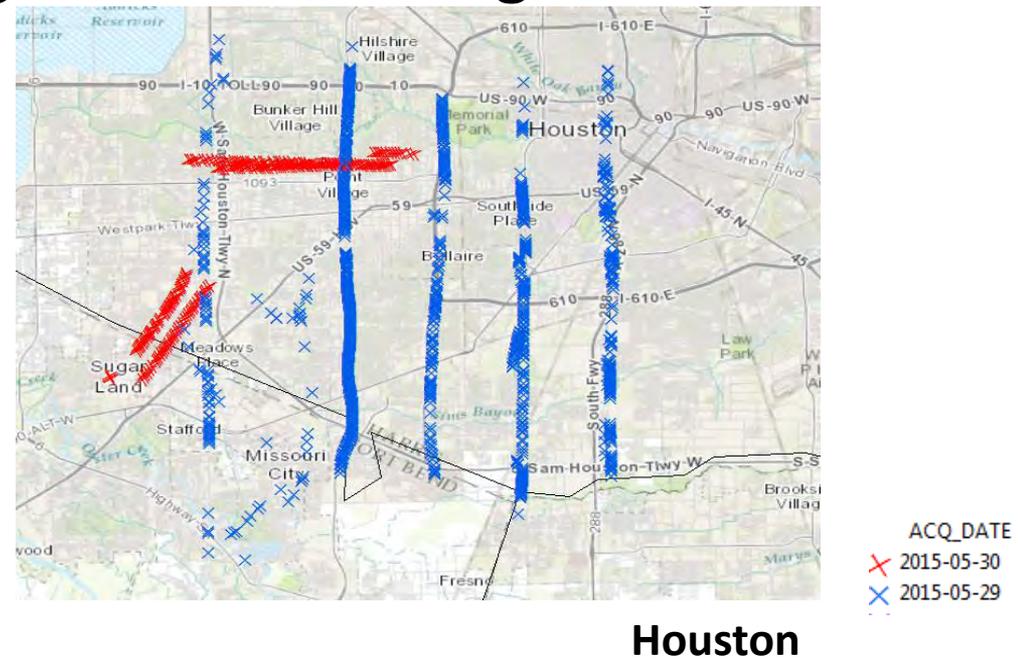
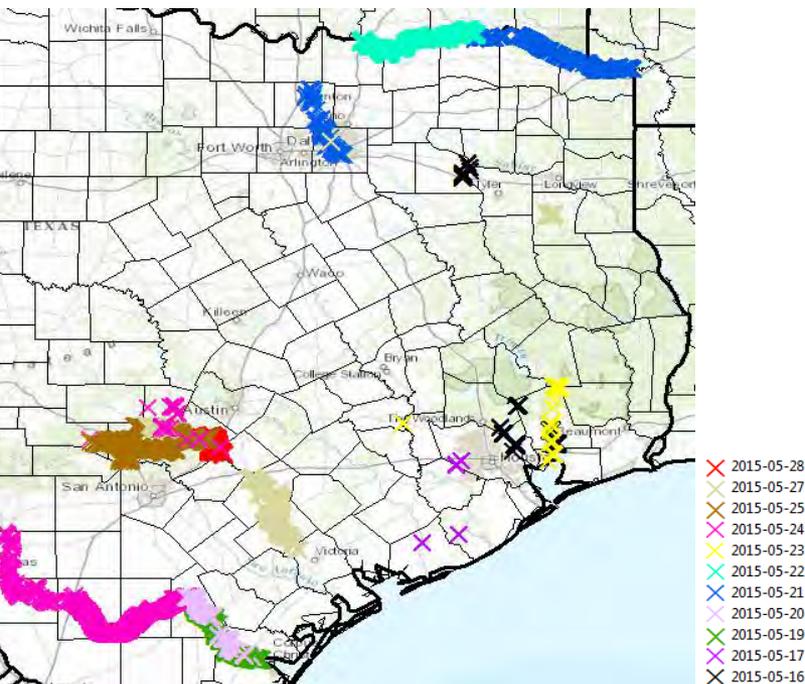


FEMA



Example: Texas Floods and Tornadoes

- Long events make it more complex to point user to most recent / what is new.
- Civil Air Patrol: 22,993 images.
- Maps are created using ArcGIS and Image Index Shapefiles from HDDS.



If you are working with a specific area download the index shapefiles. Links to browse and full resolution imagery.

Index of /disaster/201505_Flood_TX/shapefiles/index

Name	Last Modified	Size
 Parent Directory		
 201505_Flood_TX_AERIAL_CAP_POINT.zip	2015-06-26 17:37:11	2.1 MB
 201505_Flood_TX_AERIAL_USACE_POINT.zip	2015-06-04 10:08:50	1.6 KB
 201505_Flood_TX_EO_USGS_WGS84.zip	2015-07-06 15:46:06	5.2 KB
 201505_Flood_TX_LANDSAT_ETM+_USGS_WGS84.zip	2015-08-05 05:48:16	35.3 KB
 201505_Flood_TX_LANDSAT_OLI_USGS_WGS84.zip	2015-08-06 06:13:06	37.0 KB
 201505_Flood_TX_SPOT_DOD_WGS84.zip	2015-06-04 05:10:50	1.8 KB
 201505_Flood_TX_TERRA_ASTER_NASA_WGS84.zip	2015-06-17 17:45:06	5.8 KB
 201505_Flood_TX_WORLDVIEW_NGA_WGS84.zip	2015-08-06 06:33:28	786.9 KB

Use Identify function to browse and download imagery.

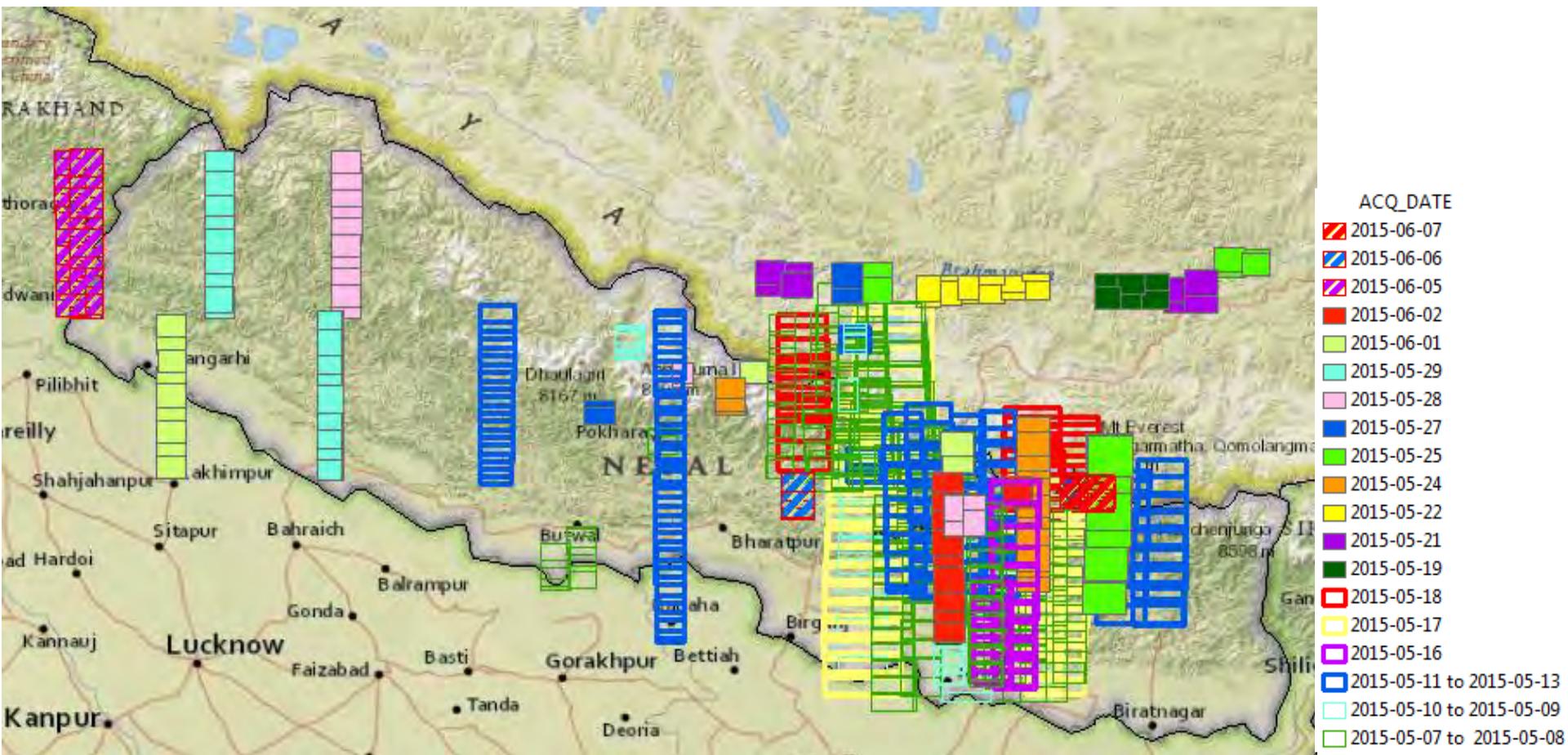
Attribute Table contains links to browse and Full Resolution Imagery

Table

201505_Flood_TX_AERIAL_CAP_POINT selection 5

FULLRESLOC	FULLRESIZ	BROWSELOC
https://hddsexplorer.usgs.gov/order/process?ordered=1200751&node=HDDS&dataset_name=EVENT1095	25889896	https://hddsexplorer.usgs.gov/browse/eo/disaster/201505_Flood_TX/AERIAL_CAP/AE00N31_200065W095_7632762015061
https://hddsexplorer.usgs.gov/order/process?ordered=1200752&node=HDDS&dataset_name=EVENT1095	23497671	https://hddsexplorer.usgs.gov/browse/eo/disaster/201505_Flood_TX/AERIAL_CAP/AE00N31_174033W095_7629052015061
https://hddsexplorer.usgs.gov/order/process?ordered=1200753&node=HDDS&dataset_name=EVENT1095	22290959	https://hddsexplorer.usgs.gov/browse/eo/disaster/201505_Flood_TX/AERIAL_CAP/AE00N31_184663W095_7630382015061
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https://hddsexplorer.usgs.gov/order/process?ordered=1200755&node=HDDS&dataset_name=EVENT1095	27793872	https://hddsexplorer.usgs.gov/browse/eo/disaster/201505_Flood_TX/AERIAL_CAP/AE00N31_171543W095_7627852015061

Map of Post-Event World View Imagery Available for Nepal



UNESCO World Heritage Dharahara Tower in Kathmandu

Animation Imagery

@Airbus Defense and Space

Photography from social
media



Social Media Feeds



Future Satellites Used for Disaster Response/Recovery

Relative Ground Swath

VIIRS 

spatial resolution: 375m, 750m

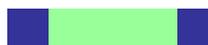


3000 km swath



Sentinel 2 

spatial resolution 10m, 20m and 60m



290 km swath



Landsat 

spatial resolution: 15m, 30m



183 km swath



Spot 5/6 

spatial resolution: 5m, 20m



60 km swath



Planet Labs 

spatial resolution: 3-5m



Commercial High Resolution Systems  

spatial resolution: .3 - 1m



10 - 20 km swath



Private Sector Competition

Imagery Acquired after Hurricane Sandy for Damage Assessments Loaded to HDDS

Public Domain ~~©~~

- ★ **NOAA Aerial Imagery**
 - 3,731 Images
- ★ **Civil Air Patrol**
 - 158,012 Images
- ★ **NC DOT Aerial Imagery**
 - 194 Images
- **EO 1 Hyperion**
 - 18 Images
- **International Space Station**
 - 78 Images
- **Landsat 7**
 - 4 images

Licensed ©

- **WorldView 1 & 2**
 - 1,028 images
- **SPOT**
 - 66 images
- **Radarsat-2**
 - 18 images
- **COSMO**
 - 8 images
- **TerraSar-X**
 - 4 images
- **DMC**
 - 3 images
- **RapidEye**
 - 3 images
- **QuickBird**
 - 2 images





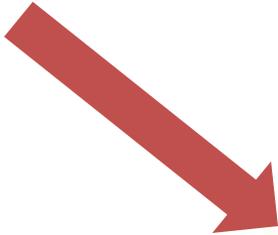
Public Domain Imagery ~~(C)~~



Hazards Data Distribution System (HDDS)

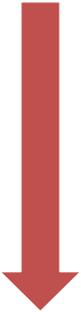
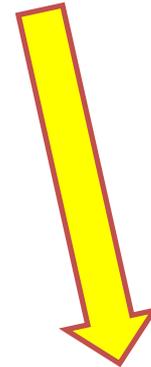
<http://hdds.usgs.gov/hdds2/>

Rest Services
Imagery Downloads



Google.org Crisis Response

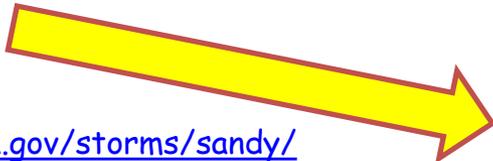
<http://google.org/crisismap/2012-sandy>



Viewer

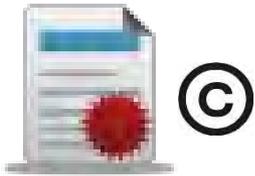
<http://ngs.woc.noaa.gov/storms/sandy/>

Plus: WMTS, TMS



Public
Governments
Responders

Use Constraints: We request that you credit the National Oceanic and Atmospheric Administration (NOAA) when you use these photos in a report, publication, or presentation.

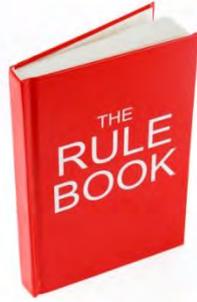


Licensed Imagery

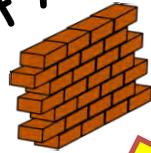


Hazards Data Distribution System (HDDS)
<http://hdds.usgs.gov/hdds2/>

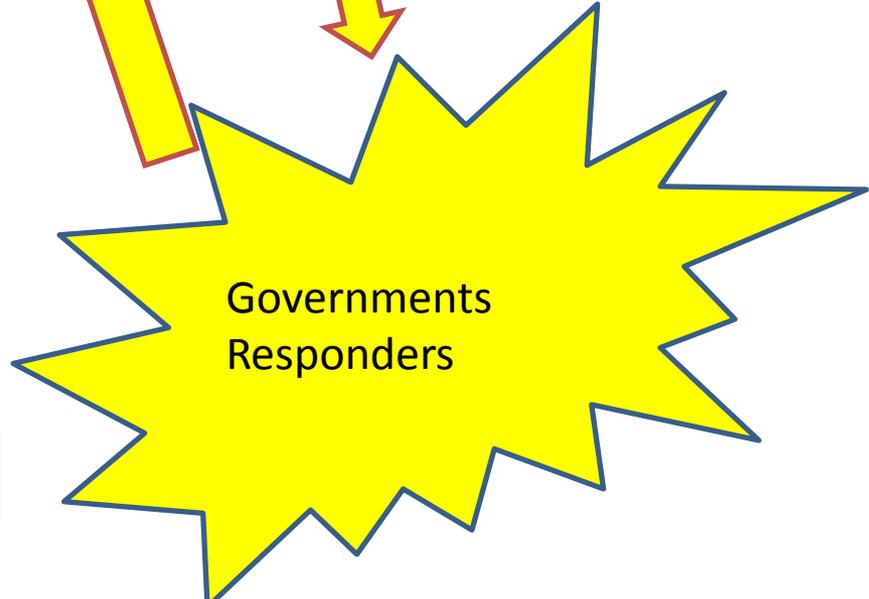
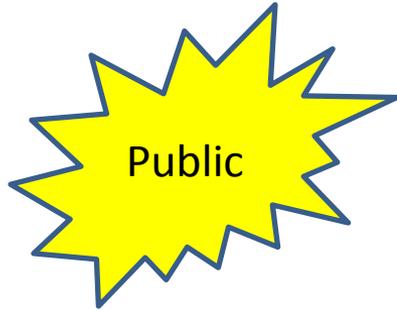
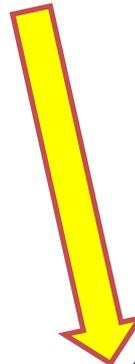
Imagery Downloads / Password Protected ★
No Rest Services

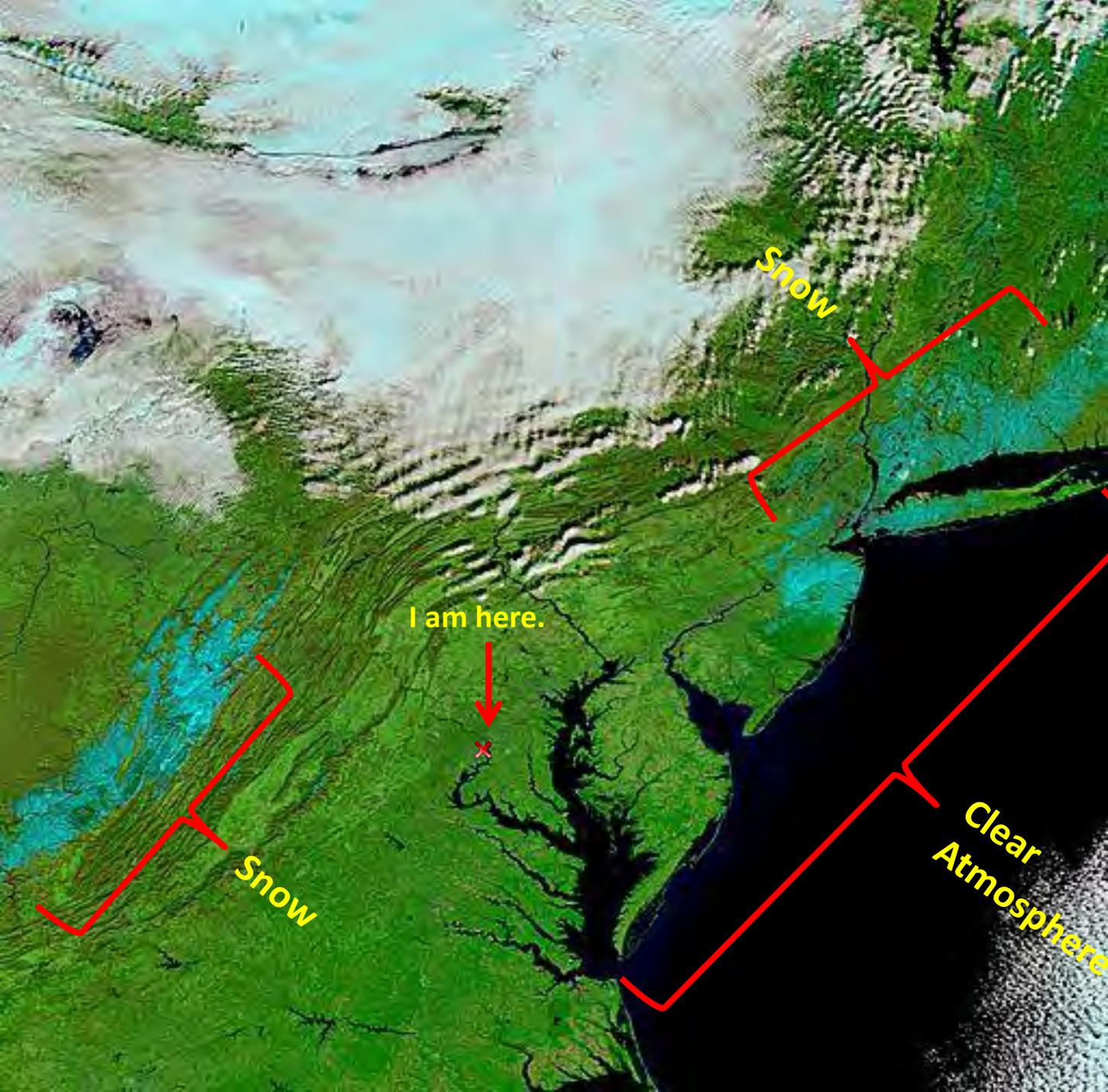


Limit Access



Request Access





Public Domain
Satellites are limited
by clouds

US Sandy Landfall:
October 29, 2012

November 9, 2012
MODIS Terra 721

11/9 was first mostly
clear day.

10 days after Landfall

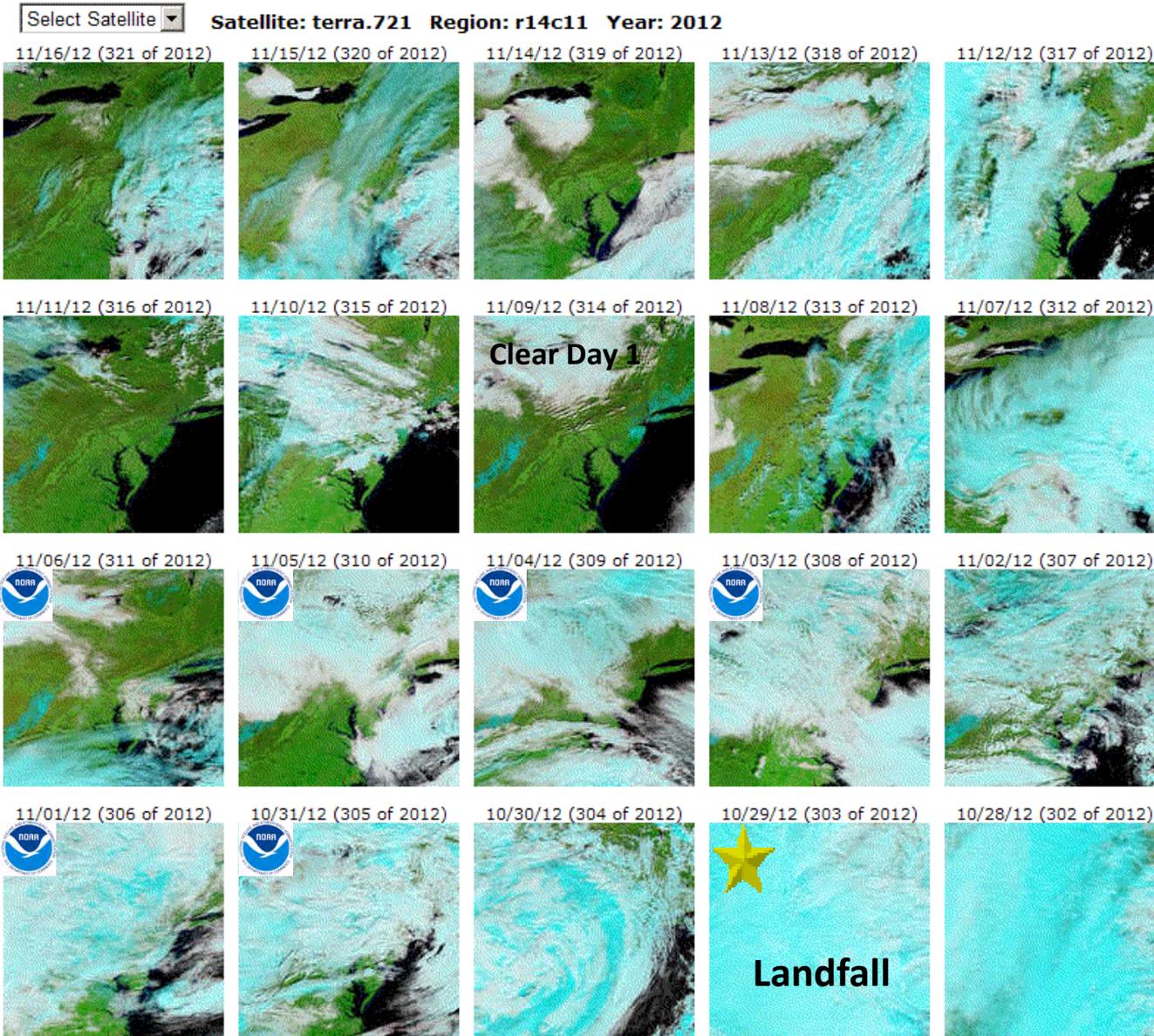
http://www.pecad.fas.usda.gov/cropexplorer/modis_summary/

Time series of MODIS Terra Note Cloud Cover

October 29, Sandy made
landfall in New Jersey

NOAA Completes flights on
November 6. Some areas
flow more than once.

 = NOAA Flights



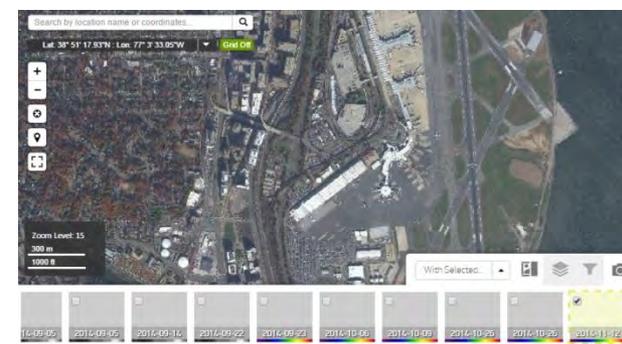
http://www.pecad.fas.usda.gov/cropexplorer/modis_summary/modis_page.cfm?regionid=us&modis_tile=r14c11

NOAA Aerial Imagery from 10/31 and 11/1/2012 plus unknown date (2014?) from Google





NGA funded



EnhancedView **Web** Hosting **Service**

DigitalGlobe orthorectified and Pan-Sharpended Imagery

<https://evwhs.digitalglobe.com/myDigitalGlobe/>

- EnhancedView Web Service (Natural Color)
- Subset of Disaster Imagery loaded to **HDSS**
- Users with .gov or .mil emails can self-register. WMS, WMTS, WFS, Google Earth KMZ

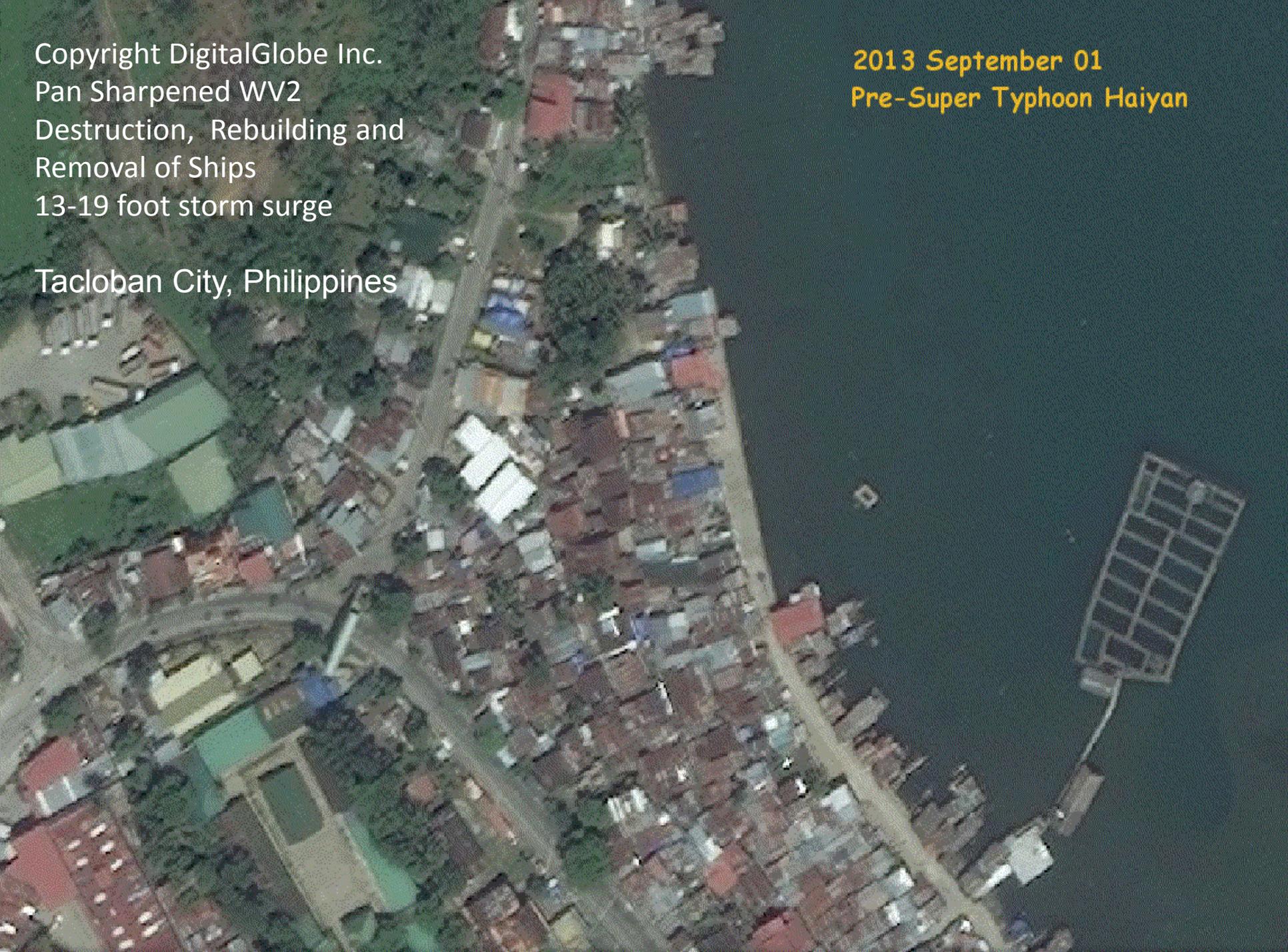
EMERGENCIES, DISASTERS, AND HUMANITARIAN EFFORTS

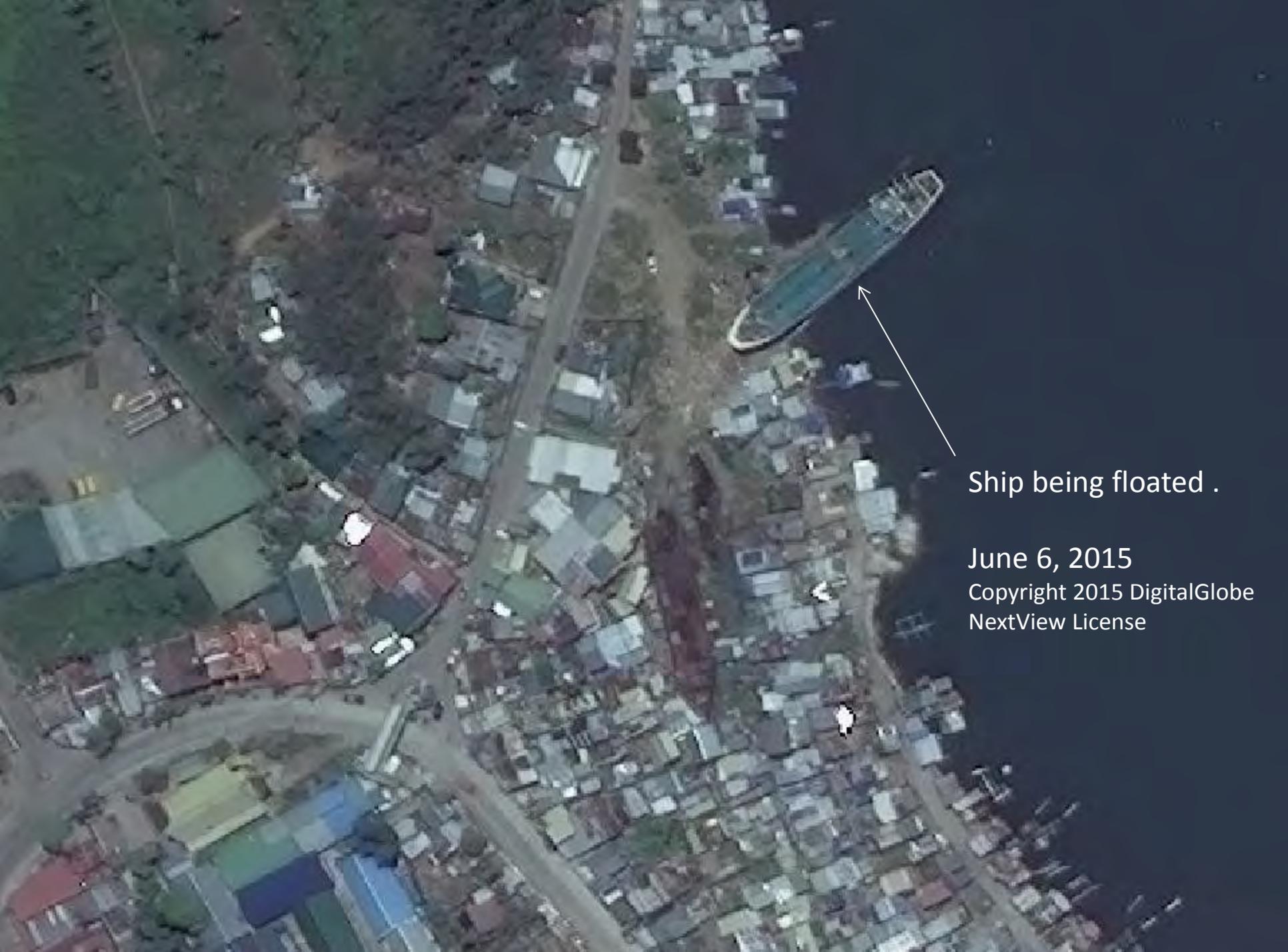
- In support of emergencies, disasters, and humanitarian efforts, the NGA may disseminate and/or post on open web sites imagery licensed under this contract regardless of whether the recipients are within the NextView license user groups. The imagery will contain the copyright notice and the NextView license notice.
 - In response to Super Typhoon Haiyan, at the request from NGA, DigitalGlobe allowed unrestricted access to imagery collected over the Philippines.
 - In response to 2015 Earthquake in Nepal, , DigitalGlobe allowed unrestricted access to imagery collected over Nepal

Copyright DigitalGlobe Inc.
Pan Sharpened WV2
Destruction, Rebuilding and
Removal of Ships
13-19 foot storm surge

Tacloban City, Philippines

2013 September 01
Pre-Super Typhoon Haiyan





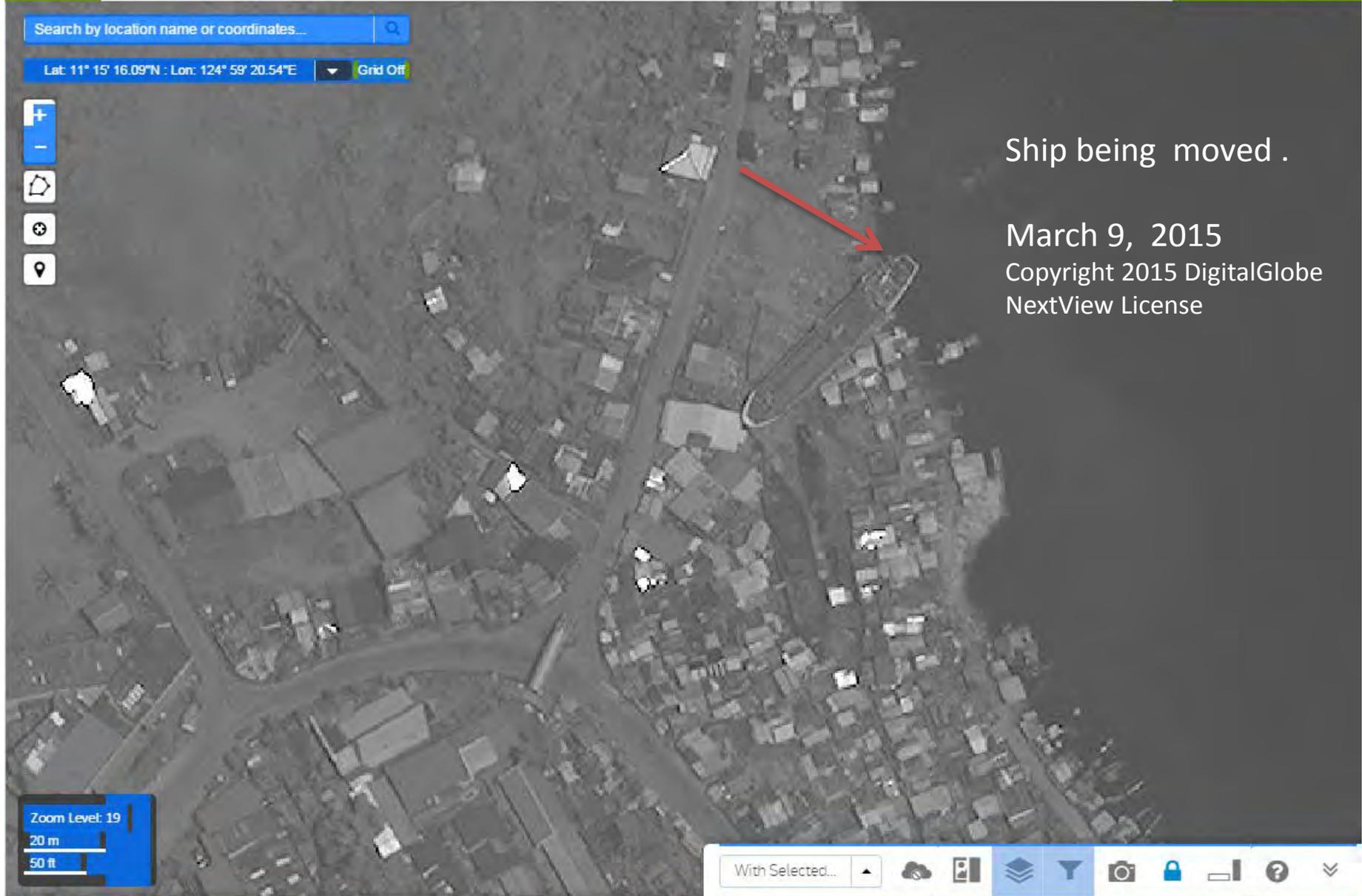
Ship being floated .

June 6, 2015

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Search by location name or coordinates...

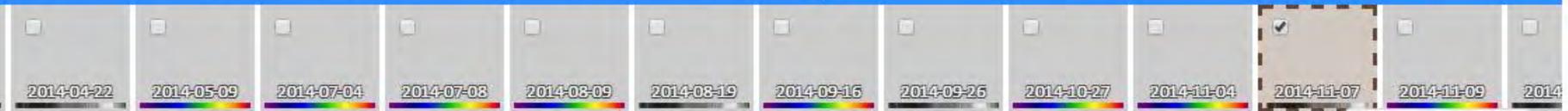
Lat: 11° 15' 16.09"N Lon: 124° 59' 20.54"E Grid Off



Ship being moved .

March 9, 2015
Copyright 2015 DigitalGlobe
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Zoom Level: 19
20 m
50 ft



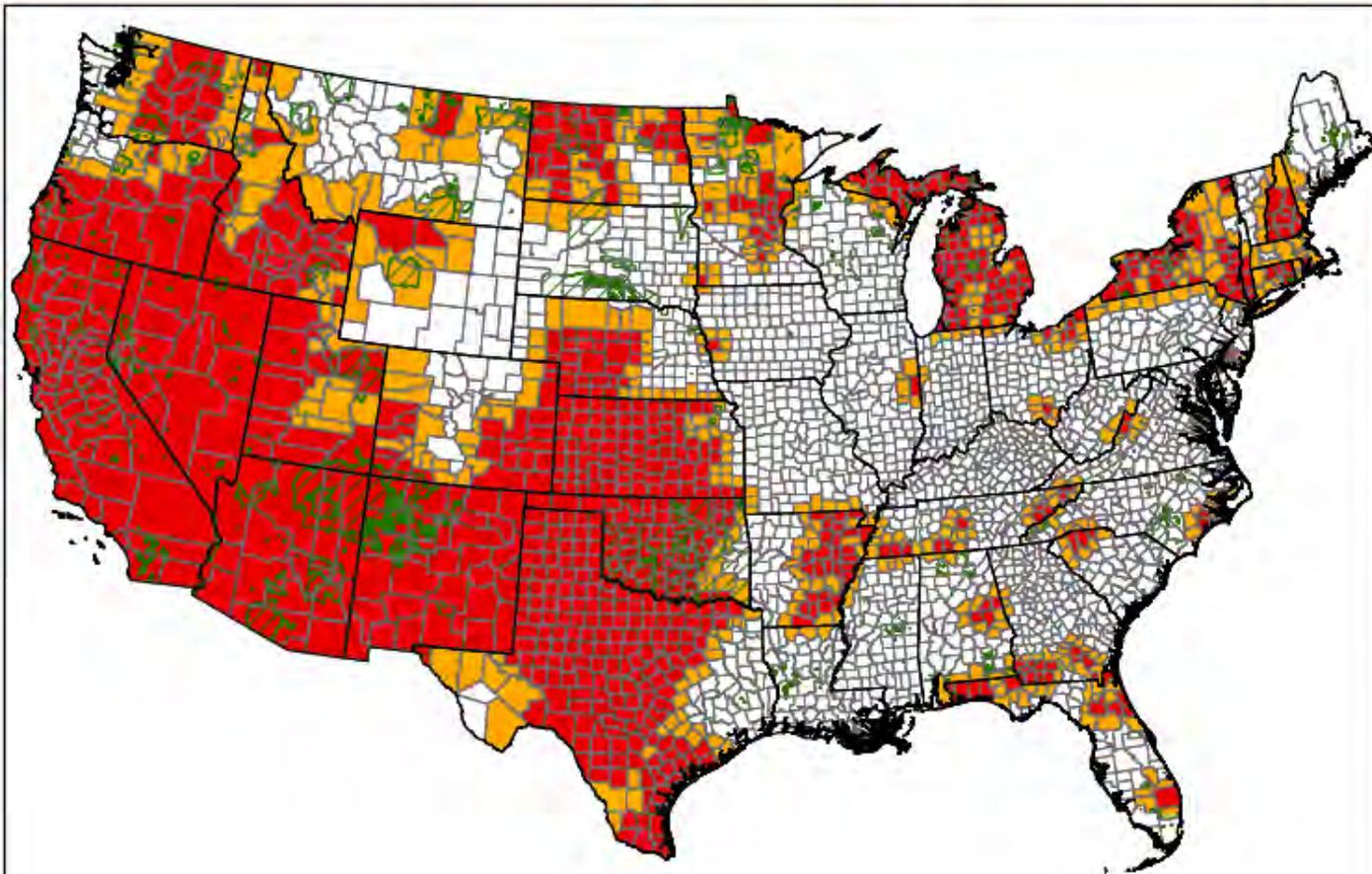


Questions?
glenn.bethel@usda.gov

2005.09.20 12:37

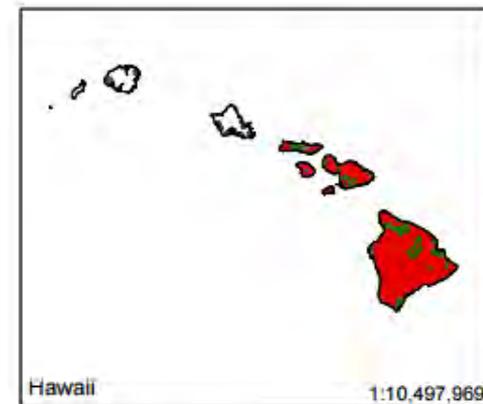
Secretarial Disaster Designations - CY 2014

Primary and Contiguous Counties Designated for 2014 Crop Disaster Losses



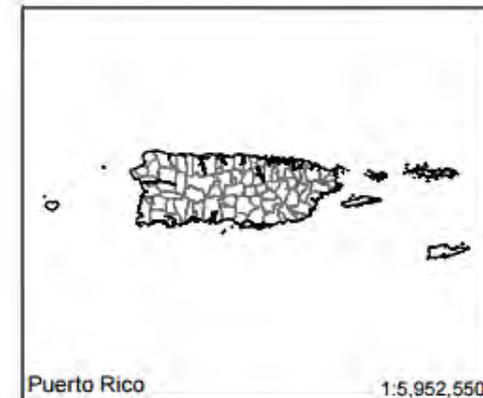
Alaska

1:51,251,424



Hawaii

1:10,497,969



Puerto Rico

1:5,952,550

All Secretarial Designations as of March 25, 2015

Total All Crop Approved Designations

-  State Boundary
-  County Boundary
-  Tribal Lands
-  Primary Counties: 816
-  Contiguous Counties: 528



USDA Farm Service Agency
Production, Emergencies and Compliance Division
Washington, D.C.
March 25, 2015

1:23,721,366