

Roundtable Discussion

Lessons Learned from Midwest Floods

February 4, 2016

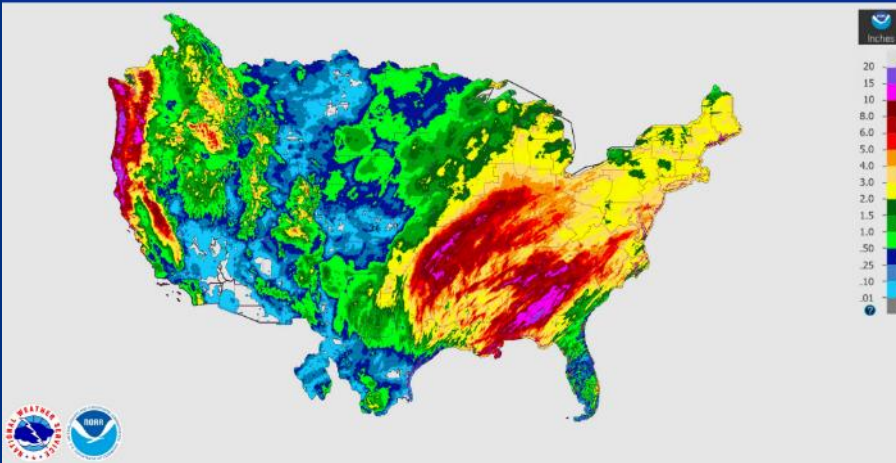


FEMA

Midwest Flood Event

December 29, 2015 14-Day Observed Precipitation - Continental United States

Created on: December 29, 2015 - 20:06 UTC
Valid on: December 29, 2015 12:00 UTC



- Warm temperatures and tropical moisture created conditions for heavy rainfall
- Many areas experienced more than 12 inches of rain
- Resulted in massive floods in Illinois, Missouri, and Arkansas

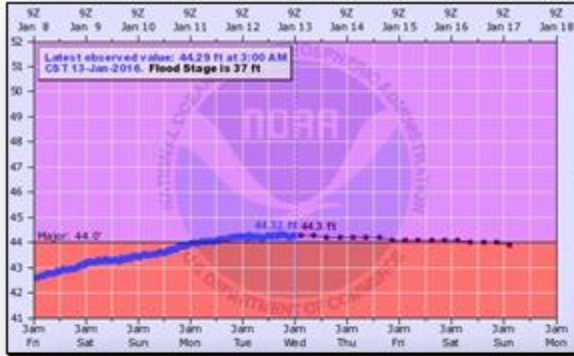


Source: (Missouri National Guard via Reuters)

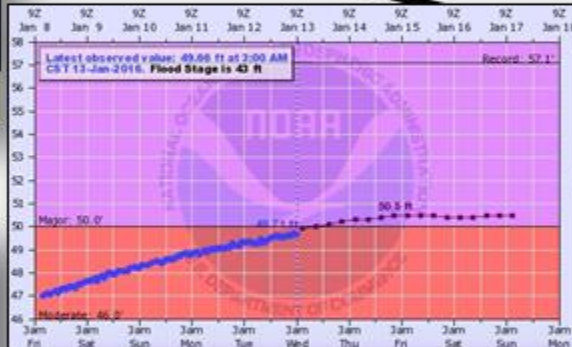


FEMA

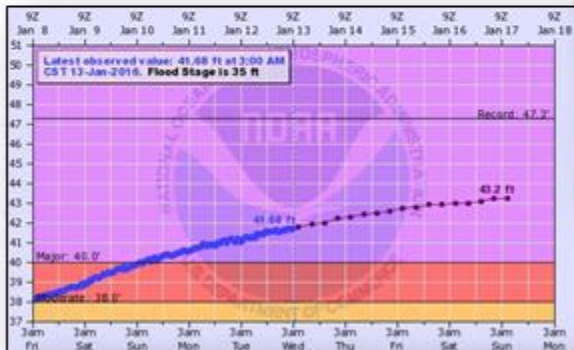
Midwest Flood Event



Mississippi River at Greenville, MS



Mississippi River at Natchez, MS



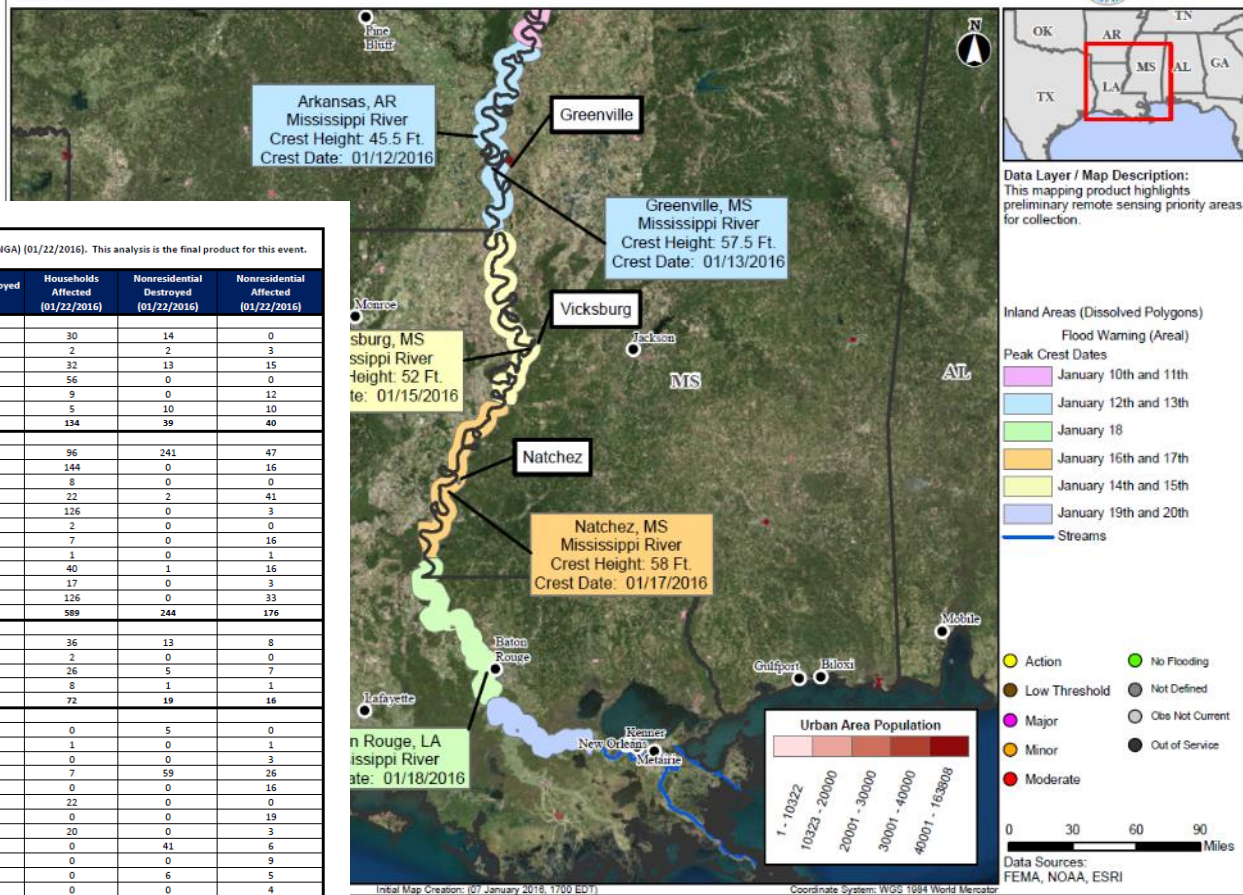
Mississippi River at Baton Rouge, LA



FEMA

Midwest Flood Event

Preliminary Remote Sensing Map: (07 January 2016, 1700 EST)
MS-AR-LA



The following table represents geospatial damage assessments taken from FEMA and the National Geospatial Intelligence Agency (NGA) (01/22/2016). This analysis is the final product for this event.

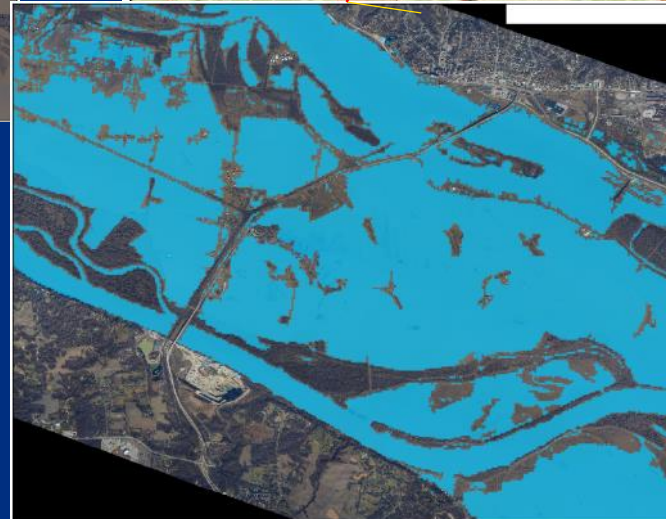
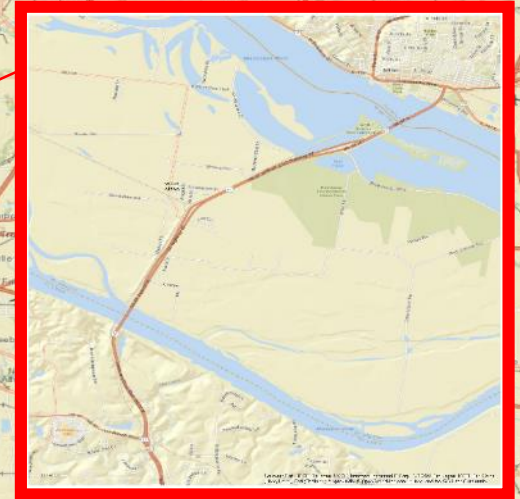
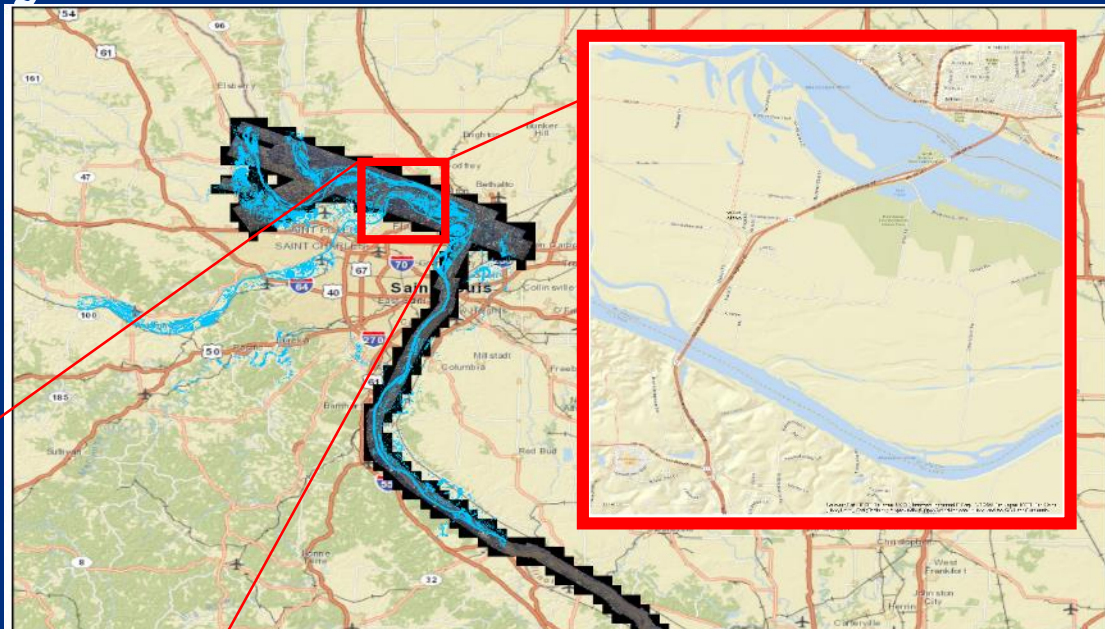
County Name/State Name	All Structures Affected and Destroyed (01/22/2016)	Total Damaged Households (01/22/2016)	Total Damaged Nonresidential (01/22/2016)	Households Destroyed (01/22/2016)	Households Affected (01/22/2016)	Nonresidential Destroyed (01/22/2016)	Nonresidential Affected (01/22/2016)
Arkansas							
Chicot	69	55	14	25	30	14	0
Crittenden	12	7	5	5	2	2	3
Desha	81	53	28	21	32	13	15
Lee	56	56	0	0	56	0	0
Mississippi	21	9	12	0	9	0	12
Phillips	71	51	20	46	5	10	10
Totals	310	231	79	97	134	39	40
Illinois							
Alexander	563	275	288	179	96	241	47
Calhoun	160	144	16	0	144	0	16
Greene	8	8	0	0	8	0	0
Jackson	65	22	43	0	22	2	42
Jersey	129	3	126	3	126	0	3
Johnson	2	2	0	0	2	0	0
Madison	23	7	16	0	7	0	16
Monroe	2	1	1	0	1	0	1
Pulaski	59	42	17	2	40	1	16
Randolph	20	17	3	0	17	0	3
Union	160	127	33	1	126	0	33
Totals	1191	771	420	182	589	244	176
Kentucky							
Ballard	97	76	21	40	36	13	8
Carlisle	2	2	0	0	2	0	0
Fulton	38	26	12	0	26	5	7
Hickman	10	8	2	0	8	1	1
Totals	147	112	35	40	72	19	16
Louisiana							
Ascension	5	0	5	0	0	5	0
Avoyelles	6	5	1	4	1	0	1
Catahoula	3	0	3	0	0	0	3
Concordia	402	317	85	310	7	59	26
East Baton Rouge	16	0	16	0	0	0	16
East Carroll	22	0	22	0	22	0	0
Jefferson	19	0	19	0	0	0	19
Madison	23	0	23	0	20	0	3
Pointe Coupee	283	236	47	236	0	41	6
St. Charles	9	0	9	0	0	0	9
St. James	13	2	11	2	0	6	5
St. John the Baptist	4	0	4	0	0	0	4
Tensas	55	38	17	37	1	17	0



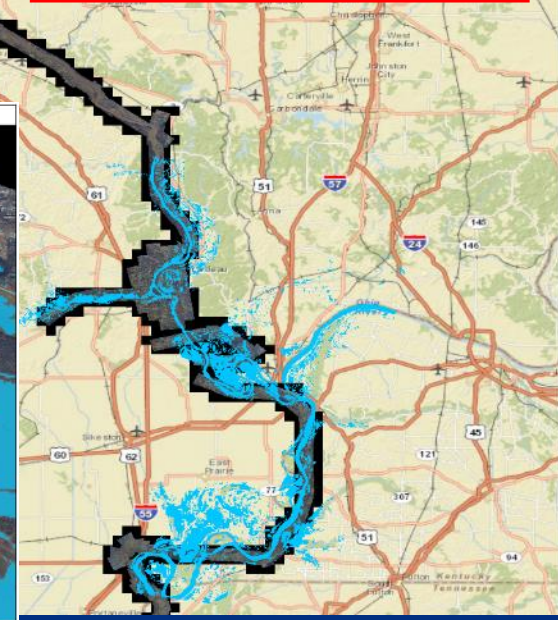
Geospatial Analysis - SAR



NOAA imagery



SAR derived flood extents

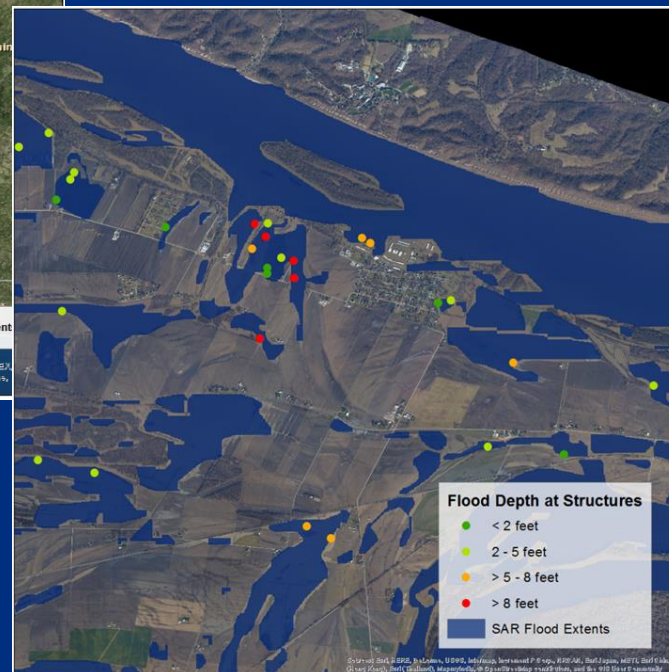


FEMA

Geospatial Analysis - SAR



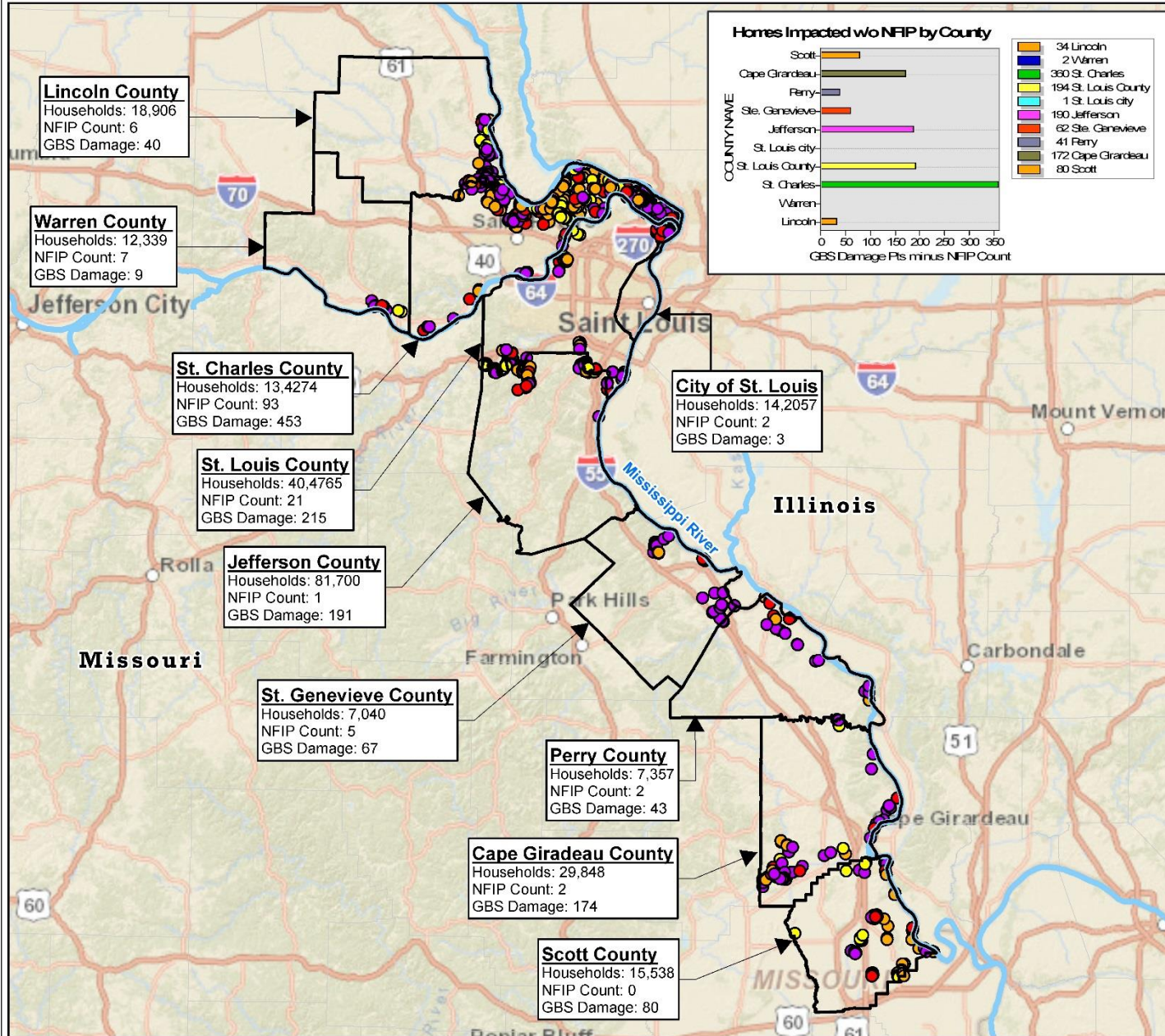
- Three SAR providers:
 - Cosmo-SkyMed, RadarSat-2, TerraSAR-X
- Each scene had different:
 - Resolutions, look angles, acquisition dates



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Estimated Impact Analysis: (03 February 2016, 1400 EST)

Mississippi River (St. Louis - Cape Girardeau), Missouri



Data Layer / Map Description:
 This map displays initial estimated impacts from riverine flooding event. This experimental analysis includes geospatial intersect of Global Building Stock (GBS) with Synthetic Aperture Radar (SAR inundation area, and National Flood Insurance Program (NFIP) polices identification.

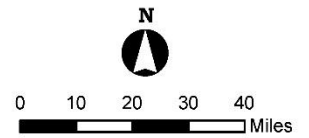
Missouri Total Impact:
 1500 Structures

Building Damage Assessment

- Destroyed Total: 542
- Major Total: 243
- Minor Total: 251
- Affected Total: 150

County of Interest

□ County with Impacted Buildings



Data Sources:
 FEMA, HSIP 2015, USACE, Esri, NGA

Interagency Briefs

NASA

NGA

NOAA

USACE / CAP

USDA

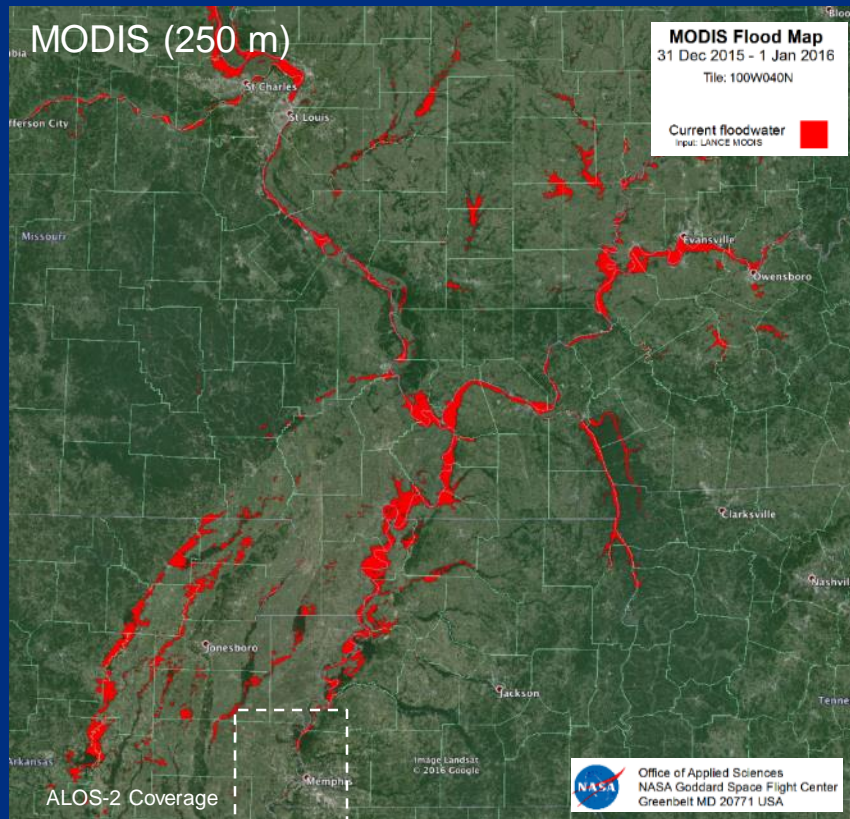
USGS - International Charter



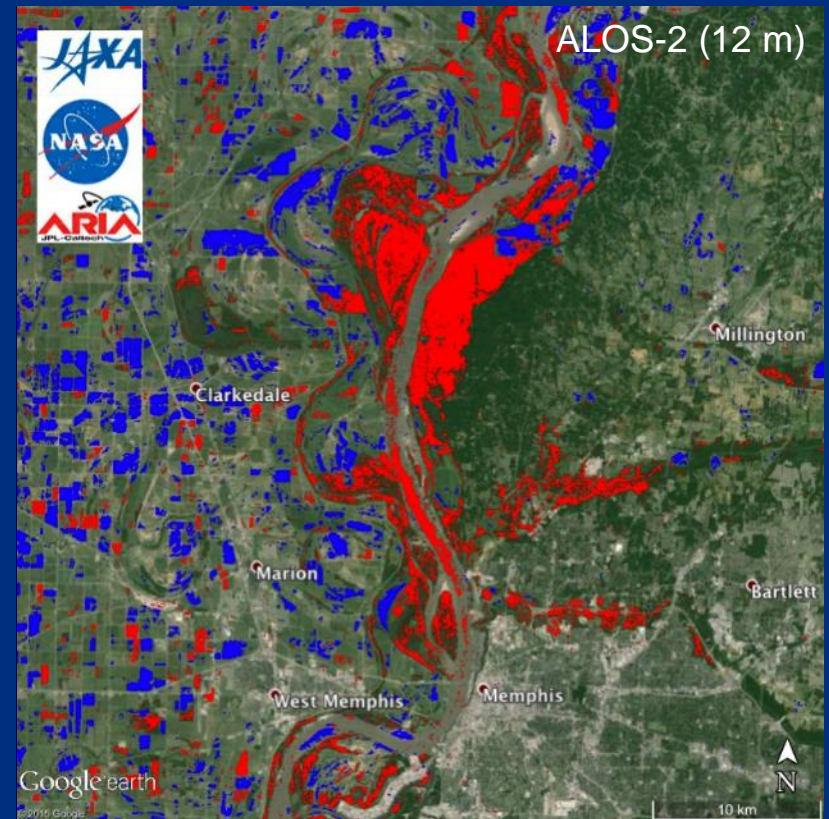
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NASA – Remote Sensing of Flood

NASA MODIS Detections and JAXA ALOS-2 Synthetic Aperture Radar



Flood detections (red) from NASA Near Real-Time Global Flood Mapping with flood extent on January 1, 2016, courtesy of Goddard Space Flight Center.



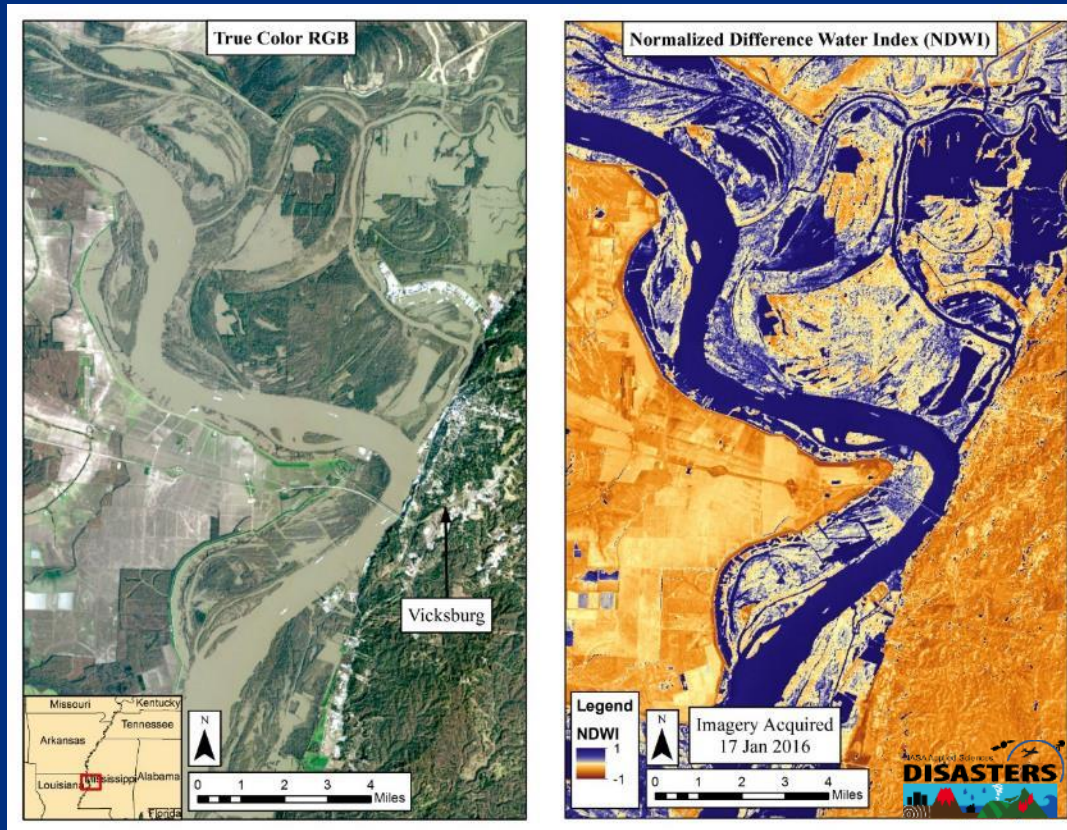
Standing water (blue) and water-inundated vegetation (red) detected by ALOS-2 and the Synthetic Aperture Radar (SAR) at the Jet Propulsion Laboratory, January 6. Coverage area shown as dashed inset of MODIS image.



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NASA - Remote Sensing of Flood

Multispectral Views from NASA's Earth Observing-1 Mission



True color (left) and Normalized Difference Water Index (right) imagery derived from NASA's Earth Observing-1 mission, observed near Vicksburg, Mississippi on 17 January 2016.

NASA staff at Goddard Space Flight Center and Marshall Space Flight Center targeted collections of imagery by NASA's Earth Observing-1 (EO-1) mission.



Multispectral imaging by EO-1 provides true color imagery (left) and capabilities for derived products (right), and can also be applied to Landsat-7 and Landsat-8 missions, Aqua and Terra MODIS, Suomi-NPP VIIRS, and other imagery provided by federal agency partners, International Charter, and commercial vendors.

Here, true color imagery near Vicksburg, Mississippi highlights flood water (left) along the Mississippi in a visual sense, while the Normalized Difference Water Index helps to draw attention to standing water (right) in shades of blue.



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NGA – Structure Assessments

FEMA  

Central U.S. Flood Journal

4. Building Impacts

Tab 1. Damage Assessments. This map depicts the damage assessments of structures as necessary and/or available.

Tab 2. NGA Flood Extent Analysis. NGA-provided flood extent estimate supplemented with statistics from ESRI covering total housing units, population, and insured homes. The statistics will be updated periodically to reflect updates from NGA to the flood extent boundaries. Current statistics reflect the assessed extent as of 12/31/2015.

Tab 3. SAR Estimated Flood Extent. Estimate derived from satellite as of 1/6/2016. Click a polygon to view ESRI estimated demographics associated with the extent.

Tab 4. NASA Estimated Flood Extent. Click the polygon to view ESRI estimated demographics associated with the extent.

5. Transportation

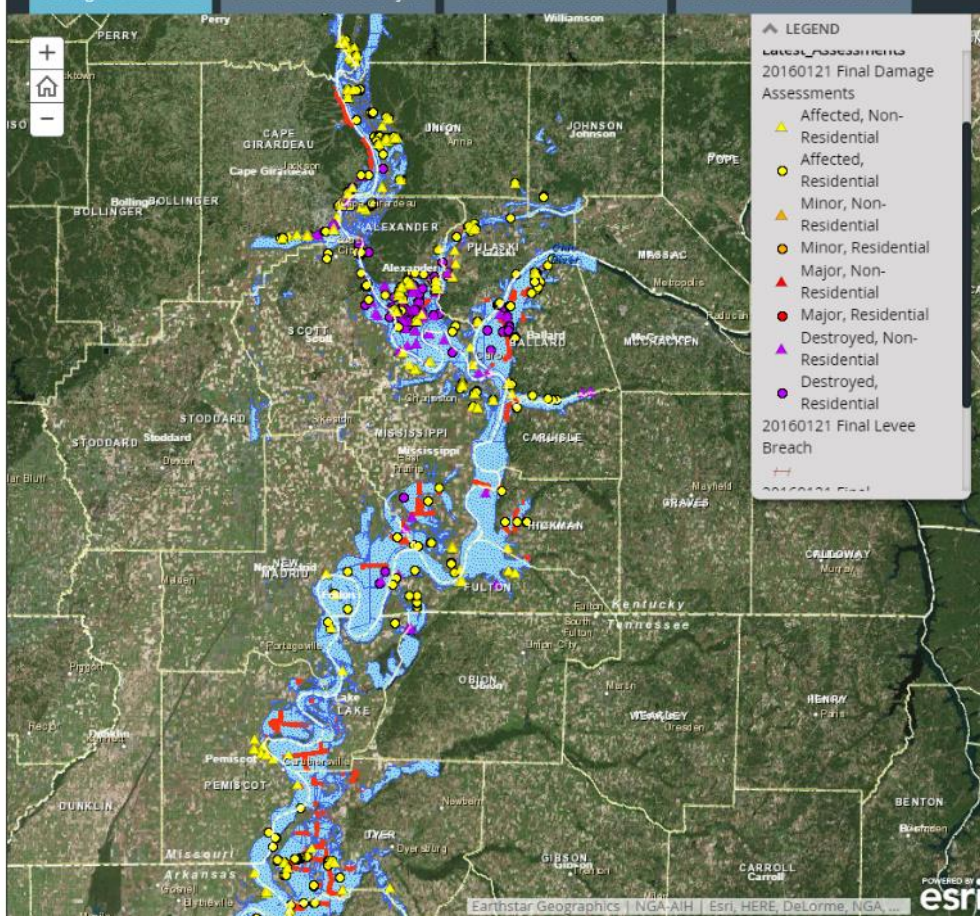
Tab 1. ESRI Live traffic feed. Zoom in to reveal greater detail and information on local road closure, accidents, or construction in this up-to-date feed.

Tab 2. Waze™ Real Time Road Closure reports.

6. Lifeline: Infrastructure and Essential Facilities

4. Building Stock Impacts

Damage Assessments | NGA Flood Extent Analysis | SAR Estimated Flood Extent | NASA Estimated Flood Extent




LEGEND

20160121 Final Damage Assessments

- Affected, Non-Residential
- Affected, Residential
- Minor, Non-Residential
- Minor, Residential
- Major, Non-Residential
- Major, Residential
- Destroyed, Non-Residential
- Destroyed, Residential

20160121 Final Levee Breach

Earthstar Geographics | NGA-AH | Esri, HERE, DeLorme, NGA... 



FEMA

NGA – Observera / iView

Order Details for ASAT Cairo 11 W (000000761)

Original Request Summary

- Status: Completed
- Created: 01/12/2016 04:39
- Last Updated: 01/13/2016 08:02
- Distribution: Imagery Standard
- Run Number: 067-13
- Account: FEMA

Operator Information

- Originator: gkm.russell
- Name: Glen Russell
- Email: gkm.russell@fema.dhs.gov
- Phone Number: 202-585-6882

New Collection Status

- Start: 01/12/2016
- Stop: 01/18/2016
- Timezone Offset: GMT - 5.0 hrs

Location

#	Type	Latitude	Longitude
1	Polygon	33.06550800N	115.39230400W
2	Polygon	33.06550800N	115.39230400W
3	Polygon	33.06550800N	115.39230400W
4	Polygon	33.06550800N	115.39230400W

New Collection Table

#	Status	Cost	# of Scenes	Expiration (GMT)	Asset	Start Time (Target Local)	Start Time (GMT)	See Im.	Notes
1	Submitted to Vendor	\$50,000.00	1.0	01/11/2016 23:07:26	ASATASAT_2 and ASATASAT_2 SWR +MULI+MCSB	01/12/2016 06:37:26	01/12/2016 06:37:26	11.0	Extended High
2	Not TMS					01/12/2016 06:37:26	01/12/2016 06:37:26		high resolution

Product Status Table

Work Order #	Status	Product	Image Type	Image ID	Pr
000000761_1	Available	Native (SICD or SCS)	New Collection	Collection Page 1	00
000000761_2	Pending	Sub-aperture Stack (SAS)	New Collection	Collection Page 1	00
000000761_3	Pending	Flour	New Collection	Collection Page 1	00
000000761_4	Available	Colorized Sub-aperture Image	New Collection	Collection Page 1	00

iView Workspace Manager

Workspace (Data): DIFEB16R500, Auto DTED, Panel1

Coordinate System: Geographic, Horiz Datum: NAD83

Map View: 33 06 55.0800N 115 39 23.0400W

COORDINATE SYSTEM: Geographic
DATUM: WGS_84 (NAD 83)

iView Image Tools

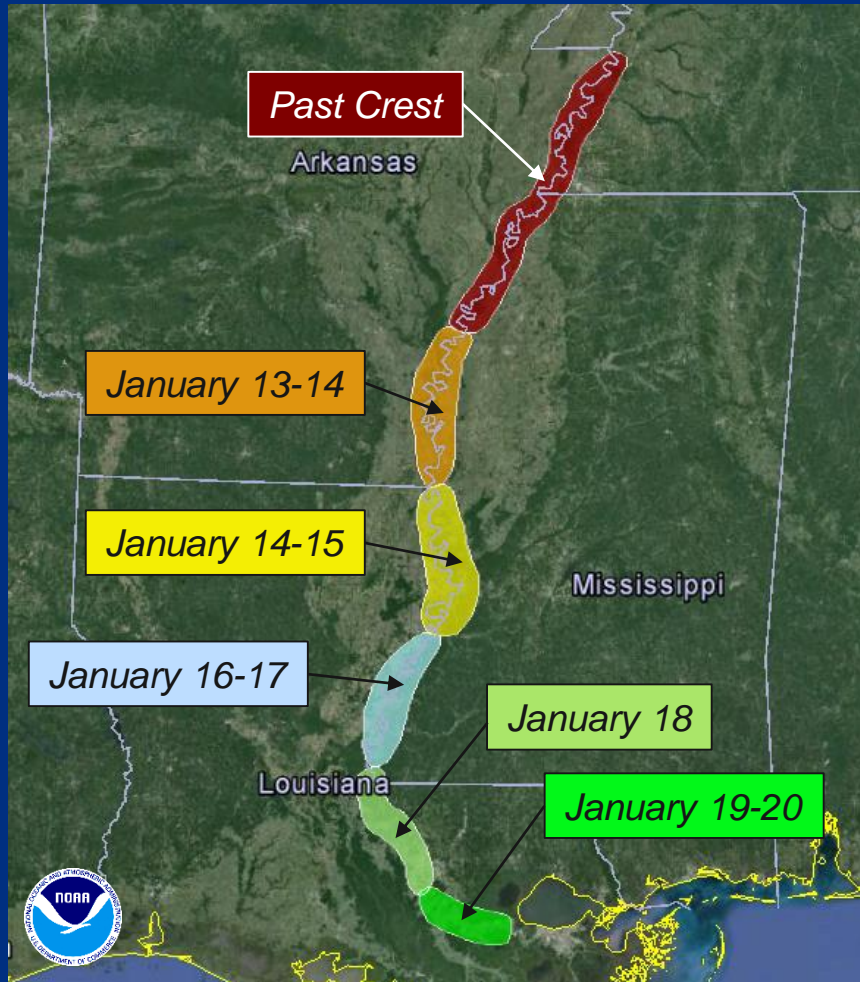
Image Tools: Pan, Zoom, Rotate, Linked Panel, Overviews

20 48 42.7 45.660 m DTED N/A Math Model: Four Corner (EXT)



FEMA

NOAA – Decision Support



- The NOAA Liaison to FEMA translated hydrologic forecasts into KMZ files to depict location and timing of peak crests along the Mississippi River
- The liaison also provided cloud cover forecasts to help prioritize remote sensing / aerial imagery collection opportunities
- Forecast information was briefed to FEMA and interagency partners on a daily basis

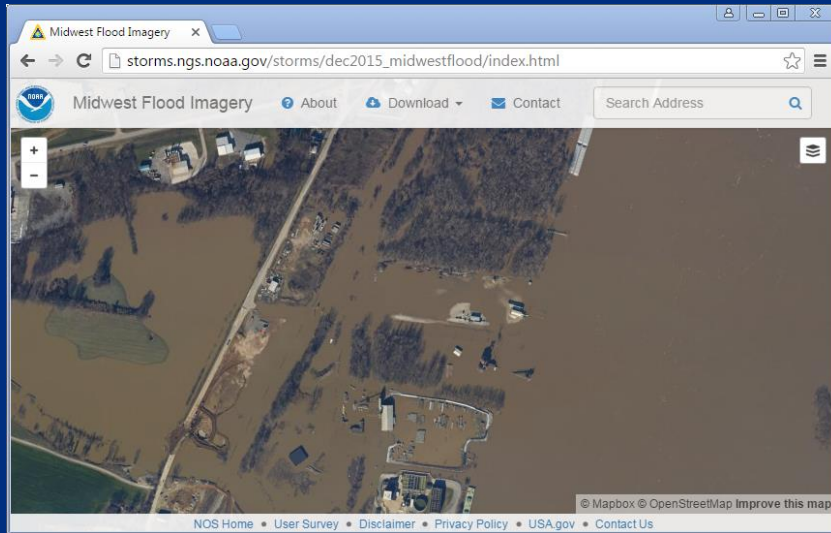


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NOAA – Flood Response Imagery



Georeferenced airborne imagery acquisition: January 1–18, 2016



- 68 total hours flown (two aircraft)
- Data published to the web within hours of landing
 - 9 million web “hits” / 1 TB of data downloaded
 - http://storms.ngs.noaa.gov/storms/dec2015_midwestflood/index.html
- Primary users FEMA and NGA
 - Available to other users and public
- Imaged ~7,475 sq. miles
 - 10,067 frame images acquired – including 4,710 Red/Green/Blue, 2,713 Near Infrared and 2,644 Oblique (side looking)



NOAA King Air Aircraft



Aerial Digital Camera



FEMA

USACE/CAP

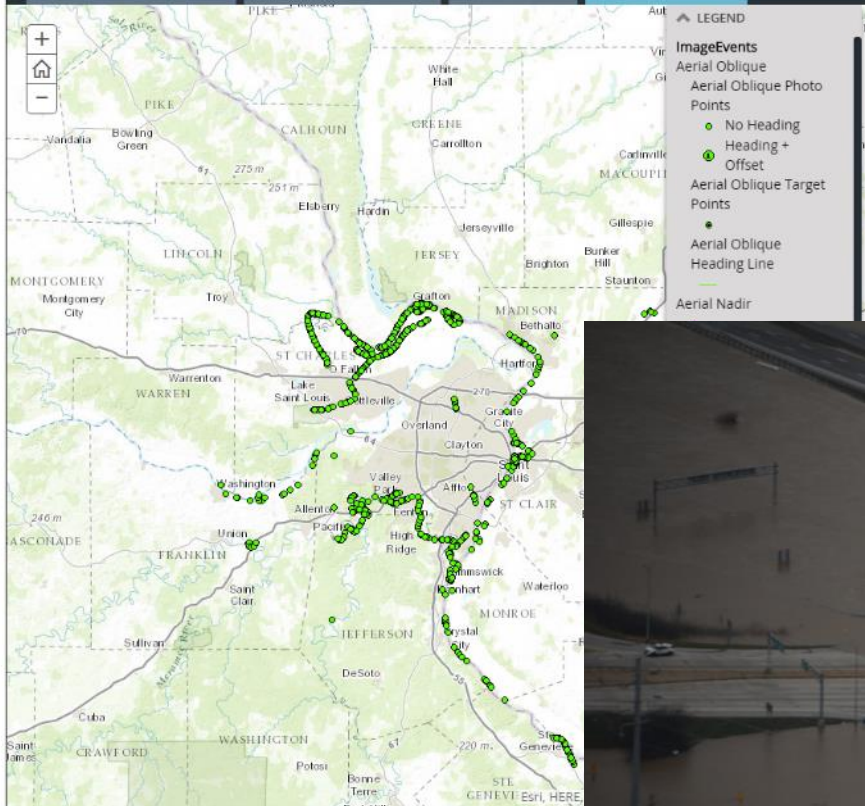
FEMA



1. Hazard Map

FEMA

- Precipitation and Gauge Data
- National Flood Hazard Map
- Areas of Interest
- Civil Air Patrol Images



Central U.S. Flood Journal

This journal presents the FEMA GeoFramework web map collection for floods. At any time, this journal can be used for demonstration purposes and to serve as a template for future events. During an actual event, maps presented in this journal depend on the availability and quality of data.

1. Hazard Map

Tab 1. Precipitation and Gauge Data. National overview of precipitation and stream gauge information to indicate flood events and threats.

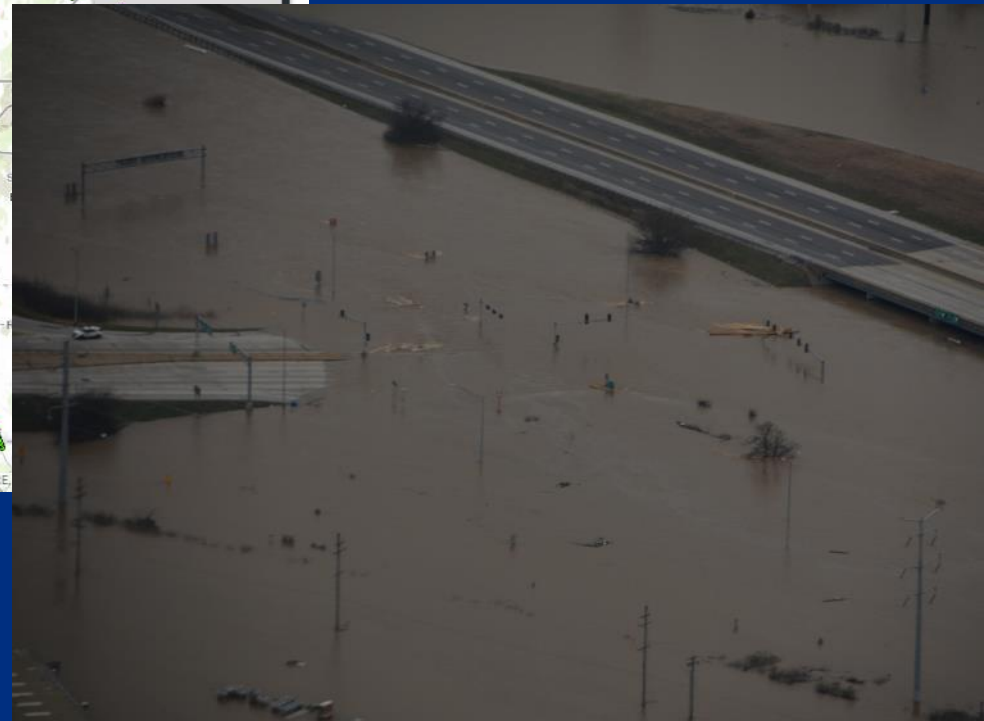
Tab 2. National Flood Hazard Layer by FEMA.

Tab 3. Some selected areas of interest.

Tab 4. Civil Air Patrol Imagery. Click a point on the map, then click "More Info" in the ImageURL field to view the image.

2. Declaration

Tab 1. Filter by state or declaration number.



FEMA

Daily emails listing geospatial information and remotely sensed imagery products

January 28, 2016


201512_Flood_Midwest_US
Geospatial Information and Remotely Sensed Imagery Products

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

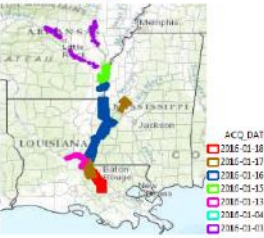
Select Event: "201512_Flood_Midwest_US" → click on "*" and then "Search"
Download Shapefiles for image footprints:
http://hddsexplorer.usgs.gov/data/list/disaster/201512_Flood_Midwest_US/shapefiles/index

Note: For the HDDS links, copy the links and paste them into your browser.

NOAA Aerial WGS84



NOAA Aerial NAD83



USGS – International Charter

Agency	Sensor	Scenes	New Acquired or Archived	Sensor type
DLR	TerraSAR-X	8	New Acquired	Radar
	RapidEye	19	New Acquired	Optical
DMCii	UK-DMC2	5	New Acquired	Optical
		2	Archived	Optical
ISRO	RISAT-1	8	New Acquired	Radar
	Resourcesat-2	4	New Acquired	Optical
MDA (via DoD Eagle Vision)	RadarSAT	6	New Acquired	Radar
JAXA	ALOS-2 PALSAR-2	14	New Acquired	Radar
		11	Archived	
ROSCOSMOS	RESURS-P	15	New Acquired	Optical
	KANOPUS-V	1	New Acquired	
USGS	Worldview 2&3	3664	New Acquired	Optical
	Landsat-7	24	New Acquired	Optical
	Landsat-8	67	New Acquired	Optical



FEMA

Lessons Learned

SAR flood extents

SAR Interagency calls

International Charter

Local interagency coordination for products



FEMA

Lessons Learned

Need for more interagency collaboration to produce products in support of response and recovery efforts

Ensure existing protocols are continued to obtain SAR data quickly

Outreach to FEMA leadership

Have an after-action focused on scientific / analytical / modeling efforts





FEMIA