National Aeronautics and
Space Administration

ARSET

Applied Remote Sensing Training

http://arset.gsfc.nasa.gov

@NASAARSET

Advanced Webinar on using NASA Remote Sensing for Flood Monitoring and Management

Instructors:

- Amita Mehta (ARSET)
- Kyle Peterson (ARSET)

Week-2

Acknowledgements

- **Training Set-up, Coordination, and Website Help**

  Brock Blevins
  Elizabeth Hook

- **QGIS Exercise**

  Kyle Peterson

Spanish Translation

  David Barbato

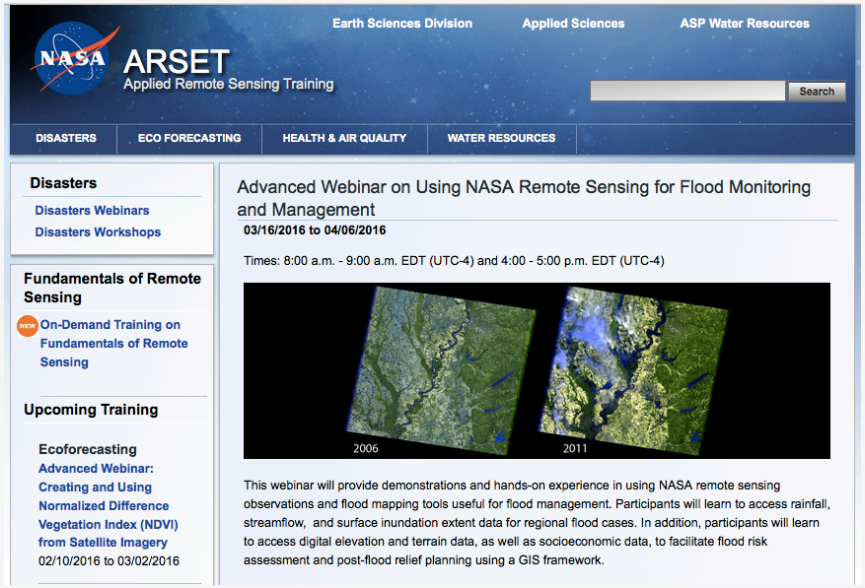
- **ARSET Manager**

  Ana Prados

Course Material

http://arset.gsfc.nasa.gov/disasters/webinars/advfloodwebinar

Webinar presentations, exercises, homework assignments, and recordings



Links will be available here

Course Materials

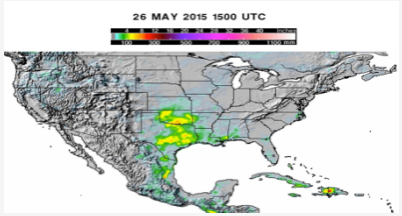
Date	Title	Materials
March 15, 2016	View **Week 1**, **Week 2**, and **Week 3** of **NASA Remote Sensing Observations for Flood Management**	**Homework** - due March 15
March 16, 2016	Demonstration of Flood Mapping Web Tools Based on NASA Remote Sensing Observations of Rainfall	Recording Slides Homework
March 23, 2016	Demonstration of Flood Mapping Web Tools Based on NASA Remote Sensing Observations of Land Cover	Recording Slides Homework
March 30, 2016	Overview and Access to Ancillary NASA Data for Flood Management	Recording Slides Homework
April 6, 2016	Flooding Case Studies Using NASA Web Tools and GIS	Recording Slides Homework

Homework and Certificate

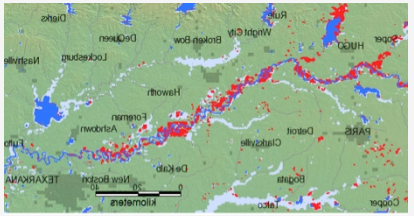
- **Homework**
  - Hands-on exercises
  - Answers to homework questions via Google form
  - Available at http://arset.gsfc.nasa.gov/disasters/webinars/advfloodwebinar
- **Certificate of Completion**
  - Attend all 4 webinar sessions
  - Complete all 4 homework assignments
  - Certificates will be emailed approx. 2 months after the course finishes by Marines Martins (marines.martins@ssaihq.com)

Course Outline

Week 1: Demonstration of Flood Mapping Web Tools Based on NASA Remote Sensing Observations of Rainfall

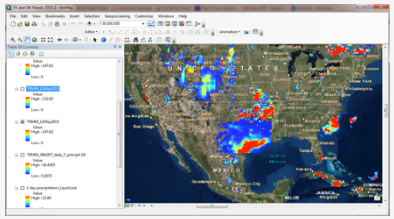


Week 2: Demonstration of Flood Mapping Web Tools Based on NASA Remote Sensing Observations of Land Cover



Week 3: Overview & Access to Ancillary NASA Data for Flood Management

Week 4: Flooding Case Studies Using NASA Web Tools and GIS



Agenda: Week 2

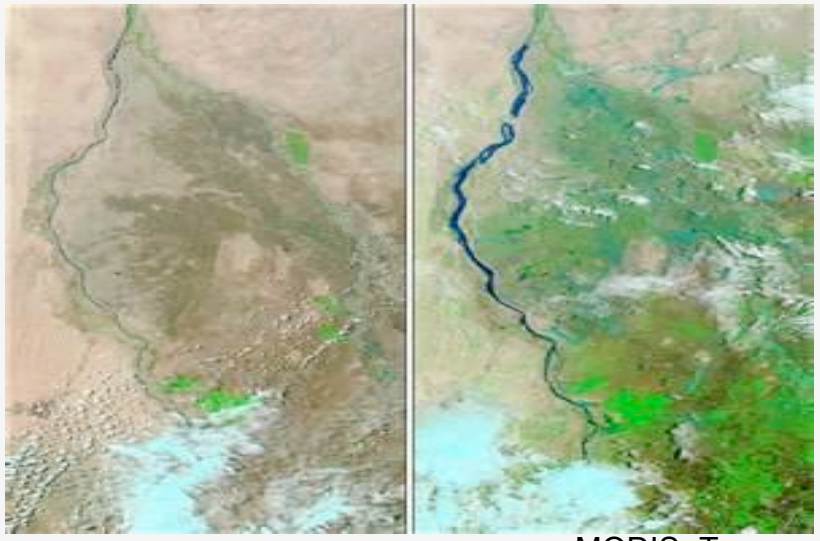
- Demonstration and hands-on exercises of flood mapping using remote sensing of land cover from Terra and Aqua – Moderate Resolution Imaging Spectroradiometer (MODIS)
  - Overview and Demonstration of The Dartmouth Flood Observatory
  - Overview and Hands-on Exercise of using MODIS Near Real-Time Global Flood Mapping
  - Exercise of MODIS Flood Mapping using QGIS

Inundation Mapping

Using Terra/Aqua MODerate Resolution Imaging Spectroradiometer (MODIS)

- MODIS provides observations of land-surface. MODIS reflectance from these bands 1, 2, and 7 [620-670 nm, 841-876 nm, and 2105-2155 nm respectively] indicate the presence of water on land surface previously not covered by water
- A global reference database of water bodies is formed at at 250 m resolution – inundation is mapped with respect to this reference water
- MODIS can not see the surface in the presence of clouds

Flooding along the White Nile, Sudan
earthobservatory.nasa.gov



MODIS-Aqua
6/19/2003

MODIS- Terra
8/11/2003

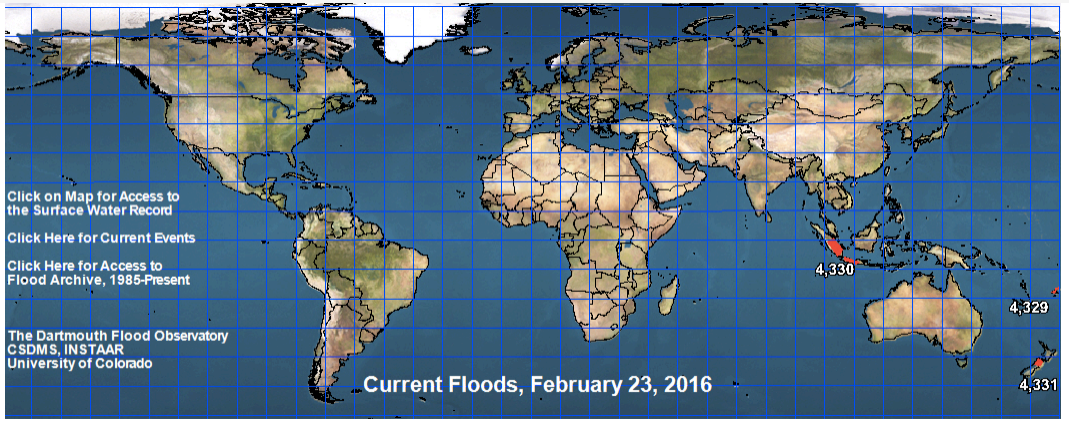
The Dartmouth Flood Observatory (DFO) Overview and Demonstration

http://floodobservatory.colorado.edu/

Image Credit: Terra MODIS/Worldview; 17 Jan 2016

DFO

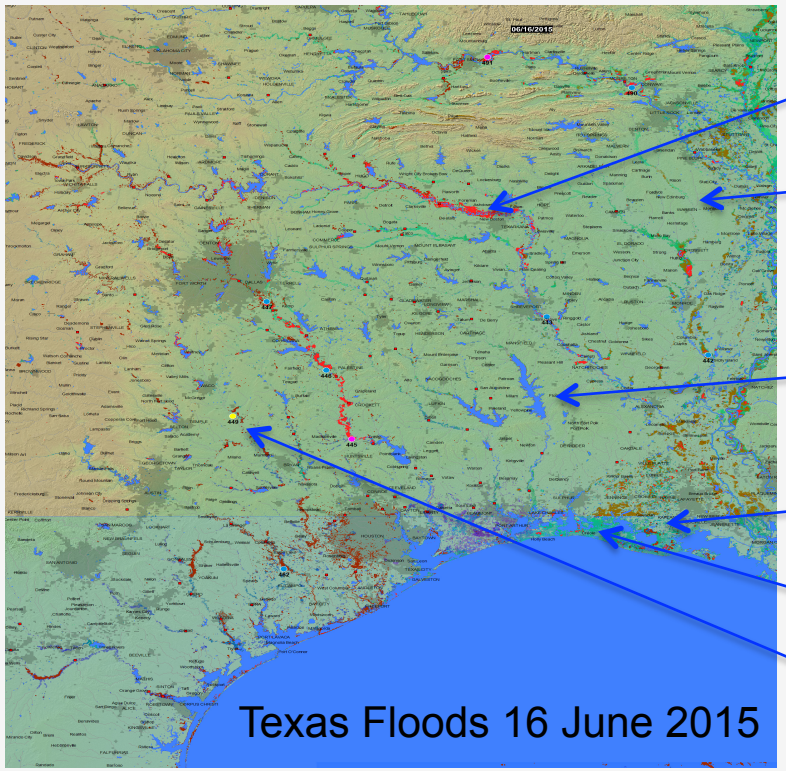
- Uses Flood Mapping based on MODIS reflectance
- Also uses Landsat-8 and EO-1 images, and COSMO-SkyMed and Sentinel-1 synthetic aperture radar (SAR) images when available
- Experimental River Discharge obtained by using Microwave data (AMSR, AMSR-2, TMI, GMI) and a run-off model



Provides near-real time flood mapping and current/past flood event mapping

http://floodobservatory.colorado.edu/

DFO Flood Event Mapping



Red*:* Flooding within the past 14 days (MODIS automated product)

Light Red: Flooded during this event, from earlier MODIS coverage or non-automated MODIS mapping

Dark blue, Permanent water, February, 2000 (Shuttle Water Boundary Data)

Darker Red: Flooded areas from high resolution SAR or Landsat 8 data

Past Floods

Colored dots show *access River Watch Site*

DFO Demonstration

http://floodobservatory.colorado.edu/

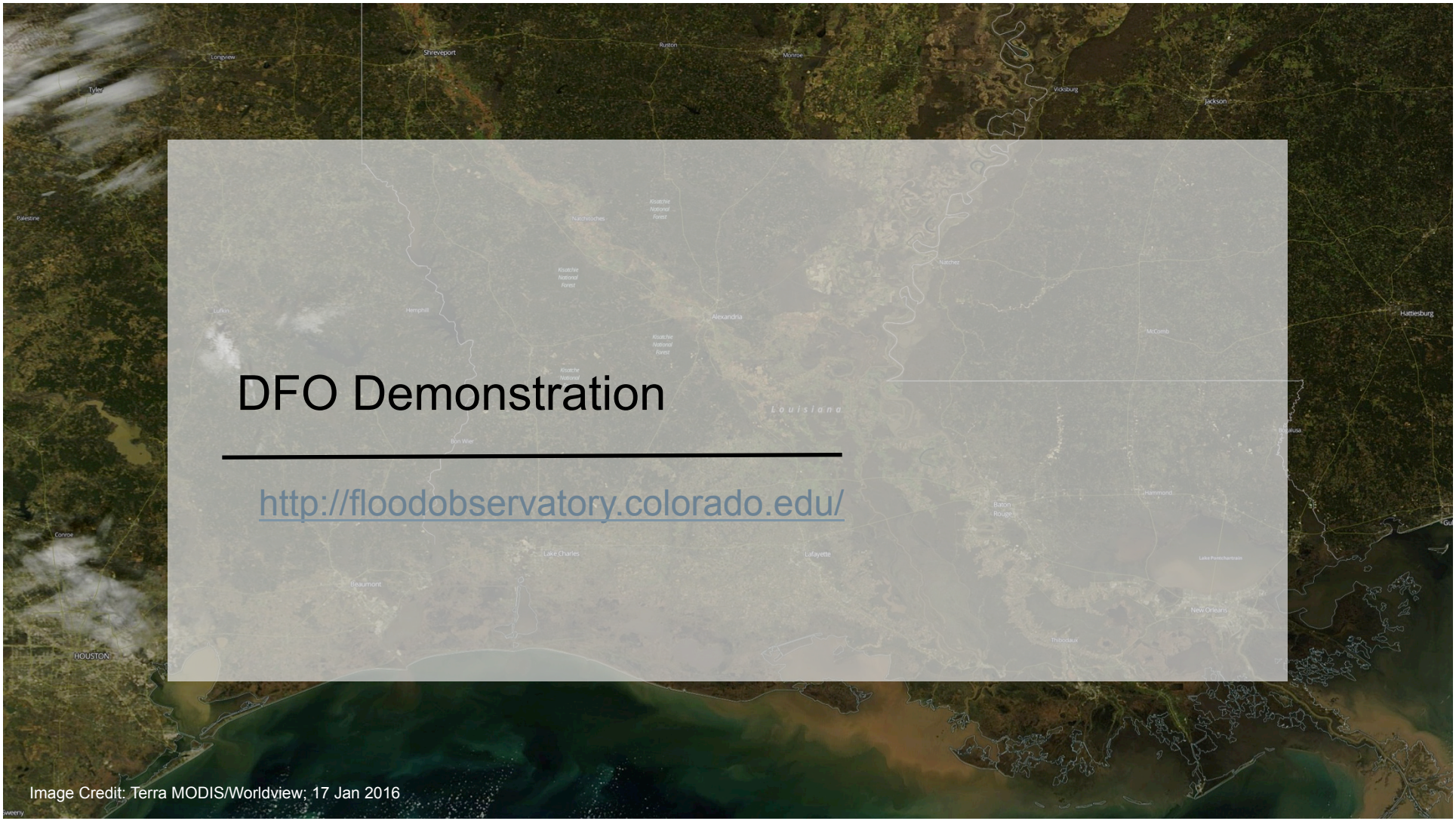
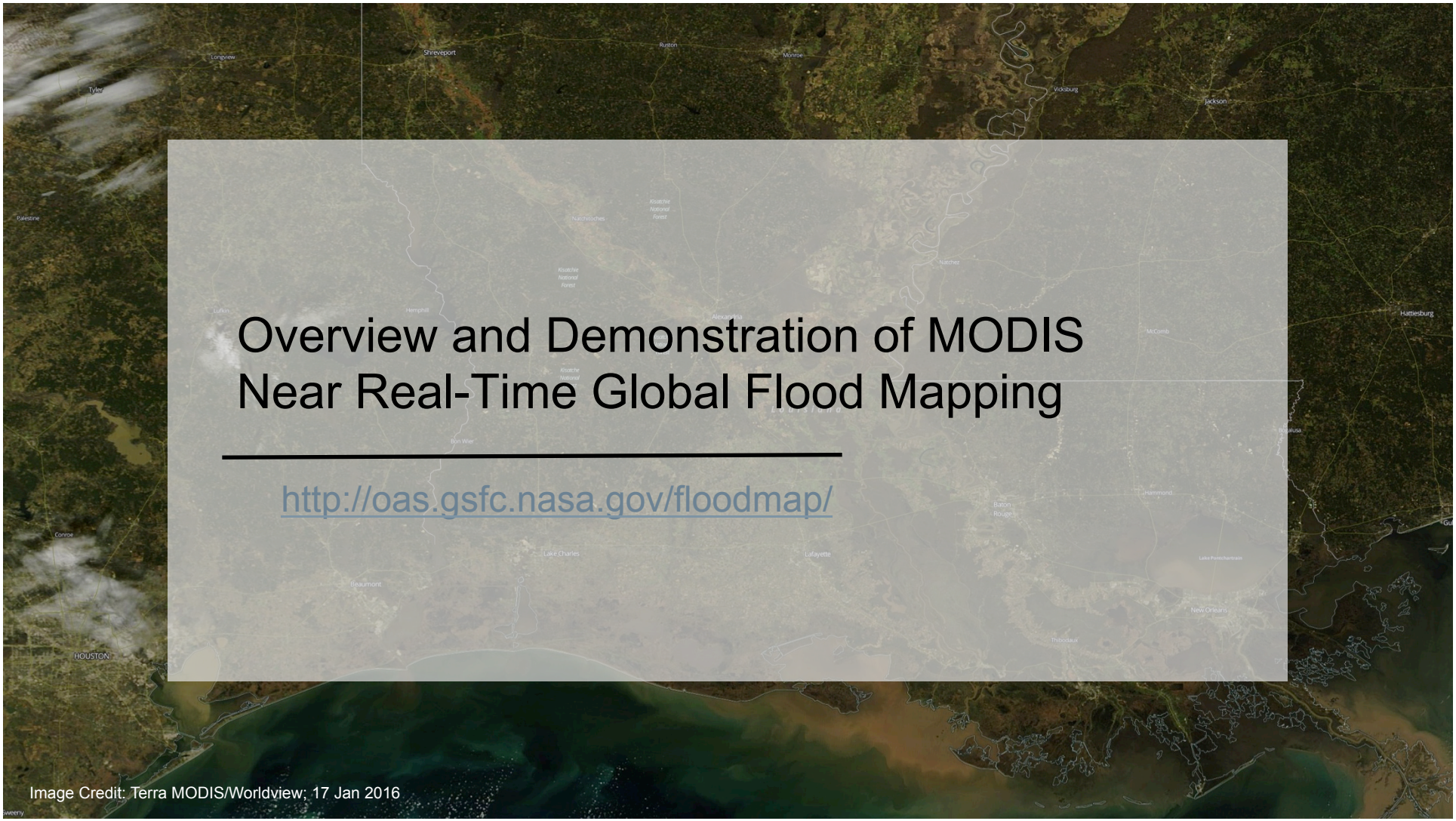


Image Credit: Terra MODIS/Worldview; 17 Jan 2016



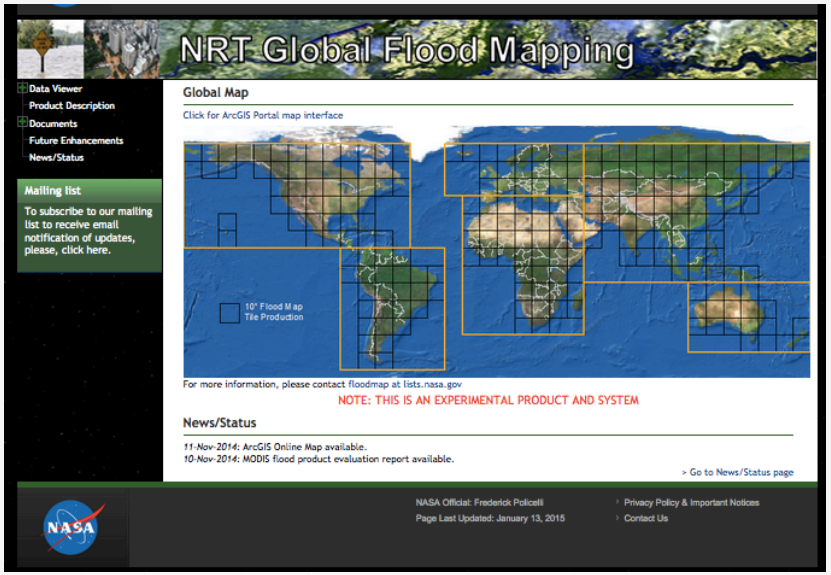
Overview and Demonstration of MODIS Near Real-Time Global Flood Mapping

http://oas.gsfc.nasa.gov/floodmap/

Image Credit: Terra MODIS/Worldview; 17 Jan 2016

MODIS NRT Global Flood Mapping

- Flood Mapping based on MODIS reflectance at 250 m resolution, composited on 2, 3, and 14 days
- Flood maps available on 10°x10° tile
- Permanent water and surface flood water data available
- Cloud shadows or terrain shadows can be misinterpreted as surface water

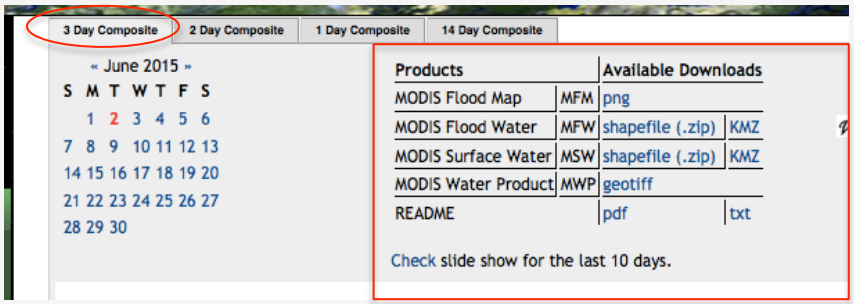


Provides near-real time and past flood mapping from April 2011

http://oas.gsfc.nasa.gov/floodmap/

MODIS Flood Mapping : Texas Floods

Texas Flood Map
June 2, 2015 (3-day composite)



Filename Convention:

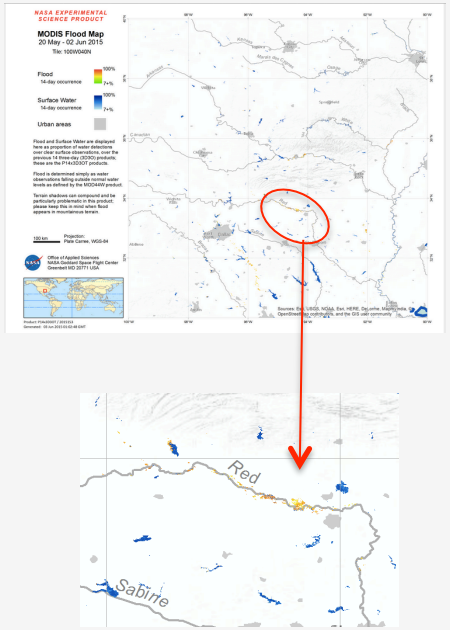
PRODUCT_DATE_TILE_COMPOSITE_XTRA.EXT

MSW_2012009_020E000S_3D3**O**_V.shp
MFM_2012009_020E000S_2D2**O**.png

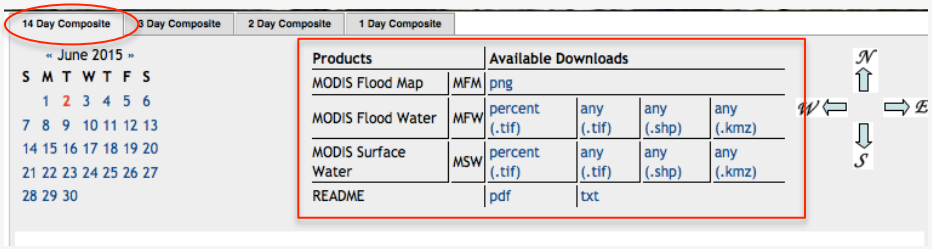
(yyyydoy (Year and day of year)) lon-lat 2 or 3 day **O**bservations

MODIS Flood Mapping : Texas Floods

Texas Flood Map
June 2, 2015 (14-day composite)



Composites of the previous 14 days' 3-day product

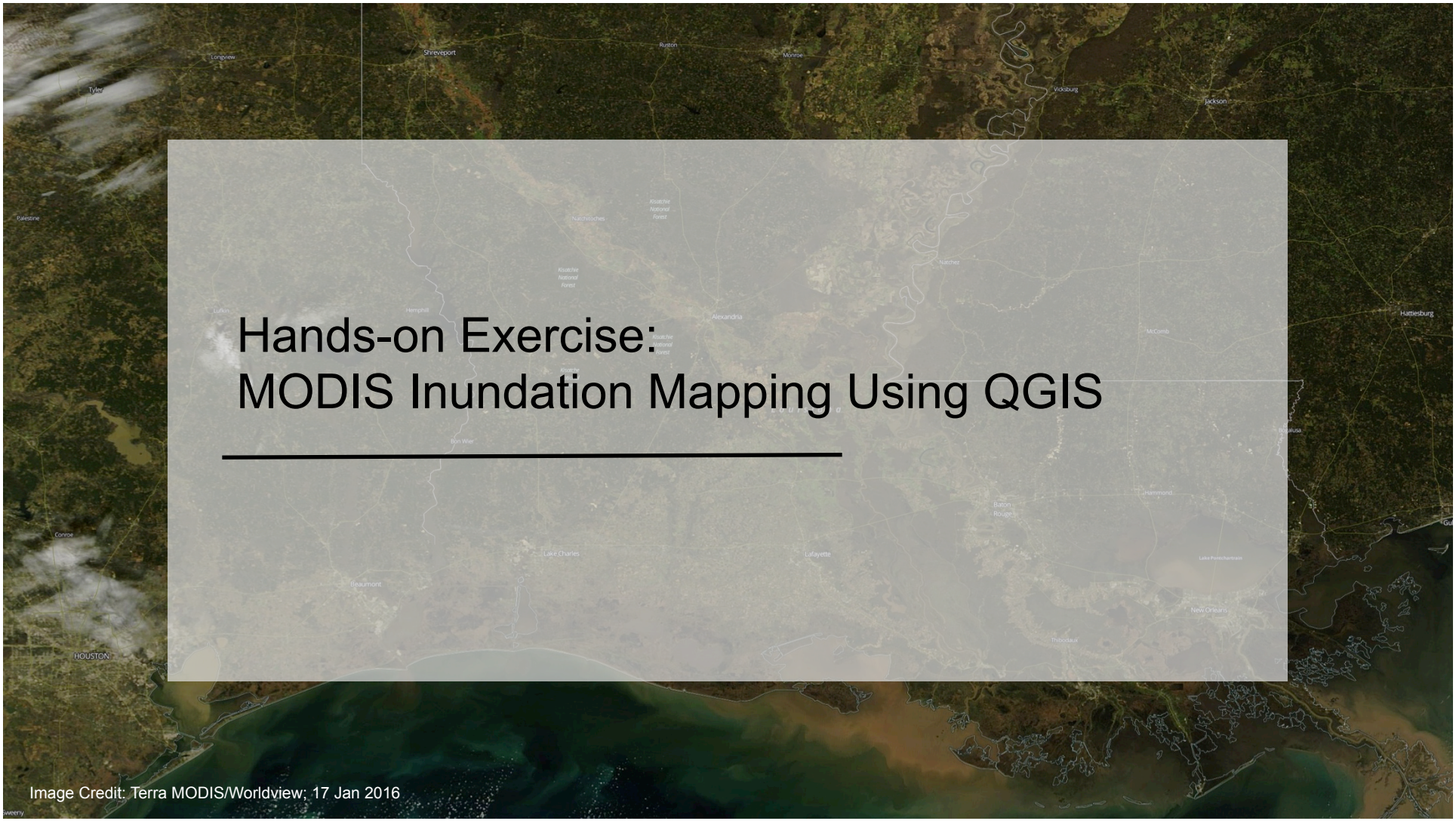


Similar Filename convention with additional processing information for composite field:

N: No shadow masking
T: Terrain shadow masking
C: Cloud shadow masking
S: both terrain and cloud Shadow masking

For Example: **2D2OT:** 2 Days imagery, 2 Observations required, Terrain shadow masking applied

Provides the occurrence of water as the percent of clear observations over the last 14 days' products (GeoTIFF and shapefile)
GeoTIFF are 0-1 images; it is 1 if the percent water is > 0



Hands-on Exercise: MODIS Inundation Mapping Using QGIS

Image Credit: Terra MODIS/Worldview; 17 Jan 2016

Coming Up Next Week

Overview & Access to Ancillary NASA Data for Flood Management

- Synthetics Aperture Radar data and application for flood monitoring
- Shuttle Radar Topography Mission terrain data access relevant for flood plain identification
- NASA Socio-economics data access useful for flood preparedness and relief planning

Thank You

The recording of today's session will be available shortly at
http://arset.gsfc.nasa.gov/disasters/webinars/advfloodwebinar