Assessing the Spring 2011 Mississippi River Basin Floods Using NASA Radar and Multispectral Remote Sensing
NASA Jet Propulsion Laboratory
Earthzine/DEVELOP Virtual Poster Session, Fall 2011
Video Transcript
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INTRODUCTION

Understated, medium-fast tempo bass beat plays as BRUCE DAVIS of the Department of Homeland Security Science Mission Directorate, speaks about the importance of remote sensing products during disaster warning, response, and mitigation during a teleconference. FEMA representatives and interviewee, LINDA JOHNSON, discuss the effects of the 2011 Mississippi floods on her life.

SHOT – INTRO TITLE #1

DEVELOP at The Jet Propulsion Laboratory Presents

SHOT – INTRO TITLE #2

MISSISSIPPI RIVER FLOOD: A TRUE STORY

BRUCE DAVIS (V.O.)
Time is money during an emergency response. The extent and severity of any incident, you know, we need that product faster. It can never come too fast.

EXT. DAY. SHOT – FULL shot of JPL from top of East Parking lot, cutting past foliage

EXT. DAY. SHOT - FULL shot of NASA and JPL logos from West JPL entrance

EXT. DAY. SHOT – FULL shot of FEMA footage of 2011 Mississippi Floods

FEMA REP (V.O.)
Homes were submerged. Tremendous damage to the homes. They sat in flood water for up to a month.

SHOT – MED shot of FEMA footage of 2011 Mississippi Floods

LINDA JOHNSON

I moved out and I lost everything
that I have, and I'm just trying to
get back to normal.

SHOT – INTRO TITLE #3

Every spring, precipitation and
snowmelt in the central U.S. leads
to
high water levels in the
Mississippi River and its
tributaries,
with concurrent flooding and levee
damage a near-yearly event.

In the spring of 2011, historic
water levels led to extensive
flooding
from Mississippi County, Missouri,
to southern Louisiana,
necessitating
the opening of major spillways.

INT. DEVELOP OFFICE – STUDENT AND YP INTROS - DAY

ANTONY, AUSTIN and KATRINA introduce themselves.

ANTONY
Hi, my name is Antony Bina. I am
currently a student at California
State University, Long Beach.

AUSTIN
My name is Austin Madson, a fourth
year geography student at UCLA,
with a concentration in GIS and
remote sensing.

KATRINA
My name is Katrina Laygo, and I am
the Center Lead for NASA's DEVELOP
Program at the Jet Propulsion
Laboratory in California.

SHOT – MED - ANTONY walks to the DEVELOP JPL Office - DAY

KATRINA (V.O.)
We worked under the guidance of our
science advisors and would like to
thank Dr. Cathleen Jones and
Benjamin Holt of the Jet Propulsion
Laboratory.

SHOT – MED – KATRINA interview - DAY

KATRINA
The flooding that occurred this year was extremely significant. I mean, from April through May of this year, these were among the largest floods since 1927. And, they affected people I know personally. I have family in Louisiana that was affected by the flooding.

SHOT – GOOGLE EARTH – Study Area

SHOT – Telecon with DHS and Army Corps of Engineers. AUSTIN, ANTONY, BEN and CATHLEEN. (Some of this can be intercut with AUSTIN's V.O.'s.

KATRINA (V.O.)
We would also like to acknowledge our endusers, The Army Corps of Engineers and Dr. Bruce Davis of the Science Mission Directorate of the Department of Homeland Security.

Applying remote sensing to flood mapping along the main rivers and small tributatries that feed into them is valuable to our endusers, who are among the responsible for flood control.

Knowledge of water flow in the smaller tributaries and soil moisture in the watersheds is essential to the modeling that gives advance warning of flood times and locations.

INT. OFFICE INTERVIEW - DAY

KATRINA
Our study has four goals within NASA's Applied Sciences Disasters Application. The first one is to formulate a flood timeline of the Mississippi River to understand the geographic and temporal giver fluctuations. The second goal of our project is to identify times and places where there are a combination of ASTER and Landsat

data available with corresponding UAVSAR data. And then we also wanted to compare ASTER, Landsat 5 Thematic Mapper data with UAVSAR data, and this was done to determine the accuracy and resolution with which flooding can be located. And finally, fourthly, we wanted to develop this easily applied algorithm that utilizes a standard analysis package for water extent measurement along waterways, including a product outlining areas with significant changes in the water location.

INT. OFFICE INTERVIEW - DAY

Inspiring, cinematic medium-fast tempo music accompanied in background.

SHOT – UAVSAR Footage with Fall 2011 advisor, CATHLEEN JONES

SHOT(S) – ANTONY working at computer on UAVSAR/Landsat/ASTER dates.

SHOT(S) – MED - ANTONY discussing results with KATRINA

SHOT(S) – CATHLEEN's PPT of UAVSAR flights and dates, intercut with UAVSAR swaths shown in Google Earth

KATRINA
This project uses several types of data to measure the extent of the recent historical flooding that occurred along the Mississippi River this Spring 2011. We had polarimetric synthetic aperture radar data that was used in conjunction with optical data in order to map the extent of the flooding, as well as to determine the spatial resolution that was required to accurately measure the flooding of different sized waterways.

IMAGES OF METHODS AND RESULTS (PPT SLIDES)

SHOT - Flooded grain storage facility near Greenville, MS (River Mile 530)

AUSTIN (V.O.)
These figures show a flooded agricultural area of approximately 10,000 acres on the unprotected side of the mainline levee. This area is located at Bunch's Bend, near river mile 511, which is just to the north of Lake Providence, Louisiana. Figure 4a is a real color Landsat image, which shows a location of the subset. Figures 4b and 4c are color composite UAVSAR images acquired in June of 2009 and June of 2011, respectively. Figure 4d shows the inset outlined in Figure 4a, with the red pixels being classified as water that was present in the June 2011 image, and not in the June 2009 image. These pixels were created using the previously discussed classification methods.

AUSTIN (V.O.)
These figures show a flooded agricultural area just north of Greenville, Mississippi, around River Mile 545. Figure 2a is a real color image that shows the location of the subset, and figure 3b is a large scale look at the area in question. Figure 2c is a Band 2 MODIS subset of the agricultural area, with the red pixels being classified as water that was present in June of 2011, and not in June of 2009. These pixels were classed using a band threshold technique. All the pixels with the digital number between 0 and 40 were clustered into one class. In this case, water. Only these pixels were extracted from both the 2009 and 2011 near infrared MODIS images.

Next, the 2009 class image was

subtracted from 2011 class image, leaving us with a product showing the pixels with water extent in June of 2011 and not in June of 2009, or the flood extent. Figure 2d is a Landsat 5 thematic mapper near infrared image showing the same agricultural area, with the red pixels being classified as water that was present in June of 2011 and not in June of 2009.

These pixels were classed using the same threshold technique previously discussed for the MODIS image. Figure 2e is a UAVSAR color composite image showing the same agricultural area, with the red pixels being classified as water that was present in June of 2011 and not in June 2009.

A threshold was then set at 0 where only the pixels with a digital number of 0 were classed as water. Only these pixels were extracted from both the 2009 and the 2011 UAVSAR images.

Comparing the flood extent classifications from the three different sensors pictured in figures 2c, 2d, and 2e, we can see how the varying spatial resolutions play a major role in the usefulness of the product.

KATRINA (V.O.)
We acquired ASTER data from concurrent UAVSAR dates, and classified the flood extent using an unsupervised classification scheme. We then overlayed the results into Google Earth for our end users.

INT. INTERVIEW - DAY

CONCLUSIONS

KATRINA (V.O.)

Varying spatial resolutions play a major role in the usefulness of the product. We utilized a variation of high resolution datasets for our study. There were varying overlapping dates in both the UAVSAR and optical satellite sensor coverage, and some cases in which there was no overlap at all for comparison.

The best method for flood extent and levee seepage tracking is through a combination of in-situ surveying, ground validation, radar, and high resolution/hyperspectral optical satellite and airborne sensor data.

INT. SCENE. DAY.

SHOT – Outtakes of ANTONY

SHOT(S) AUSTIN and science advisor, BEN, review UAVSAR flood data products.

SHOT – CLOSE UP – BEN reviews Mississippi Flood data in Google Earth.

SHOT – MED – Von Karman Visitor's Museum – Earth section.

SHOT – BEN's OFFICE with AUSTIN.

KATRINA (V.O.)
We are empowered to take a step towards positive and measurable change.

We are stewards of the environment. Of this planet. We seek to serve as that bridge between Earth observations and society.

In order to foster future innovation,

To cultivate the professionals of tomorrow,

And this is done by addressing diverse environmental issues, such as the Mississippi flooding.

Today.