Flooding Risk and Disaster Relief in Coahuila

Using NASA EOS and in Situ data to model danger zones due to flooding in the city of Piedras Negras, Coahuila, Mexico

Coahuila Disaster Team

Earthzine Video Script

Fall 2012

NASA DEVELOP NATIONAL PROGRAM

Coahuila, Mexico and Wise, USA

Begin (Video)

Scene 1

Voice (Hector Hernandez)

(Appear, Team Photos)

The DEVELOP teams at Wise, USA and Monterrey Tech at Saltillo, Mexico present from the Mexico team Hector Hernandez, Daniel Martinez, Alejandro Alvarado, and Carlos Cardenas; the Wise team Pedro Rodriguez, Rohini Swaminathan, Ryan O'Quinn, and Zachary Tate (Appear, zoom in on Piedras Negras in Google Earth) present flooding risk and disaster relief in Coahuila, Mexico, with a focus on one of the most vulnerable municipalities Piedras Negras.

Scene 2

Voice (Carlos Cardenas)

Appear (Seal of Coahuila Government)

In the summer of 2012, the Wise and Coahuila teams worked on a flooding project which concentrated its efforts of studying the (Appear, CONAGUA Symbol) application of remote sensing technologies for flood mitigation in Mexico City.

(Appear, DEVELOP Logo)

The government of Coahuila recognized the importance of this project and to the very recent problems of flooding in Piedras Negras the governor of the state contacted Saltillo develop students in between the summer and

(Appear, INEGI Logo)

Fall 2012 terms and requested a flood risk analysis for Coahuila. This project will look to combine several aspects that affect flood risks such as social vulnerability and physical hazards.

Scene 3

Voice (Daniel Martinez)

(Appear, Slide Show of Piedras Negras flooding photos)

Why is this investigation so important to Piedras Negras? In the city of Piedras Negras, over the years there have been various weather phenomenons which have caused damage and losses to the general population. The main causes can be attributed to the

(Appear, Terrain Model of the Rio Escondido and Rio Bravo)

typical rains and the fact that the city is crossed by two rivers, Rio Escondido and Rio San Antonio, which are directly affluent to the Rio Grande. (Appear, Map of Piedras Negras) The city is also crossed by several streams like El Soldado. El Tornillo and Primavera.

Scene 4

Voice (Alejandro Alvaredo)

(Appear, ArcGIS screenshot showing data)

The team used US Geological Survey's air observation platform selected datasets have been collected from MODIS, Landsat, TRMM and high resolution aerial photographs have been used to draw flood inundation (Appear, USGS Earth Explorer Screenshot) mapping and to do further hydrologic analysis. In situ data from rain gauges provided by CONAGUA, the water commission in Mexico and socio-economic information (Appear, Image of Satellite Scanning Earth) from INEGI the in situ for statistics and geographic in Mexico have been used to compliment the data collected from satellite images. Several GIS platforms including ArcGIS, MicroDEM and image processing software like ERDAS has been used to process the data obtained.

Scene 5

Voice (Zachary Tate)

Appear (Methodology Slide)

There were three overall methods involved in this project. The first was image analysis; this is where the physical factors are analyzed using satellite. The second was socio economic analysis; here we analyze the social and economic factors that influence the flood vulnerability. The last was the model analysis, for which we use HAZUS, a highly effective math model to validate our results from first two steps

Scene 6

Voice (Rohini Swaminathan)

Appear (Flood Inundation Map)

After collecting the before and after imageries from Landsat, we were able to derive a flood inundation map with the use of iso data unsupervised classification in ERDAS Imagine. We compared this inundation map with NDWI analysis (the Normalized Differential Water Index) to identify the water pixels. One of the greatest disadvantages is the inability to differentiate water pixels from that of asphalt or concrete.

Appear (Flood Simulation from Microdem)

The animation here using MICRODEM shows the rise of water level near the confluence of Rio Bravo and Rio Escondido, south of the city of Piedras Negras. An assumption of rise in water level of 20m, comparable to a 500 year flood, has been made to see the spread of flood from the most accumulated area to the least.

Appear (GLC 2000 Classification)

The slide shows the different land use classifications derived using different datasets. GLC 2000 (global land cover) at 1km resolution

Appear (MODIS land use classification)

And MODIS land use data at 500m resolution

Appear (Landsat Classification)

And Landsat at 30m resolution was used to make the comparison.

Scene 7

Voice (Pedro Rodriguez)

Appear (Land use Classification with Aerial image)

In our project, we look into the possibility of using a land cover/ land use raster into six classes from a high resolution aerial image. These are aerial imageries collected from USGS earth explorer database, has a resolution of 30cms, with originally considered to be an option for deriving a more specific and accurate classification.

Appear (Drainage Density)

However, due to the extensive size of these imageries further analysis on them were not possible. Therefore we decided to use the results gathered using Landsat and it was with these results, we were able to obtain a description of the surface characteristics of the catchment areas in our hydrologic network.

Appear (Surface Runoff)

Through this information, we identify the respective surface runoff and roughness coefficients for each of these catchment areas, both of them are very important parameters in calculating the time of concentration and surface runoff.

Scene 8

Voice (Ryan O’Quinn)

Appear (HAZUS logo)

The team applied the HAZUS model produced by FEMA to the study area of Piedras Negras.

Appear (HAZUS Results 1)

HAZUS is a multi-hazard loss estimation tool designed for use in the United States and can determine the amount of damage caused by Hurricanes, Floods and Earthquakes.

Appear (HAZUS Results 2)

One of the goals of our project is to internationalize the HAZUS model and to create a methodology, so that our partners would be able to perform flood risk analysis in other areas of Mexico, if they wish.

Appear (HAZUS Results 3)

We also wanted to compare the results from the model to the results found from other areas of our study.

Appear (Develop webpage information followed by team names)

End (Video)