Detecting Floods in Greensboro, MD
NASA Goddard Space Flight Center
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Video Transcript

Slide 1:
"Hi, I am Melissa Oguamanam from the University of Maryland, College Park and I am working with Scott Cook from James Madison University at NASA Goddard Space Flight Center with the DEVELOP program. The title of our project is called, „Comparing Multiple DEM Sources and Spatial Resolutions for Hydrologic Model Performance and Accuracy in the Choptank Watershed.‟ In this project we will be using a Hydrological Model that simulates some of the water cycle processes. First we will talk about what applications our project will have in the community. We will then talk about our project partners, give a description of how flooding can occur, and explain how our hydrological model can simulate disasters such as flooding."

Slide 2:
"Our project addresses 3 NASA applications: water, disasters, and ecological forecasting.
For the water application, the model used in this project will attempt to simulate hydrological processes such as the movement of water and contribute to an enhanced understanding of the drivers controlling surface water inundation. For the disasters application, natural disasters can be tracked and forecasted by inputting the most current precipitation data into our hydrological model. For the ecological forecasting application, our findings could help hydrologists forecast hydrological events such as flooding."

Slide 3:
"Our project partners for the summer semester include the University of Oklahoma, the United States Department of Agriculture (USDA), and NASA. University of Oklahoma, in partnership with NASA, created the hydrological model we are currently using. The USDA supplied some of the inputs, including elevation models, necessary for evaluating our model."

Slide 4:
"Global efforts for flood modeling and wetland mapping have been made at low-resolutions, but current and more accurate models are needed. Here are some statements that you should think about:
-Flooding is the leading cause of weather-related deaths in the US, at about 200 per year.
-In a high-risk area, your home is more than twice as likely to be damaged by flood as by fire.
-Flash floods happen in all 50 states."

Slide 5:
"Within the water cycle, water falls from the atmosphere to the ground. The water then infiltrates into the soil or runoffs into the ocean through streamflow before it evaporates back into the atmosphere. Floods are a natural part of the environment and can occur from excess water runoff. A hydro logical model can be created to simulate the movement of water within a watershed to forecast events such as flooding."

Slide 6:
“As mentioned earlier, the goal of our project was to calibrate a hydrological model in the Greensboro Watershed in preparation for future testing. Our study area examines the Greensboro Basin within the Choptank Watershed of Maryland and Delaware. Greensboro consists of approximately 293 sq km of relatively low topographic relief. In other words, the area we are working with is very flat. Landcover within Greensboro contains more forests and less agriculture than the Choptank Watershed overall. Runoff and discharge are both affected by the climate, land use, size, and topography of a watershed.”

Slide 7:
“Multiple satellites and sensors were used to collect the data needed for our hydrological model. The Tropical Rainfall Measuring Mission (TRMM) supplied us with rain data, which is the most important input for the model. The Shuttle Radar Topography Mission (SRTM) supplied us with Earth elevation data. Finally, the United States Geological Survey (USGS) gauge station supplied us with a physical river discharge quantity that tells us how much water is flowing through the river.”

Slide 8:
“The Hydrological Model we are using is CREST 1.6c. There are five inputs for the CREST model. The accuracy and resolution of the inputs dictate how well the hydrological model will simulate the water cycle. The most important input for the CREST model is rainfall because it drives the entire water cycle.”

Slide 9:
“This is a view of the Tropical Rainfall Measuring Mission (TRMM) precipitation data that we used for our CREST model. Notice that the entire globe is not covered. The TRMM mission collected data around the equator where the majority of the Earth‟s precipitation takes place.”

Slide 10:
After the rain and other maps are input into CREST, the model is able to run.
CREST 1.6c can be ran in multiple modes including simulation and calibration modes. Calibrating the model was very important for this project. The output of CREST 1.6c included simulated discharge data. This data is the simulated amount of water flowing through the Choptank River. We then compared the simulated and actual amount of water flowing through the Choptank River to validate our model.

Slide 11:
Here is a quick view of how CREST 1.6c operates. It includes the control file, where the simulation and calibration settings are adjusted.

Slide 12:
This image shows the visual results of preprocessing the original Digital Elevation Model, which shows the elevation of the Greensboro basin. The higher resolution objects are much clearer. Also, the resampled 90m Digital Elevation Model (in the 2nd to last column) is a much better representation of Greensboro than the 90m SRTM Digital Elevation Model.

Slide 13:
This slide is a three dimensional representation of the Greensboro Basin.
Notice that this area is relatively flat. There is about 30m of elevation change from the highest point to the lowest point. The low elevation change may have contributed to the longevity and poor calibration of CREST. Disregard the large red spike near the middle of the river channel. This was a building in the area.

Slide 14:
One of the largest problems we encountered when running our model was using inaccurate precipitation data. The sporadic rain data points, in red, are inaccurate because we used precipitation data with a resolution that was too low for the study region. As you can see, the simulated discharge is similar to the observed discharge, but it is not accurate enough to use confidently.
A majority of this semester’s efforts went to obtaining and implementing high resolution, or Next – Generation precipitation data. Next semester, student’s will be able to use the more accurate rainfall data to allow for better calibration results.

Slide 15:
Running calibration for CREST in the Greensboro basin using TRMM precipitation data has not proven successful. The model might not be able to run as well on areas of low topographic relief. Also, the rain data and potential evapotranspiration data used in this area were very coarse for the relatively small watershed.

Slide 16:
This project is intended to be completed in two semesters. A summary of the first semester’s progress is presented above. High resolution inputs were successfully obtained. CREST was able to run using the high resolution DEM products. Testing has been done with the Next-Generation precipitation data for small periods of time. The Next-Generation rain data was formatted and made accessible for the second semester students to easily integrate. Calibrating CREST was accomplished successfully, although we had no successful outputs. Calibration knowledge will be passed on to the efforts of next semester. The second semester will focus on running CREST in near-real time with high resolution rain data. Future efforts with this model might also include running CREST on a more powerful server over a larger land mass.