GIS Flood Tool (GFT) for Mapping Extent of Inundation

(A)   GFT Overview

The 5, 50 and 100 year return period (recurrence interval) maps for selected towns along the Juba and Shabelle Rivers were produced using the GIS Flood Tool (GFT), a USGS product. The tool was developed to produce an initial estimate of flood inundation hazard virtually anywhere in the world. It is particularly useful in settings that lack the field surveys and hydraulic modelling studies required for detailed flood hazard mapping. The tool takes advantage of publically available Digital Elevation Models (DEMs) in a simple Geographic Information System (GIS) based implementation of the Manning equation. The tool can be used to produce an inundation pattern by specifying either a stage or a discharge value at a location of interest. The GFT runs on ArcMap 9.3, and has the tool bar shown below:

(B)   Methodology

The steps followed in producing the flood inundation maps for the Juba and Shabelle is summarised below:

1.   Data
1.1 DEM Data:- The elevation data used was the Digital Terrain Model (DTM) data processed from the 2008 aerial photography conducted by SWALIM along the riverine areas of Juba and Shabelle Rivers.
1.2 River levels:- The long term seasonal river levels at the gauging stations located near the selected towns were used.

2.   Defining the study area
The areas of interest (selected towns) along the Juba and Shabelle Rivers were identified, and using GFT the extent of the flood inundation analysis was defined using "Draw Box" method.

3.   Stream delineation
For each area of interest, the tool was used to process streams feature layer and the flow accumulation grid. The density of the streams depends on the flow accumulation threshold selected.

4.   Relative DEM
Using the above mentioned DTM, a relative DEM was processed. A relative DEM sets all elevations along the stream segments to zero. Each pixel in the DEM is linked to the pixel on the stream network to which it is tributary, and elevations are adjusted to reflect the elevation relative to the stream network. The development of the Relative DEM expedites the flood inundation mapping.

5.   Cross sections

Several cross sections were developed along the stream reach, perpendicular to the trend line of the reach. The tool allows the user to add or edit the cross sections as they wish.

6.   Elevation

This function of the GFT was used to produce, for each stream segment, a stage-discharge curve using the cross sectional information. The stage-discharge curve is derived using Manning's equation. The user has the capability to view the cross-sectional information and stage-discharge curves for each reach. If a curve is found to be inadequate, the cross-section can be moved or edited.

7.   Map library

Using the relative DEM processed in stage 4 above, flood inundation maps were produced for predetermined stages (at 0.5 m increments) based on observed river levels for the selected river gauging stations. The flood inundation maps show the extent and depth of the flood.

8.   Floods

From the analysis of the long term seasonal river levels at the selected stations, the flood inundation maps corresponding to 5 year, 50 year and 100 year return periods were selected from the map library, and presented in the following links: