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BLUE TEAM

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ARCGIS REPORT

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Introduction

This report is presenting the work that the blue team has realized on ArcGIS during the Hydroasia event.

I. Objectives and purpose

A. What is ArcGIS?

ArcGIS is a suite developed by ESRI which contains Geographic Information System (GIS). GIS are able to capture, store, analyze, manage, and present data that are linked to location. In the simplest terms, GIS is the merging of cartography, statistical analysis, and database technology.

We have used ArcGIS 9.2 for our work, mainly ArcMap with different extensions (spatial editor, 3D analyst, ArcSWAT, ArcHydro).

B. Why do we need it?

We need to delineate the different sub-basins existing inside the Gyo Watershed to get information as the area, the width or the slope of each subcatchment. Then these results will allow us to get input data which can be combined with the sewer network to simplify the hydraulic model that we will have to use (MOUSE or SWMM).

II. Use of the software

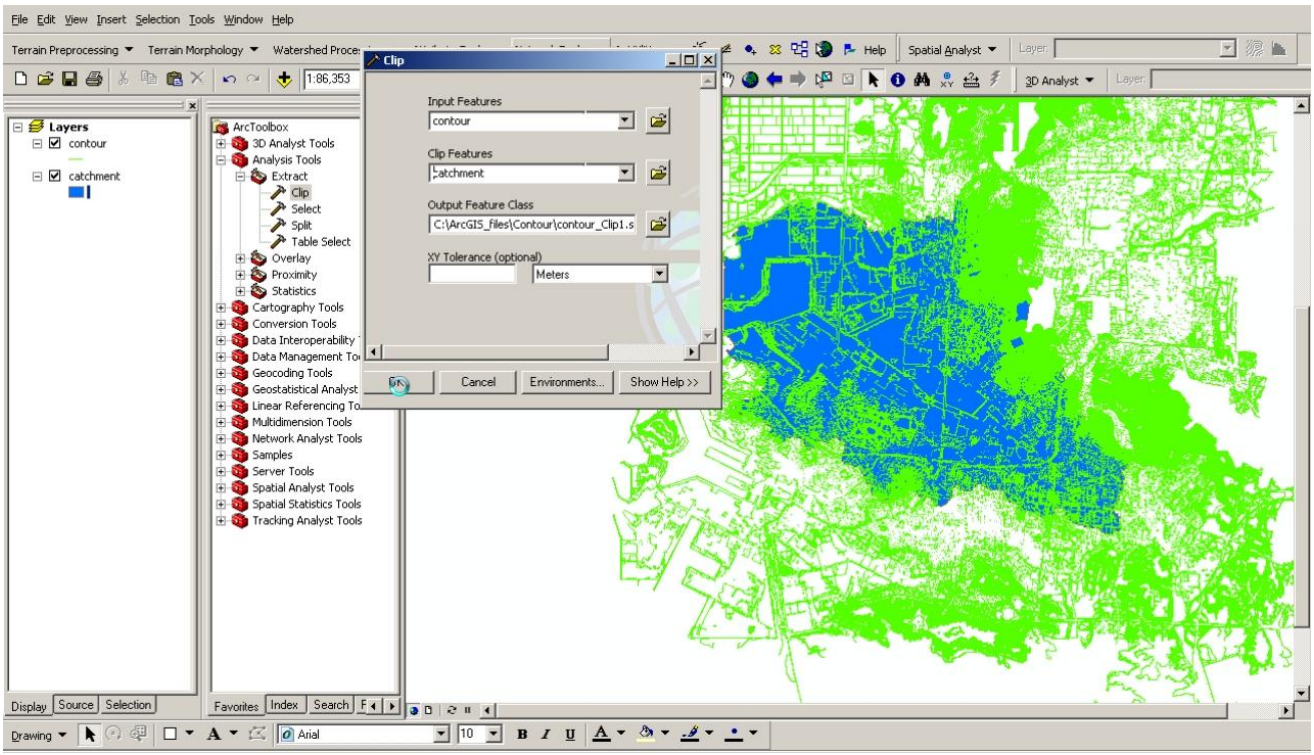
This part describes the different steps that we have achieved on ArcGIS on the purpose to build a model where we could delineate the different sub-basins inside the whole catchment. We use the following data that are available on the hydroasia website (http://www.hydroasia.org then Project/data/GIS files):

- Building
- Catchment
- Contour
- Manhole_groundlevel
- road

A. Creation of the DEM

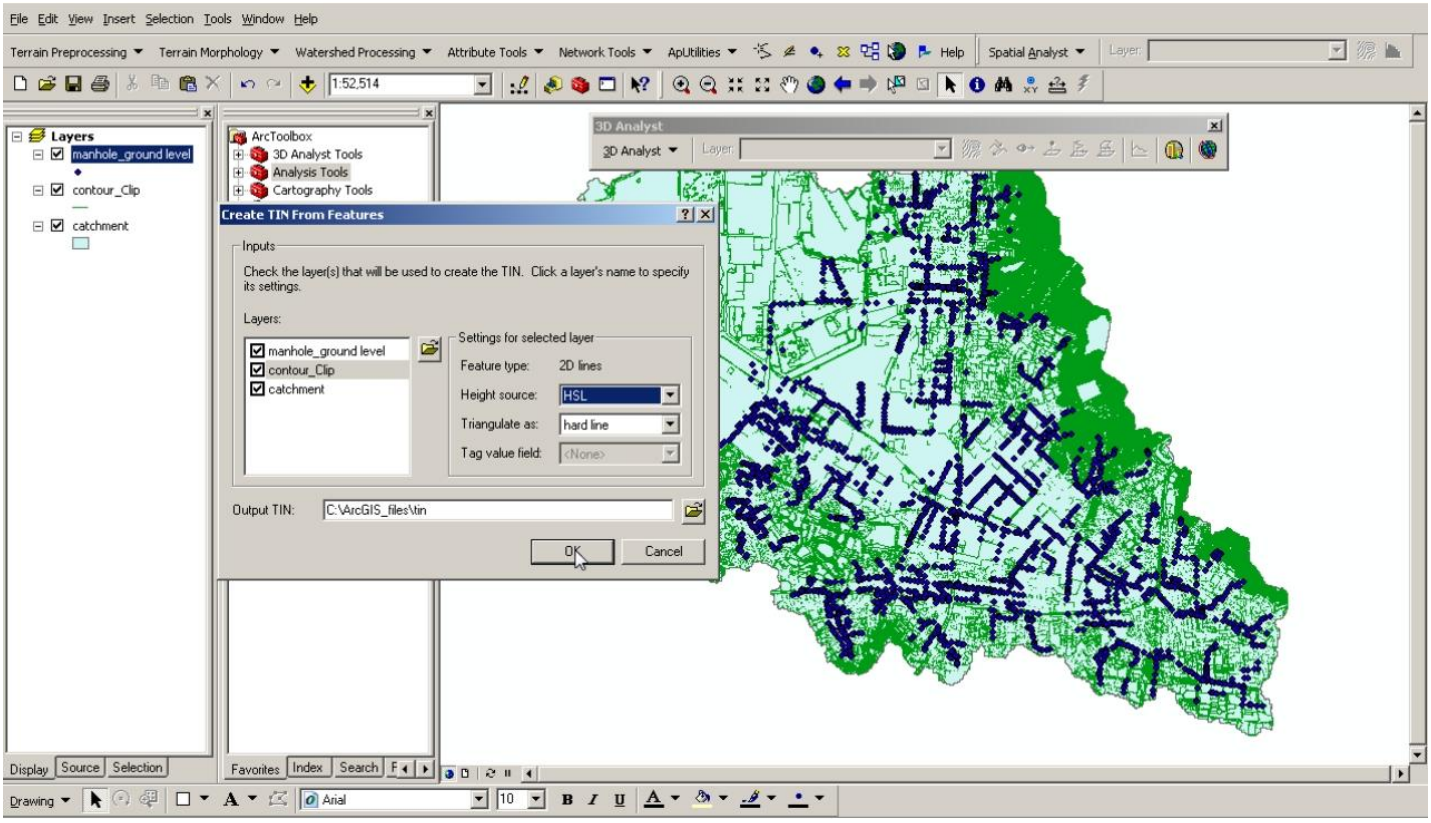
The first step in our work is to create a DEM (Digital Elevation Model), which is a digital representation of ground surface topography or terrain. A DEM is a raster.

We launch ArcMap and add the catchment and contour layers, then we use the clip tool to produce a contour which has just the shape of our catchment (we do not need all the data around this shape) and we call it contour_clip:

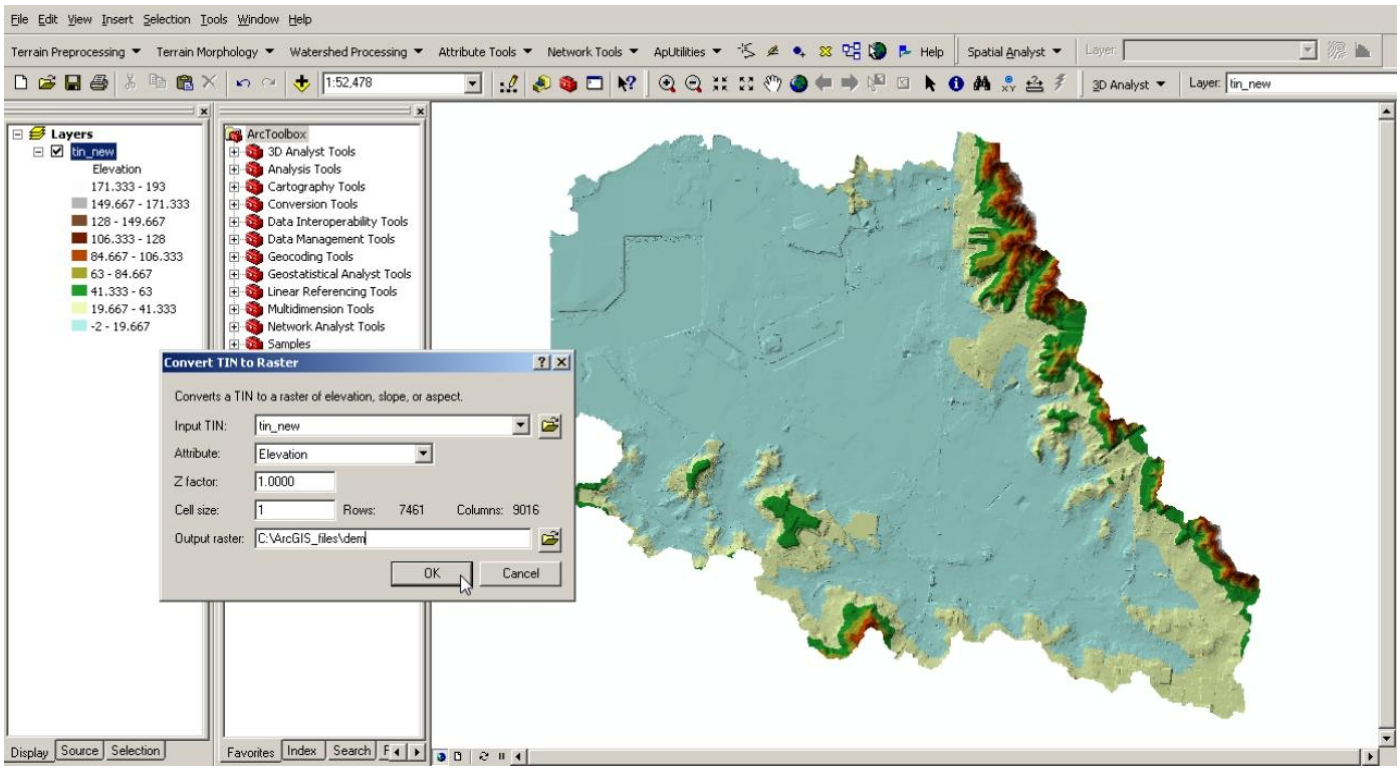


Then, we need to add an elevation to this layer to obtain a TIN (Triangulated Irregular Network). A TIN is a digital data structure used in a geographic information system (GIS) for the representation of a surface. A TIN is a vector based on the representation of the physical land surface, made up of irregularly distributed nodes and lines with three dimensional coordinates (x,y, and z) that are arranged in a network of non overlapping triangles.

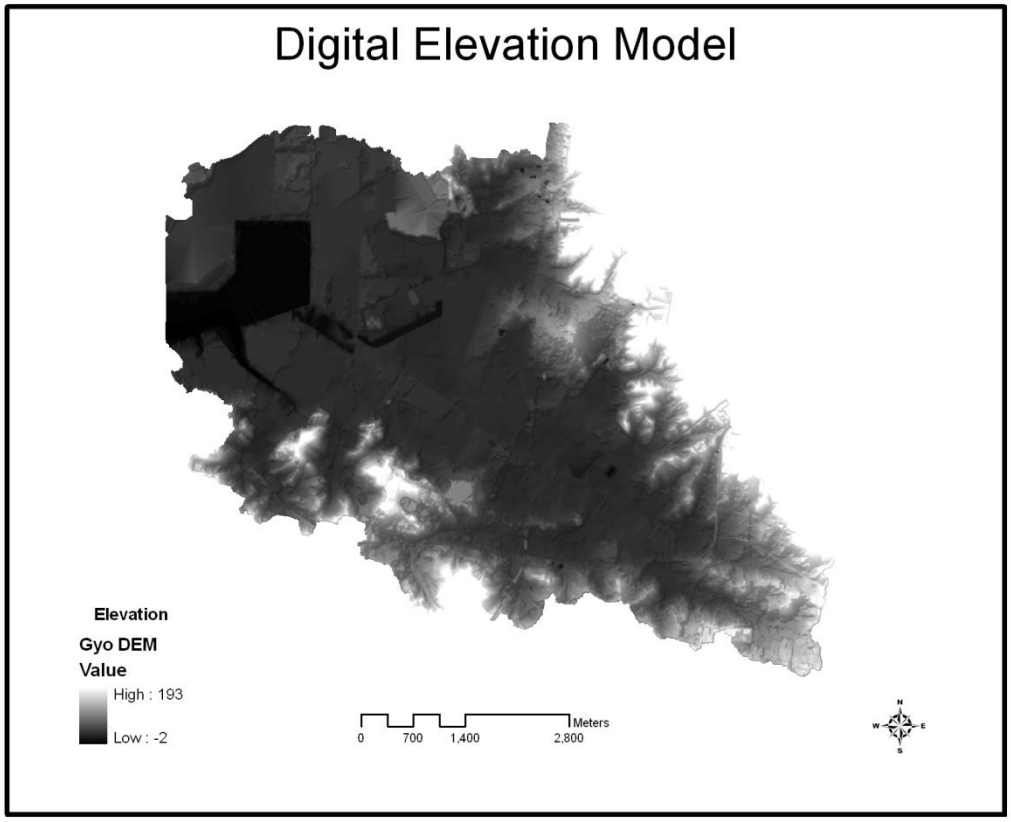
For that, we add the manhole_groundlevel feature to ArcMap and we use the 3D analyst toolbar: create/modify Tin → create tin from features; we use the field HSL for the height of the contour_clip layer and we add the catchment layer in the tin creation because we need to cut the shape again (if not, this step can be managed after the tin creation by clicking create/modify Tin → add features to tin); we save the output as "tin_new":



Then, finally, the created tin is converted into a DEM: we use the tool 3D analyst → convert → tin to raster, we choose a cell grid size of 1 (1x1 meters) and save the output as "dem":



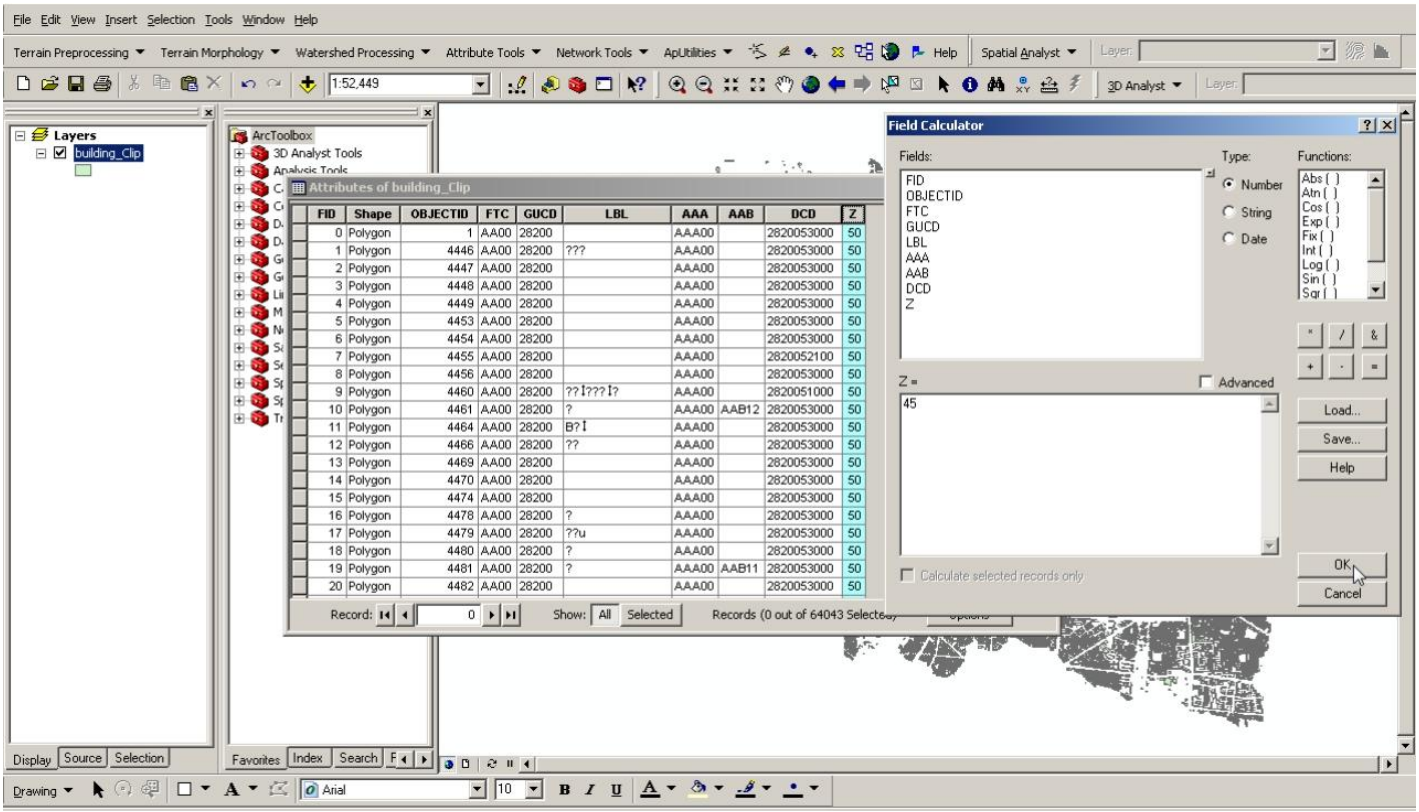
There is the final dem that we obtain:



B. Addition of the buildings and the roads

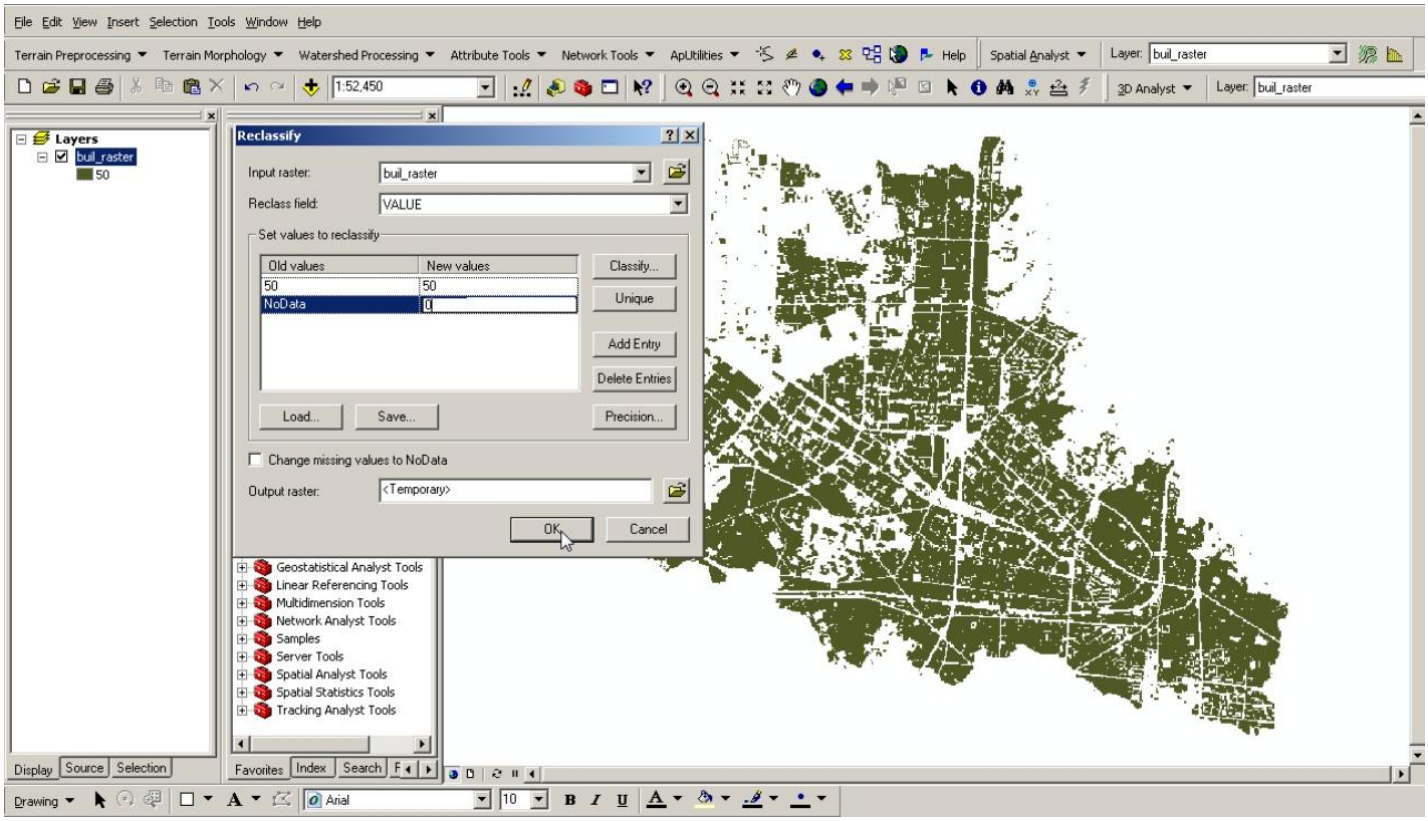
We want know to implement roads and buildings into our dem to get a more precise model to calculate our subcatchments. We will consider the roads like having 20 cm less than the ground level and the buildings 50 m high as a simplification.

The first step is to clip the road file with the catchment file (road_clip output) and the buildings file with the catchment file (buil_clip output) as before. Then, we have to add a field for the elevation. To achieve this, we open the attribute table of the buil_clip for example (click right on the file in ArcMap → open attribute table → options → add field, we call this field z and then we select the new field, click right on it and choose field calculator, then choose z in the field table and set the value on 50):



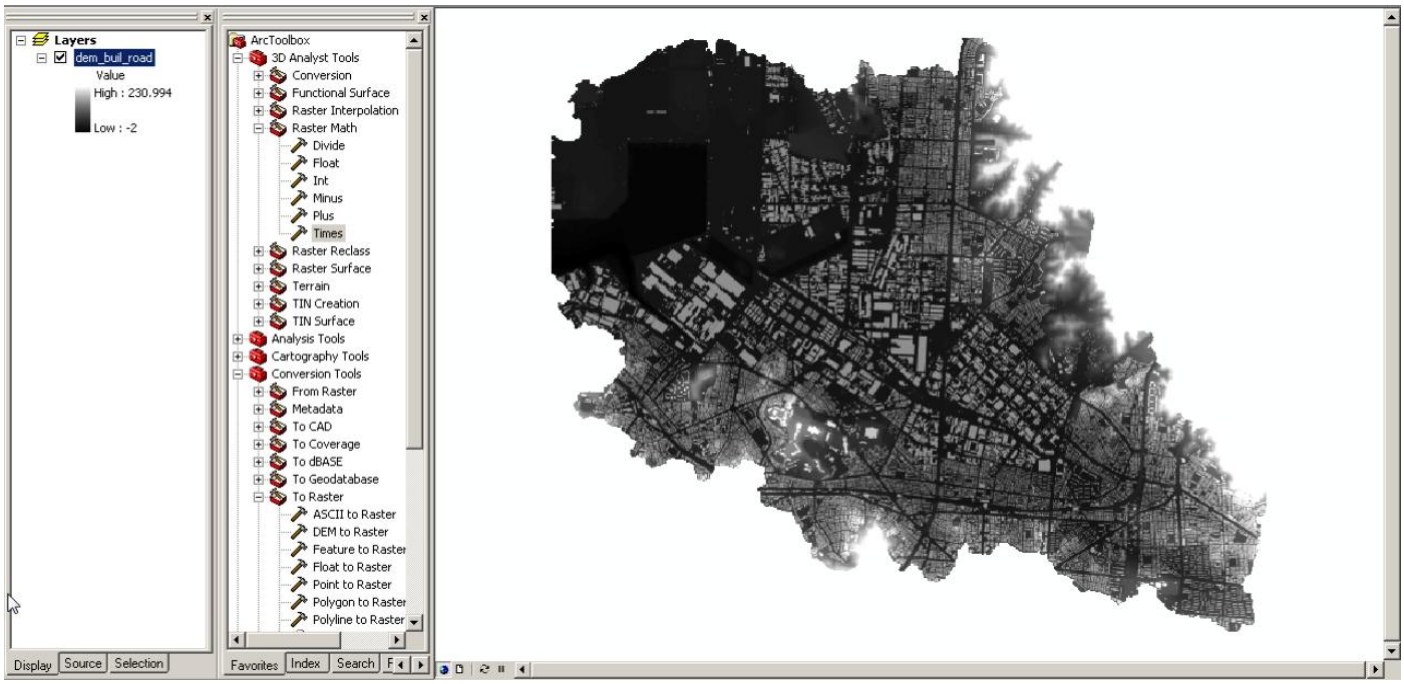
For the roads, we follow the same steps even if the process is a bit different, because field calculator is not handling the value -0.2. Then, we put 1 instead and we will correct the value after.

Next step is to create a raster with these road_clip and building_clip layers to integrate them in the DEM. We use the conversion tool in Arctoolbox → feature to raster with z for the field, we call these two new raster buil_raster and road_raster. Then, we have to reclassify the obtained raster in order to add them to the dem: we use the spatial analyst tool → reclassify and we keep the same value for the building height (50) and change the NoData to 0:



We do the same for the road_raster layer that we have created before. Next step is to set the road height to 0.2 instead of 1: we use 3D analyst tool in the Arctoolbox → raster math → times and we input first the road_raster reclassified and in the second line we put 0.2, which gives us an elevation of 0.2 meters for the roads.

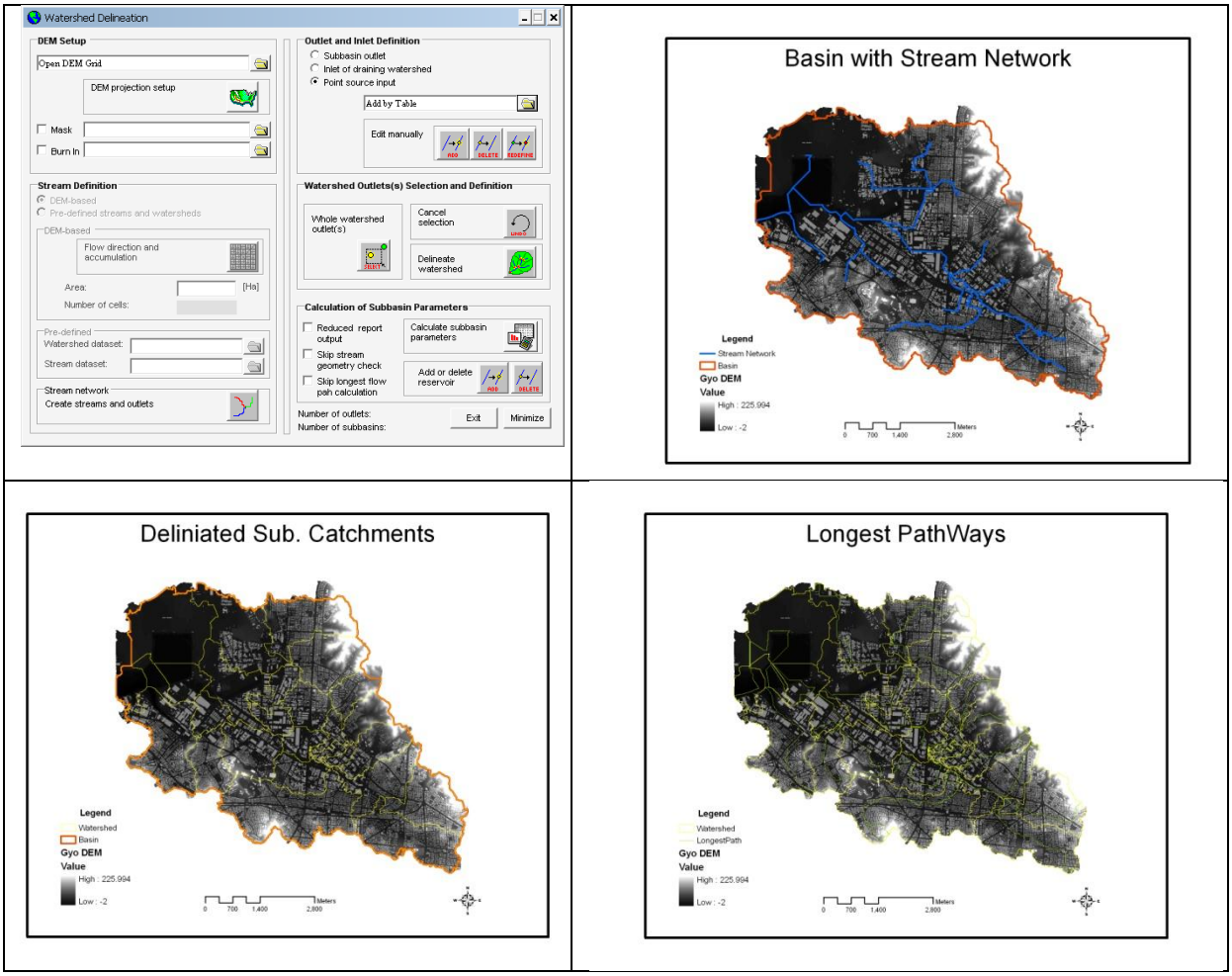
The final step is to merge the three rasters together (DEM, roads and buildings): first we add the buildings (3D analyst in Arctoolbox → Raster Math → Plus → first input: dem; second input: buil_raster reclassified → output: dem_buil) and then we minus the road layer to the dem_buil raster (3D analyst in Arctoolbox → Raster Math → Minus → first input: dem_buil; second input: road_raster reclassified → output: dem_buil_road) and we obtain our final raster, ready to use:



C. Use of ArcSWAT

SWAT – The Soil Water Assessment Tool is a very powerful application to model environmental cycles and interactions developed by the US-GS. Arc SWAT therefore is an ArcGIS extension of SWAT for an easy creation and visualization of SWAT related data. It can be used to produced DEM based watershed delineations, to find longest path ways within catchments and other catchment related hydrological data. Since many tools which are used to model floods need this type of hydrological and geometrical data, ArcSWAT is a very interesting extension to provide this input data.

Using a DEM as shown before, the main streams and the stream network, based on the number of inflow cells can be created and used again as base for the sub-catchment delineation. Having this the important parameters like longest path way, slope, area, extension etc. can be calculated and stored in related attribute tables of the sub-catchment file.



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