**Explanation of Model**

The model focuses on pre-conditioning of feature layers, clipping DEM models, converting from feet to international units, and the volume and extent of each recognized lake level, in order to calculate the change in water volume and water fluxes between each stage. The Merge tool is applied to the various Volume outputs, that can be used for graphing later.

Step 1 Data Acquisition

Acquire all 30m DEM tiles from USGS The National Map that cover the study area (21 files) and GSL Shoreline Feature from ARGC (Utah State Government). Also from ARGC, the feature Historic Lake Bonneville that marks the high-water mark will be loaded.

Step 2 Modern GSL Shoreline feature preparation

The GSL Shoreline feature contains four different polygons representing historic highs and low levels of the Great Salt Lake. Take four copies, so the original feature will not be impacted. With the Select By Attribute tool each lake level gets selected and saved as separate file. Since the elevation is stored in feet, a new field will be added and with the tool Calculate Field converted to meters. Finally, all polygons of the lake level get dissolved into a single multipart polygon. This process is repeated for all four levels.

Step 3 Merging DEM tiles

With the Mosaic to New Raster tool all 21 tiles get merged to a larger, single raster.

Step 4 Reducing the DEM size

Since the shapefile for the highstand of Lake Bonneville is already available, and all other lake levels are going to be contained within this maximum extend, it is saving resources if we remove excess information of the DEM outside of the lake. Using the tool Extract by Mask, the Merged DEM is being cut to the Historic Lake Bonneville extent.

Step 5 DEMs of the paleo lake levels

Using the shoreline elevations published in the literature, we can calculate the extent of three other lake levels: Gilbert, Stansbury, and Provo. First, take a copy of the DEM, then use the tool Set Null on the DEM for all elevations larger than the current lake level.

Step 6 Polygons of the lower lake levels

Taking the DEMs of Gilbert, Stansbury, and Provo, run the tool Raster to Polygon and then Dissolve everything. Since the polygon will mimic the shape of the DEM pixels, run the tool Simplify Polygon.

Step 7 Volumes of paleo lake levels

Use the tool Surface Volume to calculate the space between a DEM raster and a hypothetical surface. For each paleo lake level plug in the elevation and select below surface calculation. Result is a table/text file.

Step 8 DEMs of the modern lake levels

Take a copy of the Bonneville Highstand DEM and use the tool Extract by Mask to reduce the DEM to the polygon of each modern lake level.

Step 9 Volumes of the modern lake levels

Use the tool Surface Volume to calculate the space between a DEM raster and a hypothetical surface. For each modern lake level plug in the elevation and select below surface calculation. Result is a table/text file.

Step 10

Us the Merge tool to combine all volume tables in a single table and convert the volumes and areas from meters to kilometers. Use the Add Field and Calculate Field tools.