THESIS

ASSESSMENT OF DIGITAL ELEVATION DATA ON SELECTION OF A DAM SITE

By

SHAHZAD AHMED

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ABSTRACT

Digital elevation data have wide range of applications in natural resources management systems. In water resources, it is generally utilized in the tasks such as watershed and stream network delineation, reservoir capacity estimation, river analysis and catchment modeling etc. Modernization has increased the number of elevation data sources. These elevation data sources provide elevation data with various resolution, cost and accuracy. So, the trade-off between these data sources for a particular task has become difficult.

First part of this study was an attempt to assess and improve the accuracy of digital elevation data obtained from different sources. This assessment was based on some reservoir parameters, which were estimated from elevation data obtained from different sources. Elevation data was collected from GPS survey, Google Earth, ASTER DEM, SRTM DEM, GTOPO DEM and Topographic Map (G.T. Sheets). All of the elevation data sources were correlated with the GT sheet elevation values and correlation equation (named as correction factors in this study) for each data source was developed. Subsequently, these correction factors were applied on corresponding DEMs in the ArcGIS environment.

Second focus of this study was to make the best choice of cell size available for different task related to dam site investigations. The cell sizes of 30 m, 90 m, 125 m, 250 m, 500 m and 1 km were utilized. This range of cell sizes was obtained by resampling the finer resolution DEM to coarser resolution.

With the help of Geographical Information System (GIS) the reservoir parameters; watershed area, reservoir surface area and elevation-capacity curves were

calculated from DEMs. These calculated parameters were compared with the parameters which were collected from The Small Dams Organization, Govt. of Punjab, Pakistan.

Third focus of this study was to improve the accuracy of DEMs. It was accomplished by using two processes; (i) application of the correction factors on DEMs and (ii) DEM reconditioning. The DEM reconditioning process generated the hydrologically corrected DEMs (DEM based stream features were matched with that of topographic sheets). Effectiveness of the improvement process was tested on reservoir parameters by comparing the two results; (i) data obtained from Small Dams Organization (SDO), Islamabad and (ii) the results with improvement.

All of the elevation data sources were found in close relationship with the G.T. sheet data (with R^2 value 0.991 – 0.994) except GPS (with R^2 value 0.926) and GTOPO DEM (with R^2 value 0.952). The highest value of maximum and minimum percentage error was found in GPS data and it was lowest in SRTM data. Further, the curves of relative percent error were drawn; the curves of Google Earth and SRTM data were found of same order of accuracy, the curves of GPS and GTOPO data were of same order of accuracy. While the order of accuracy, of ASTER data, was intermediate in nature. Rather, it was closer to the SRTM and Google Earth curve.

The accuracy of cell sizes and effectiveness of improvement technique were measured by a statistical factor, called as standard error. With the help of this factor two conclusions were drawn; (i) the cell sizes of 30 m and 90 m were reliable for the estimation of the dam parameters and (ii) the DEM improvement procedure is useful to some extent but not considerably.