# Optimization of ASTER Elevation Data to Improve Watershed Delineation

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*Abstract*- **The primary goal of this research is to examine the practical use of public domain satellite data in natural hazard modeling. Watershed delineation and characterization is one of the most important step in hydrological modeling. In last decade, considerable developments have been achieved for satellite industry, specifically in acquisition of terrain elevation data from the space. High resolution of digital elevation model (DEM) are now global freely available. The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) - Global DEM version 2 is one the pioneer source of elevation data available from October 2011. Optimization techniques were applied for ASTER-GDEM to improve watershed delineation and parameterizations in Muar watershed located in Peninsular Malaysia. The HEC-GeoHMS is employed to automate the watershed delineation and parametrization process. Result of this research shows that, DEM reconditioning by using complementary drainage network derived from google earth, significantly improve the watershed boundary delineation in flat and urban areas.**

***Keywords:ASTER-GDEM; HEC-GeoHMS; Muar***

## I. INTRODUCTION

One of the most useful applications of Geospatial Information Systems (GIS) is the delineation of watershed boundaries. A watershed boundary is the line that divides two basins mountain peaks, while in flat and urban areas it is invisible. Watershed delineation and parametrization is primary and basic steps in hydrological modelling and it can significantly affect the results of hydrological simulations. Now, it is done using digital elevation model (DEM) and automated processor which embedded or linked with GIS software. There are several GIS software including ArcGIS, ILWIS, Map Window, Grass and many more available for GIS- based watershed boundary delineation.

## II. Digital Elevation Model

With the invention of Geospatial Information Systems (GIS) and computer models, the role of DEM has become very important and effective tools in water resources studies. The digital terrain model (DTM) is defined as a numerical representation of the terrain. Since Miller and Laflamme [1] who coined the original term, other expressions such as DEM, digital height models (DHM), digital surface model (DSM), digital ground models (DGM) and digital terrain elevation model (DTEM) have been used by Maidment [2], Djokic and Ye [3], Vieux [4] and Li et al. [5]. These terms originated from different countries. According to Li et al. [5] the word DEM is widely used in United States, DHM in Germany, DGM in the United Kingdom and DTEM was introduced and is used by united states geological survey (USGS) as well as and the Defence Mapping Agency (DMA). In hydrology and flood modelling, applications of DEM are mainly focused on automate watershed boundary delineation and segmentation, definition of drainage divides, identification of flow length, flow direction and flow accumulation as well as flood inundation depth and areas. In distributed hydrological models, DEM plays a very important role. The DEM and its derivatives including slope, aspect, upslope contributing area, watershed area and curvature are important factors [6] for flood modelling and landslide susceptibility mapping. One of the key characteristic of the DEM is the cell size or DEM resolution. Many researchers have carried out to find best suitable DEM cell size for different purposes and different scales. A comprehensive study by Maidment [7] have shown that DEM resolution for rainfall-runoff and flood modelling changes by watershed area (see Table 1). In theory, the DEM resolution should be selected as a function of the land surface features, scale of the process that are modelled, and numerical model used to model process [8]. But in practice the selection of DEM is often driven by data availability, judgment, test applications, experience and, last but not least, cost [9].

TABLE 1: Recommended DEM cell sizes and their range of applications (After Maidment [7])

| Cell Size | Watershed Area (km$^2$) | Typical Application |
|---|---|---|
| 30 m | 5 | Urban watersheds |
| 90 m | 40 | Rural watersheds |
| 460 m | 1000 | River basins |
| 930 m | 4000 | Nations |
| 5.6 km | 150,000 | Continents |
| 9.3 km | 400,000 | Global |