Enhancing Quality of Global DEMs for Geomorphological Analysis – Case Study in Danang City, Vietnam

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Abstract: Global Digital Elevation Models are considered very useful spatial information and find wide use in several applications. DEM derived from ASTER stereo pairs (ASTER GDEM) and Shuttle Radar Topographic Mission (SRTM) offer almost global coverage and provide elevation data for geospatial analysis. Both ASTER GDEM and SRTM offer potential for extracting terrain and hydrographic parameters on medium-scale over large areas. The problem with ASTER GDEM and SRTM is that they include many artifacts and height errors that affect the quality and elevation data significantly. This study aims to examine ways to improve the quality of these free DEM using available reference DEM and data fusion technique using data for Danang City in Vietnam. Firstly, a high-quality reference DEM was generated from elevation contour lines and used to compare with global free DEMs to detect areas with elevation discrepancies. This reference DEM was generated using BS-Horizon method developed by Nonogaki *et al*. (2012). BS-Horizon was evaluated as an effective method for generating reliable DEM using inter-contour information from elevation data. The artifacts with the extreme high elevation value in ASTER GDEM as well as low-elevation value in SRTM were detected by compare with the reference DEM. Subsequently, using the slope and aspect values that were derived from this reference DEM and the elevation of neighboring pixels, the artifacts or anomalies were minimized. The bias effect in both ASTER GDEM and SRTM was also calculated by comparing with reference DEM, ground control points and landform map. Finally, the data fusion technique was applied by combination of ASTER GDEM and SRTM based on the topographic context. The Interferometric Synthetic Aperture Radar (InSAR) technique used in SRTM has limitations in providing reliable result in conditions of high relief and steep slopes. We therefore use ASTER GDEM value for the areas with high relief and steep slopes. In relatively flat area, SRTM was used for the new DEM value. From this fused DEM, some topographic and hydrology parameters were extracted to evaluate effective representation of geomorphology. The results were compared with reference DEM to discuss about accuracy and impact of landform in variation on DEM quality. Results indicate that the fused DEM has improved accuracy than individual DEMs when comparing with the reference DEM and most artifacts are appropriately eliminated. The proposed method supports the effective utilization for the areas where other high quality DEMs are not available.

Keywords: DEM enhancement, ASTER GDEM, SRTM, BS_Horizon, Geomorphology.