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Evaluation of the SRTM, ASTER and Photogrammetric Digital Elevation Models versus GPS/levelling Data in Iran

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Digital Elevation Models are used, e.g., to determine the terrain correction and downward continuation (DWC) corrections in geoid modelling, geo-morphological simulation and classification and hydrological run-off modelling. However, a DEM is only a model of the elevation surface, and like other models, it is subject to errors. So, it is important to evaluate the accuracy of the DEM in the area of interest before using it. The accuracy of DEMs usually is not uniform because they use various data sources in their construction. A reasonable indication about the accuracy of digital elevation models (DEM) can be obtained from the comparison with the GPS/levelling data. It can be done by the determination of the Root-Mean-Square (RMS) of fitting between the DEM and leveling heights. The various errors in the DEM production may be approximated by different kinds of functions in order to fit the DEMs to a set of GPS levelling points through an integrated least squares (LS) adjustment. Several models can be used, ranging from a simple linear regression to a seven parameter similarity transformation model. The seven parameter model gives the best fitting with minimum standard division in all selected DEMs and in Iran. Based on the 476 precise levelling benchmarks (occupied with GPS) which are reasonably well distributed in different topographical areas, we obtain a RMS of 7 parameter fitting for SRTM and ASTER DEMS 3.4, 6.82 m, respectively.