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DEMs: A Multivariate Comparison Approach

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Abstract : The evaluation of the quality of a data product is based on the comparison of the product with a reference of greater accuracy. In the case of MDE data products, quality assessment usually focuses on positional accuracy and few studies consider other terrain characteristics, such as slope and orientation. The proposal that is made consists of evaluating the similarity of two DEMs (a product and a reference), through the joint analysis of the distribution functions of the variables of interest, for example, elevations, slopes and orientations. This is a multivariable approach that focuses on distribution functions, not on single parameters such as mean values or dispersions (e.g. root mean squared error or variance). This is considered to be a more holistic approach. The use of the Kolmogorov-Smirnov test is proposed due to its non-parametric nature, since the distributions of the variables of interest cannot always be adequately modeled by parametric models (e.g. the Normal distribution model). In addition, its application to the multivariate case is carried out jointly by means of a single test on the convolution of the distribution functions of the variables considered, which avoids the use of corrections such as Bonferroni when several statistics hypothesis tests are carried out together. In this work, two DEM products have been considered, DEM02 with a resolution of 2x2 meters and DEM05 with a resolution of 5x5 meters, both generated by the National Geographic Institute of Spain. DEM02 is considered as the reference and DEM05 as the product to be evaluated. In addition, the slope and aspect derived models have been calculated by GIS operations on the two DEM datasets. Through sample simulation processes, the adequate behavior of the Kolmogorov-Smirnov statistical test has been verified when the null hypothesis is true, which allows calibrating the value of the statistic for the desired significance value (e.g. 5%). Once the process has been calibrated, the same process can be applied to compare the similarity of different DEM data sets (e.g. the DEM05 versus the DEM02). In summary, an innovative alternative for the comparison of DEM data sets based on a multinomial non-parametric perspective has been proposed by means of a single Kolmogorov-Smirnov test. This new approach could be extended to other DEM features of interest (e.g. curvature, etc.) and to more than three variables

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