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Title. " Evaluation procedures for testing contour-to-grid interpolation methods using synthetic surfaces"

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This study deals with ways for the evaluation of contour-to-grid interpolation algorithms. The basic scenario is as follows : One starts off with terrain contours and then digitizes these contours. From the digitized contours , a Digital Elevation Model (DEM) is to be constructed using some particular interpolation method. One now needs to know how accurate this derived DEM is. This can be done if true elevations are known at points where interpolation takes place. A useful tool for an investigation of this type is a synthetic surface. This is defined as a surface of the form $Z=f(X, Y)$. That is , we have an exact equation whereby we can calculate an elevation (Z) for each X, Y coordinate. This value can then be compared with the interpolated value and the true error will be known.

A method is described for deriving a synthetic surface from a portion of a topographic map. Although the resulting surface map may not look like the original topographic map , it contains much of the original characteristics. Six synthetic surfaces , of differing degrees of complexity, were derived. A set of contours for each surface was generated in raster format. A DEM was derived from each set of contours using three interpolation methods. These methods were: cubic interpolation along the steepest slope ; linear interpolation in the direction of steepest slope; and linear interpolation parallel to the X and Y axes. The interpolated grid values of the elevations were compared with the true values (calculated from the synthetic surface equation) and the following measures were then obtained for each case : mean error ; maximum absolute error ; and standard deviation of the error. In addition , residual maps were constructed for each case. To obtain a better understanding of the practical significance of these errors , for each case a map was plotted showing the original (true) contours and the contours as plotted from the derived DEM.

An analysis of the results obtained is given.

We have also found indications that , although the synthetic surface does not look like a "real" topographic surface , the errors obtained with synthetic surfaces are larger than one would get if a "topographic synthetic surface" was used.