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Digital mapping and spatial analysis of planar geological features using ESRI ArcGIS 10

John-Are Hansen and Steffen G. Bergh
Institute of Geology, University of Tromsø, Norway (john-are.hansen@uit.no)

Planar geological features such as fractures, foliation or bedding may correspond with distinct topographic elements. High resolution digital elevation models (DEMs) or LIDAR data can consequently be used to extract geological information such as orientation and spatial variation of such features. ESRI ArcGIS 10 offers the possibility to map 3d polygons directly from elevation models. Since a plane can be defined from three points in space, planar features are easily mapped by constructing 3d polygons based on three points on the planar feature in question. However, no built-in function in ESRI ArcGIS 10 offers the possibility to calculate the orientation of such features. We have written a Python scripts which extracts the x, y and z coordinates of the polygons vertices, and calculates the strike and dip of the polygons based on the three point method. The calculated strike and dip of the mapped planar features are then returned to the polygon file (shapefile) and may be displayed as strike and dip symbols on a map, used for further analysis in ESRI ArcGIS 10 and/or exported to other software for analysis. We have also written a second Python script which offers the possibility to plot the orientation of the mapped planar features in an equal-area lower hemisphere stereo net, directly in ESRI ArcGIS 10. The methodology described above, using ESRI ArcGIS 10 and the scripts in question, offers the possibility to easily conduct spatial orientation analysis of planar geological features derived from digital elevation models or LIDAR data; e.g. spatial fault and fracture analysis, fold analysis etc.