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# 3-D geological modeling from remote surface information: Application to the Beirut and Antelias watersheds in Lebanon

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Recent discoveries in earth sciences are mostly related to technologies allowing graphical representations of volumes. We present a way to produce mathematically and geometrically correct three-dimensional (3-D) geologic maps consisting of the volume and shape of all geologic features of a given area. The method is innovative in that it only uses surface information based on the combination of a standard geologic map, a satellite image, and digital elevation model. It is based on a modeling algorithm that only uses surfaces calculated from scattered data points and that intersects them following a series of geologically sound rules. The major advantage of using such technology is that it provides the user with a way to quantify geology. The case study chosen to illustrate the method is the Beirut and Antelias watersheds (Lebanon) characterized by relatively simple geology. Our aim is to present a 3-D geologic map that gives quantitative data not only at the surface (i.e., bed strikes and dips) but also at depth. The map then provides the opportunity to describe the geometry of the geologic structures through different graphical representations. The 3-D map allows a reexamination of the tectonic history of the area during the late Mesozoic. For instance, in the studied area, we display extensional deformations during the middle Cretaceous that are expressed by fault throw variations, layer thickness changes, and stratigraphic relationships.