

2006 Fall Meeting Search Results

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TI: Improving geologic surface interpolations using elastic plate bending solutions with additional physical constraints

AU: * Kaven, J

EM: kaven@stanford.edu

AF: Department of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305 United States

AU: Mazzeo, R

EM: mazzeo@math.stanford.edu

AF: Department of Mathematics, Stanford University, Stanford, CA 94305 United States

AU: Pollard, D D

EM: dpollard@pangea.stanford.edu

AF: Department of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305 United States

AB: Airborne laser ranging technology (LIDAR, ALSM) provides abundant data sets containing the geographic coordinates of discrete points on the tops of folded sedimentary layers which must be interpolated to describe the three-dimensional geometry of these geologic surfaces. Owing to the potential sparsity of coverage for a particular surface due to heterogeneous erosion and lack of exposure, robust interpolation techniques must be employed to construct continuous surfaces from the discrete and sparse data. Minimum curvature splines are a common interpolation tool for geological surfaces and are the analog of fitting an elastic sheet through all the data points. This tool, however, is not well suited for studying multiple stacked layers and tends to give nonphysical predictions. Minimum curvature methods can be enhanced for the specific purpose of interpolating folded geologic strata by adding layer thickness constraints for multilayer exposures, and by including additional terms in the governing equation that specify a non-uniform bi-axial tension in the elastic sheet. Layer thickness constraints are implemented by evaluating Green's functions of sub- or suprajacent surfaces at data points on the lower or upper surface which yield additional weighting parameters in the interpolation. These weighting parameters are found such that the difference between observed and interpolated elevations at known locations are minimized. General Green's function methods have been adapted to limit erroneous interpolations where high gradients in slope exist by adding a uniform bi-axial tension term to the governing biharmonic equation. We develop the Green's functions for a non-uniform bi-axial tension in two dimensions. The interpolation method presented here is employed at Raplee monocline, Utah. Folding at Raplee is thought to be caused by thrust faulting at depth. Several resistant layers with thicknesses varying between two and 20 meter were quantified with an ALSM survey. Individual surface interpolations yield interpenetrating surfaces, or negative thicknesses, which signal an erroneous interpolation. The interpolation methods outlined here can overcome these errors. Allowing for additional terms in the governing equation provides new insight into the remote boundary conditions of the folding at Raplee monocline.

DE: 0545 Modeling (4255)

DE: 3225 Numerical approximations and analysis (4260)

DE: 8005 Folds and folding

SC: Tectonophysics [T]

MN: 2006 Fall Meeting