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Open-source modular solutions for isostasy and flexure of the lithosphere: gFlex v1.0

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In convergent margin settings, flexural subsidence of sedimentary basins is initiated by tectonically-induced stresses, and continues with a combination of (1) sediment loading, (2) concurrent erosional unloading of the surrounding mountain ranges, and (3) water loading and/or unloading. These stresses and the implicit positive feedback – that sediment loading helps to maintain a topographic low into which more sediments are deposited – has long been recognized and deserves explicit treatment in numerical models. Here I present the newly-released version 1.0 of the open-source model gFlex, simulates isostasy and flexure of the lithosphere. gFlex can compute flexural isostasy along one-dimensional transects and across two-dimensional surfaces with either constant or variable lithospheric effective elastic thickness. Variable elastic thickness is an especially important component to modeling convergent margins, where active tectonics can produce an underlying lithosphere with nonuniform rheology. gFlex can be run as a standalone model, as part of the GRASS GIS environment (for straightforward integration with data and to take advantage of the GRASS GIS graphical user interface), or as a coupled component of a larger model simulation as part of the Community Surface Dynamics Modeling System (CSDMS). The source code is freely available from the University of Minnesota Earth-surface science GitHub repository at https://github.com/umn-earth-surface/gFlex, and potential users are encouraged to download and run the model and to suggest possible future improvements.