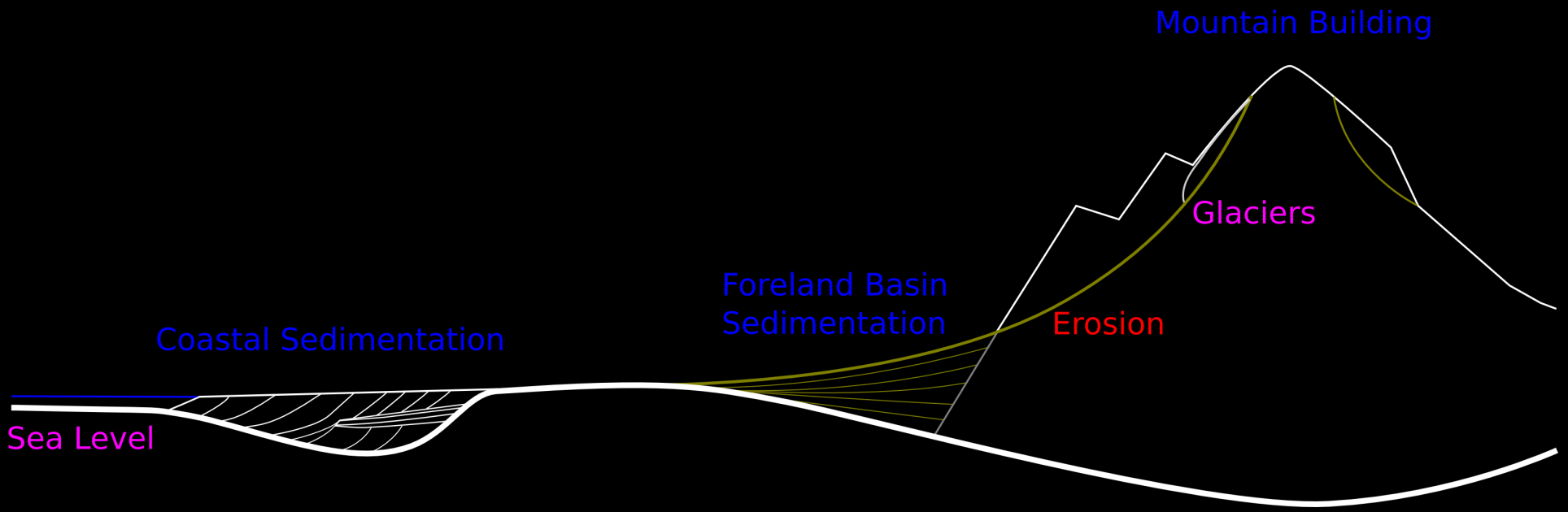
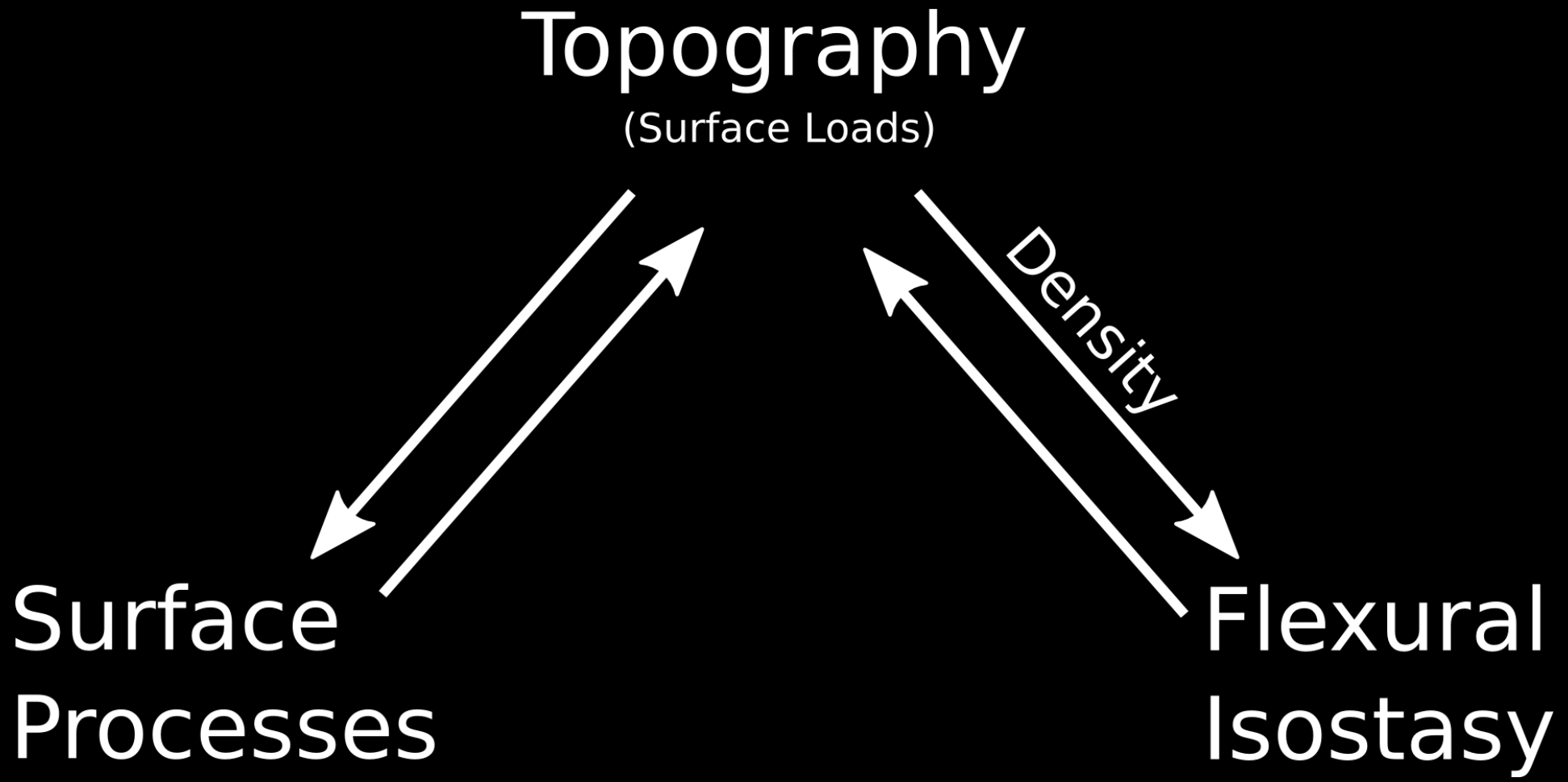
Feedbacks between surface processes and flexural isostasy: a motivation for coupling models

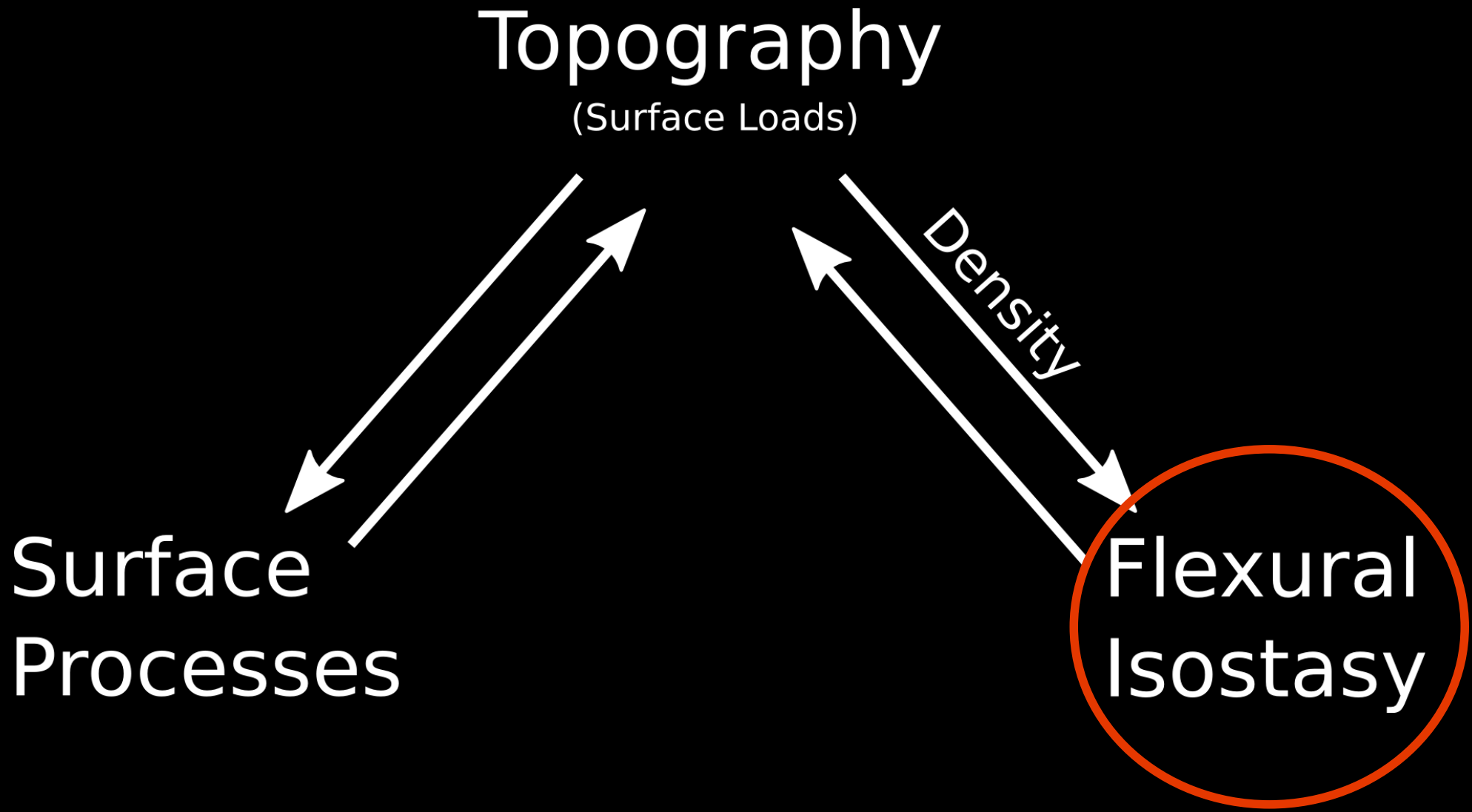


Andy Wickert, Greg Tucker, and Eric Hutton
with help and advice from Beichuan Yan, Scott Peckham, and Bob Anderson

INSTAAR, Geological Sciences, CIRES, and CSDMS, University of Colorado, Boulder

CSDMS All Hands Meeting, 29 October 2011


Topography
(Surface Loads)
Density
Surface
Processes
Flexural
Isostasy


Topography
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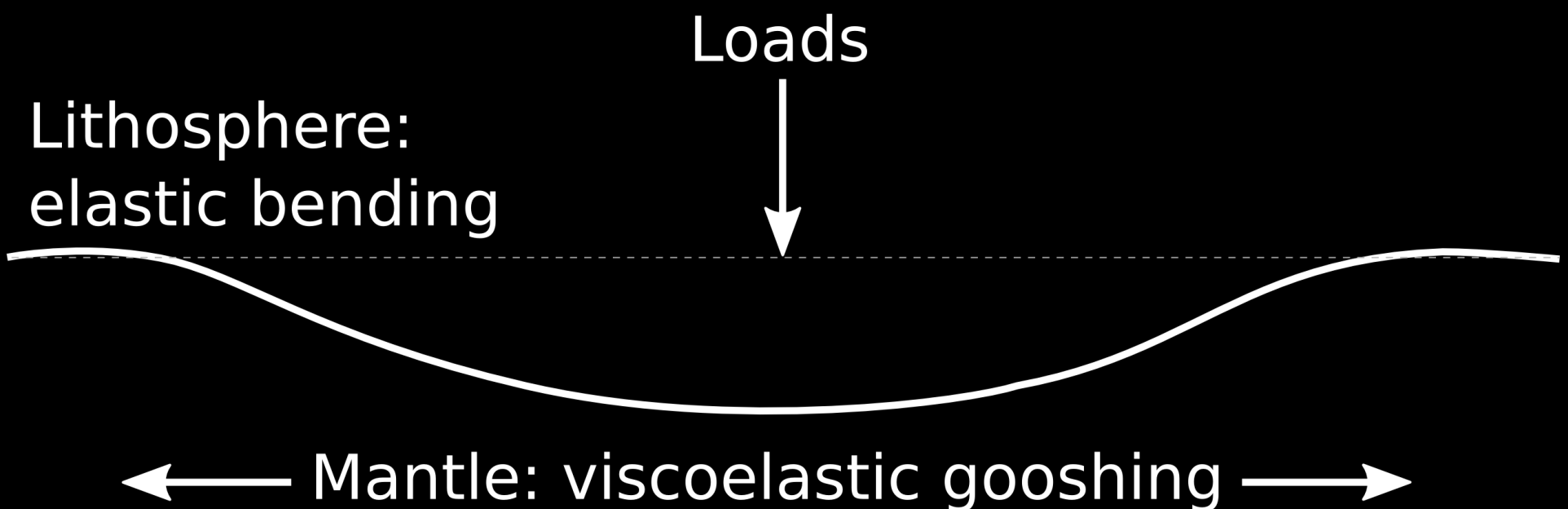
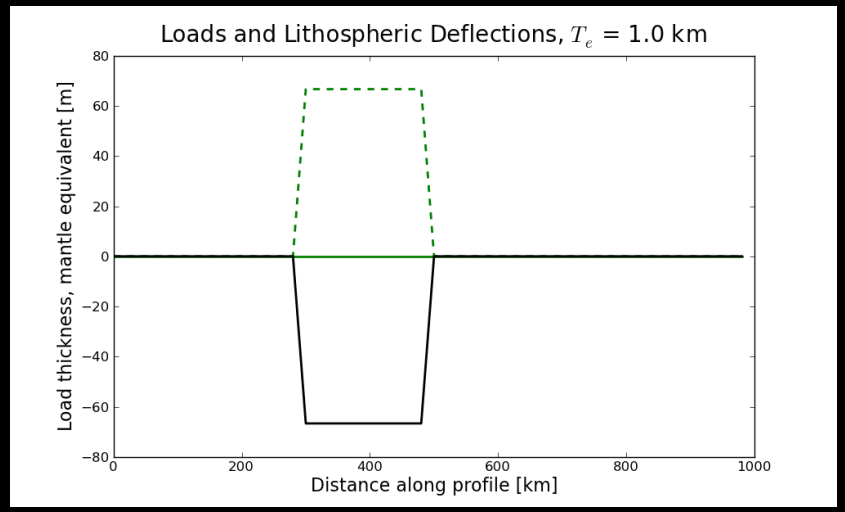
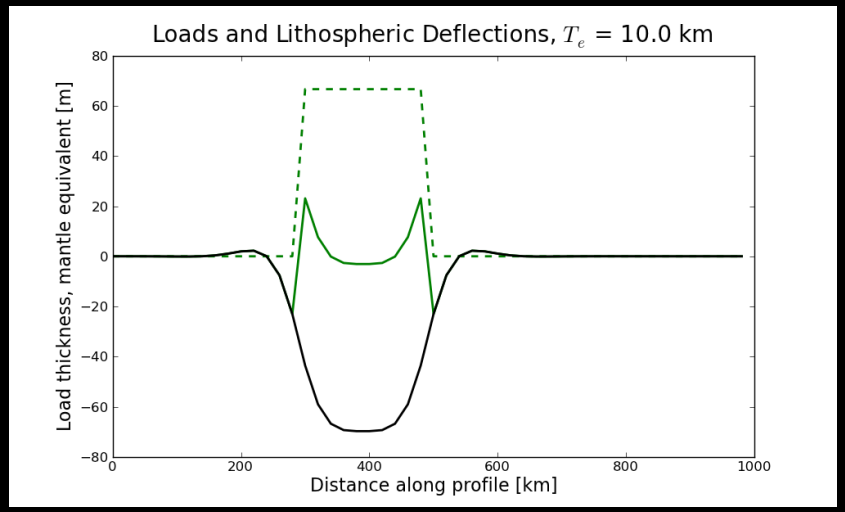
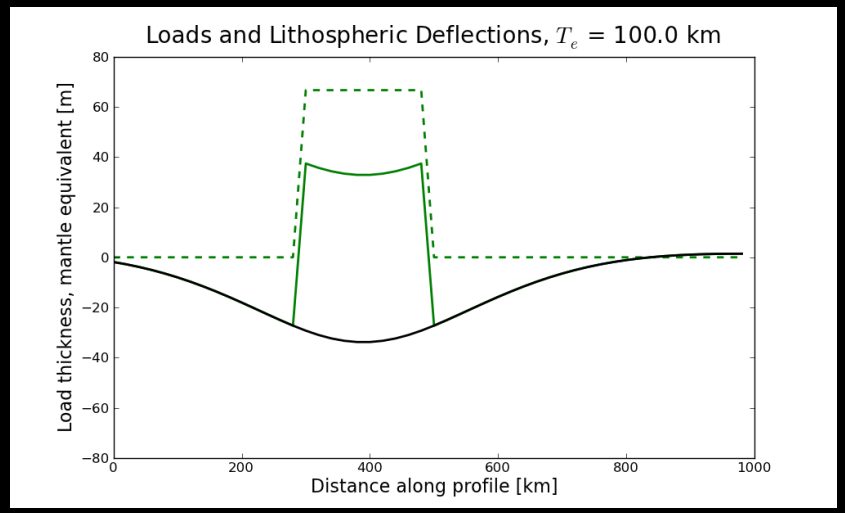
Isostasy and Lithospheric Flexure



Elastic thickness sets wavelength of isostatic compensation

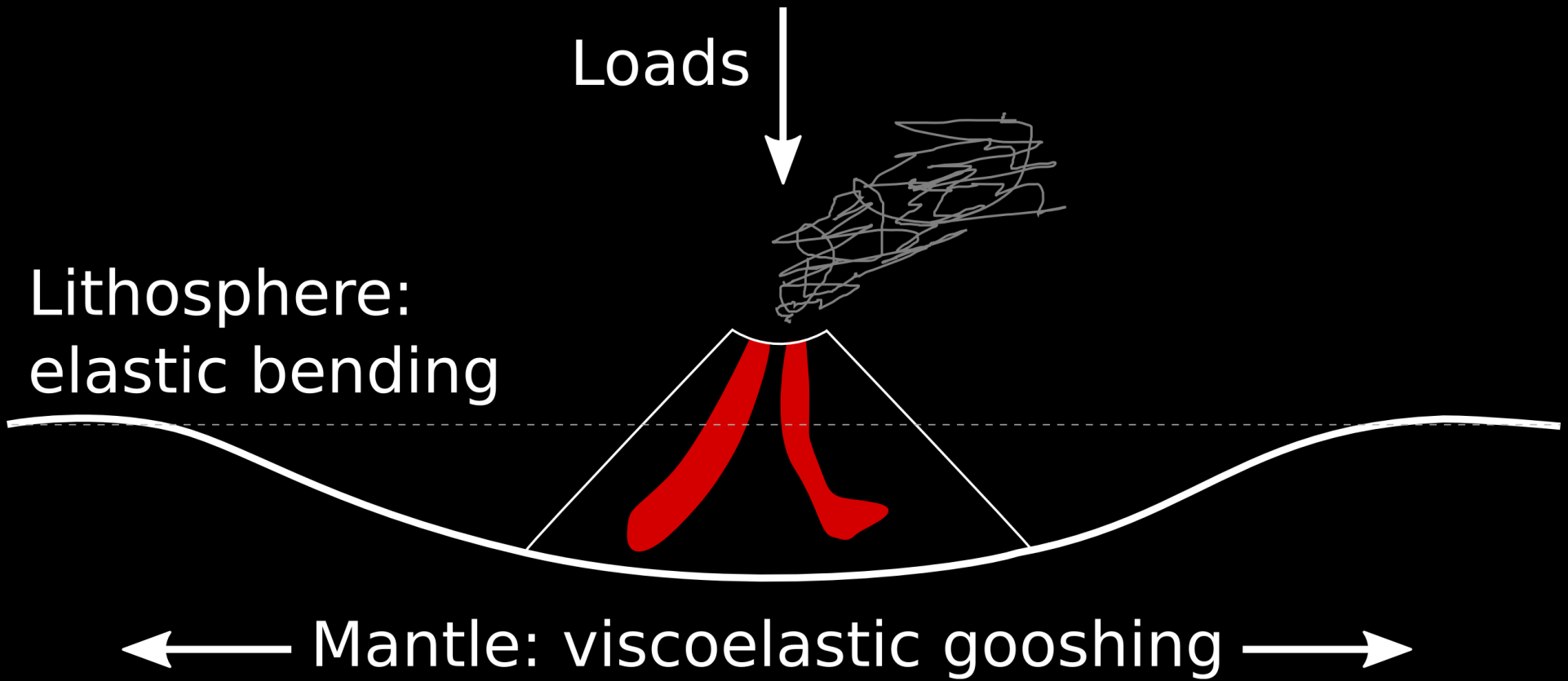




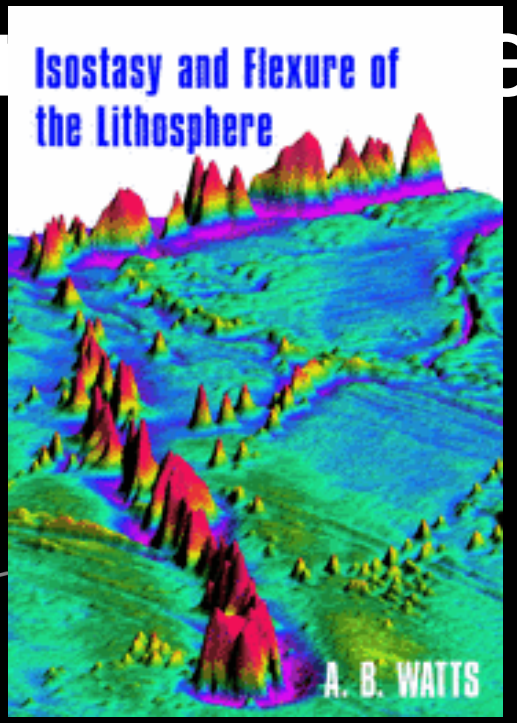


Elastic thickness sets the isostatic response, from total compensation (top left) to increasingly spread out compensation (above

Isostasy and Lithospheric Flexure



Isostasy and Lithosphere



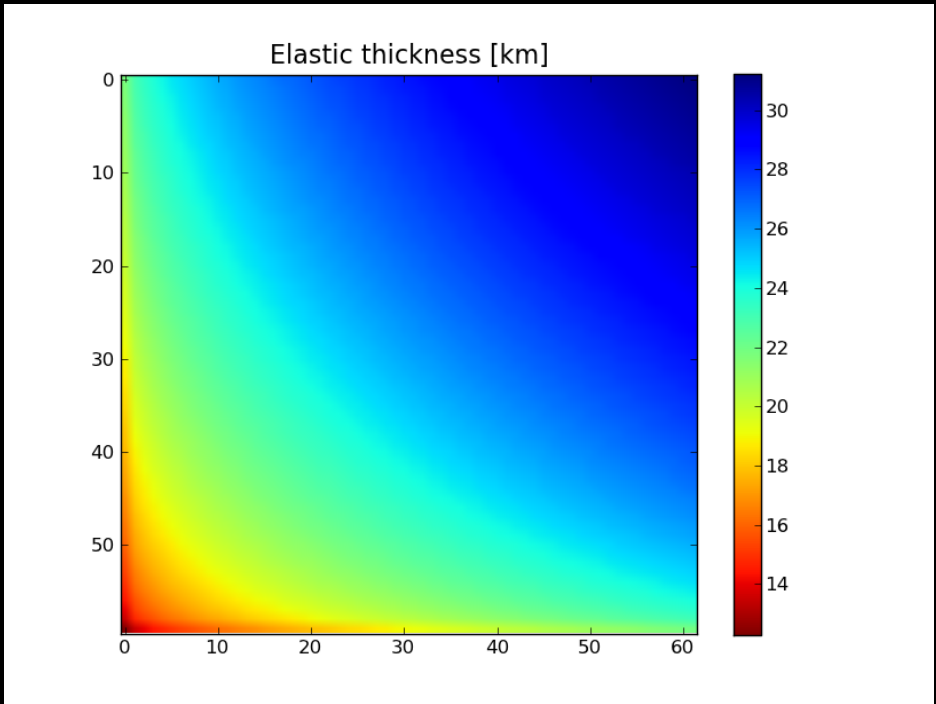
Loads

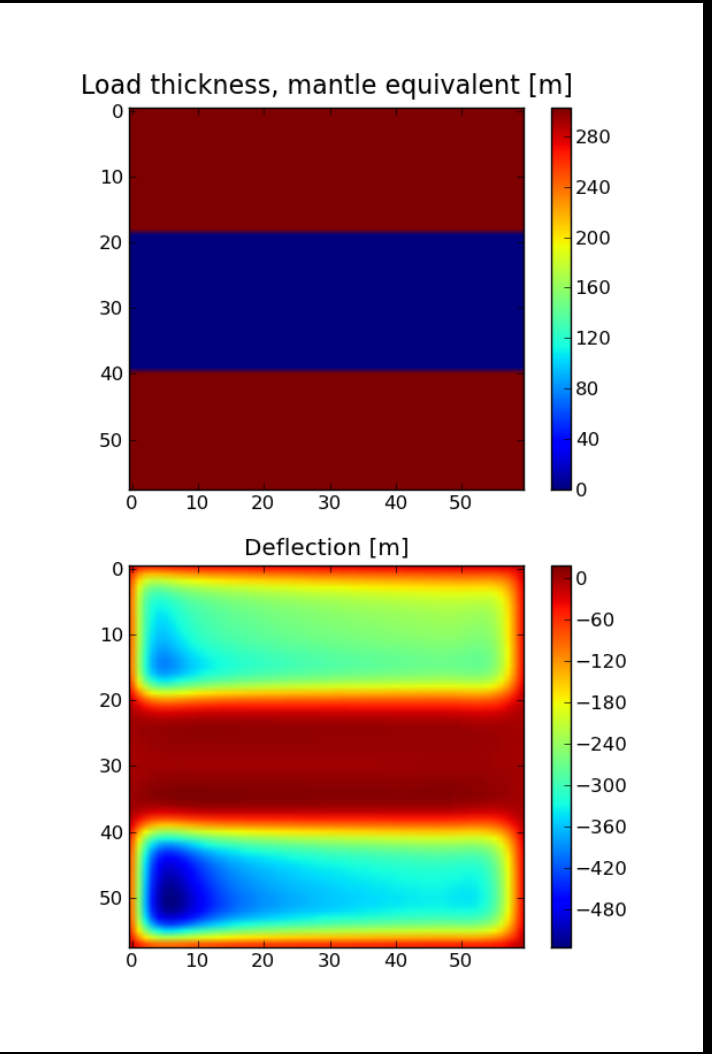
Lithosphere:
elastic bending

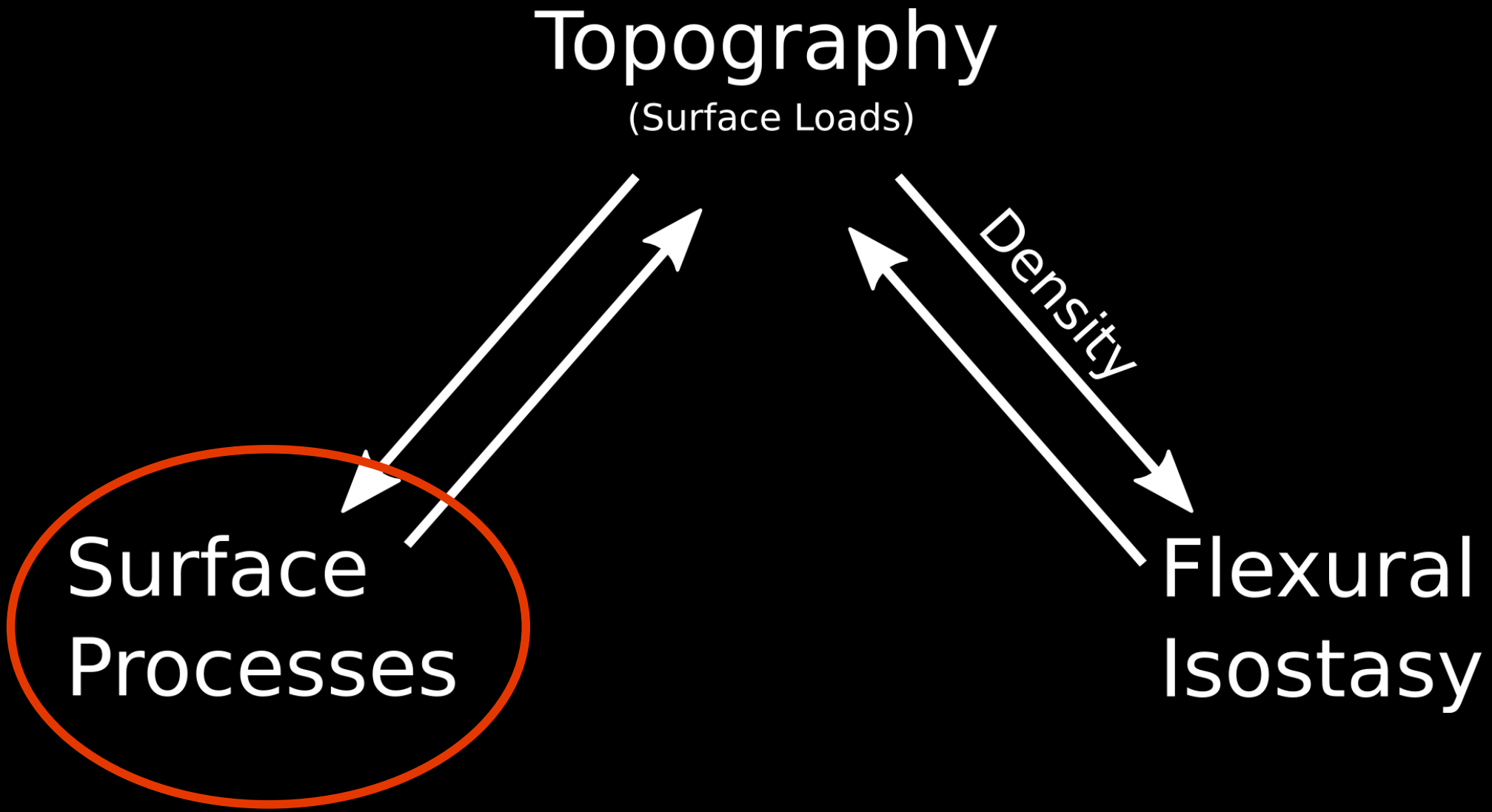
Mantle: viscoelastic gooshing

Flexure and Isostasy Model

Numerical and analytical solutions of 1D and 2D lithospheric thin-plate flexure with constant or varying elastic thickness, written in Python

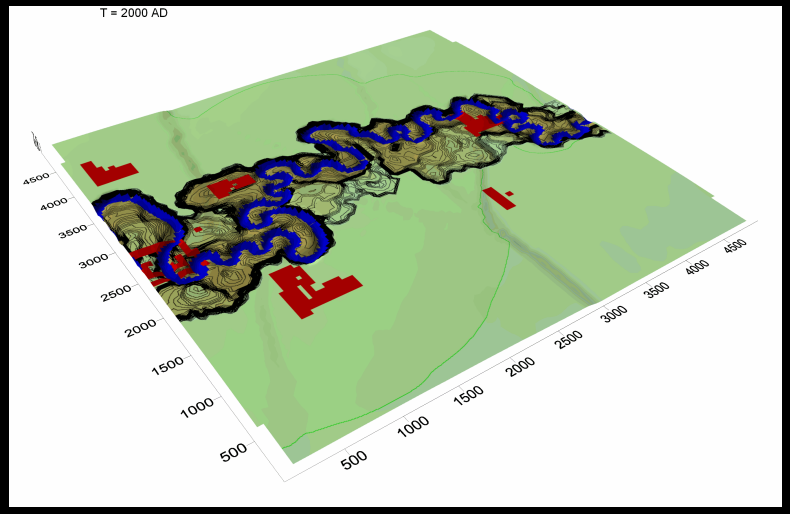


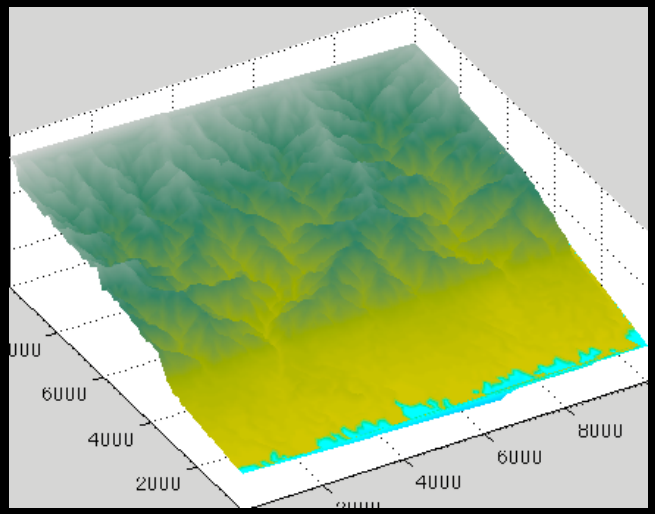


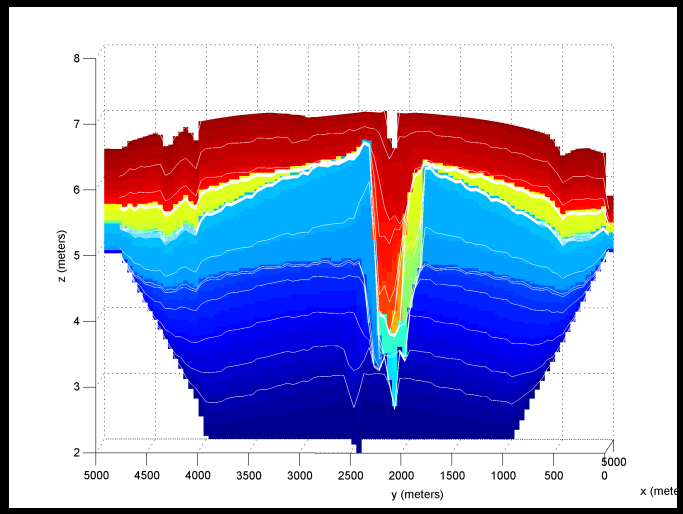

Topography
(Surface Loads)
Density
Surface
Processes
Flexural
Isostasy

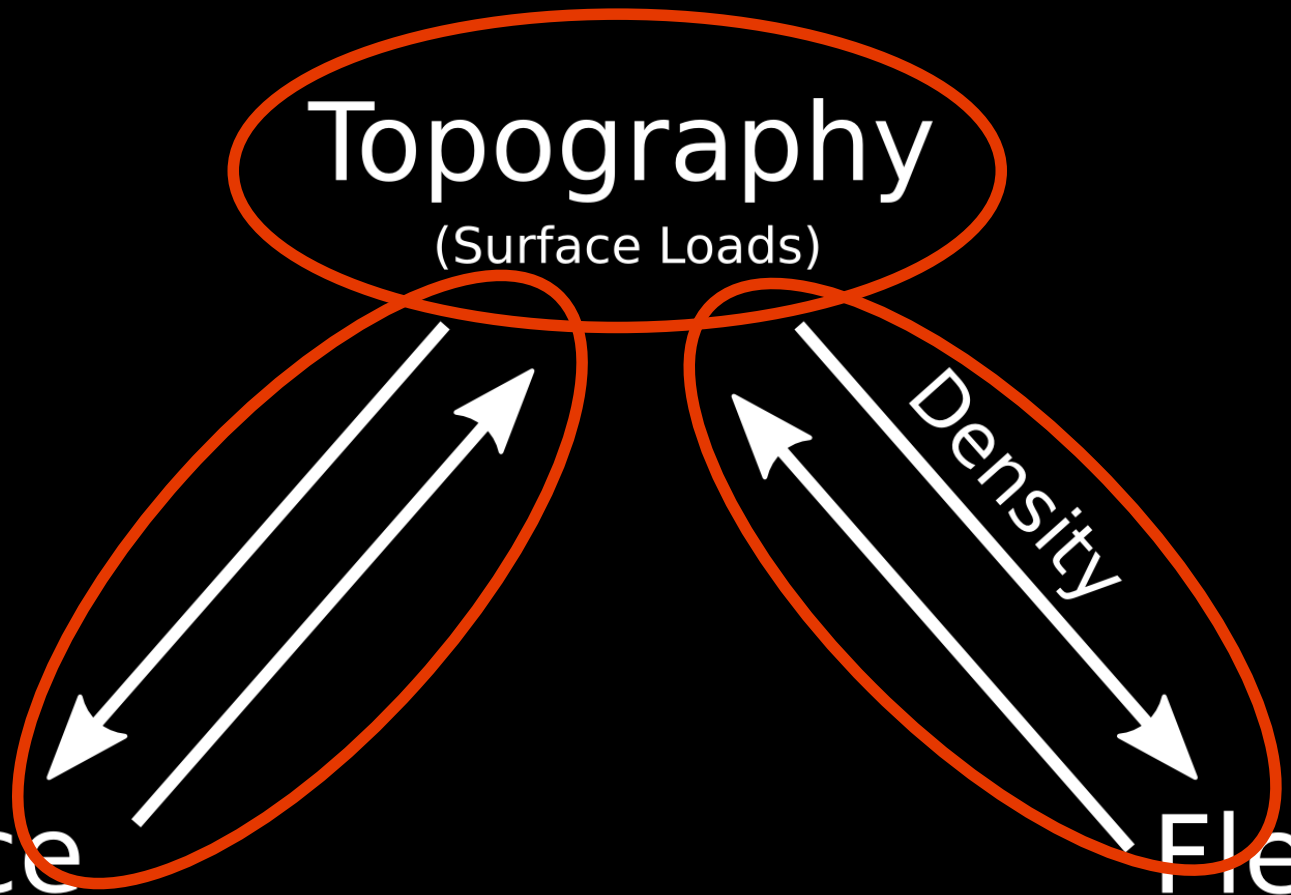
Channel-Hillslope Integrated Landscape Development (CHILD)

A large “do-it-all” landscape evolution model with an irregular grid, written in C++








Topography
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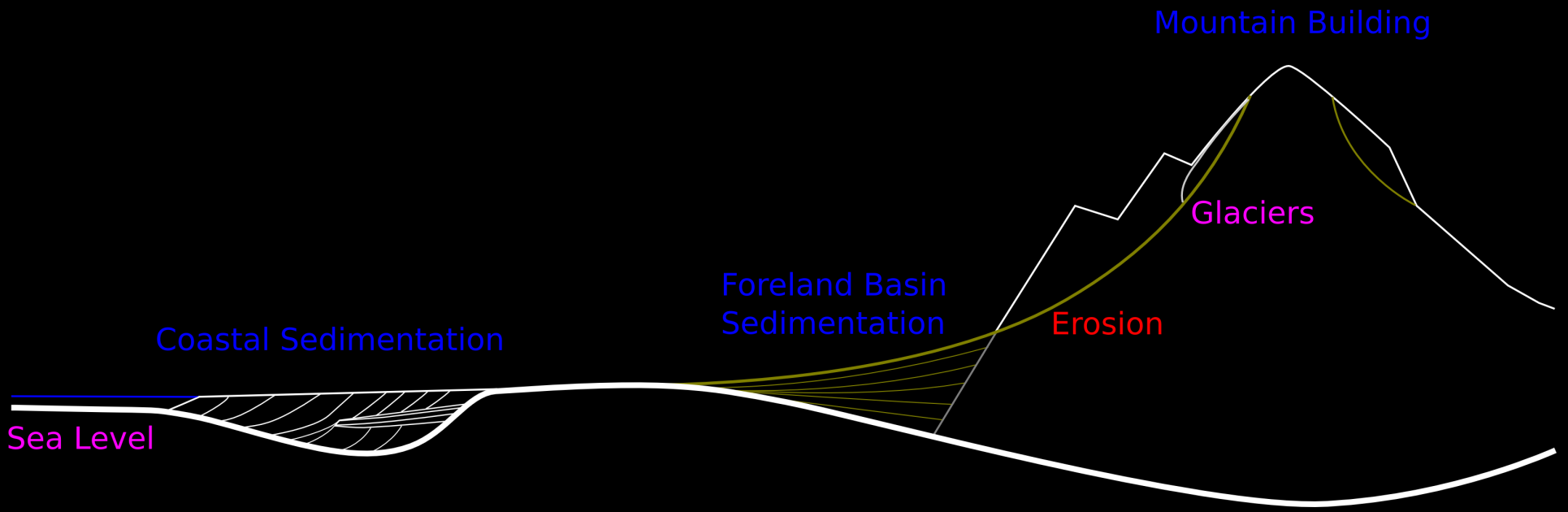
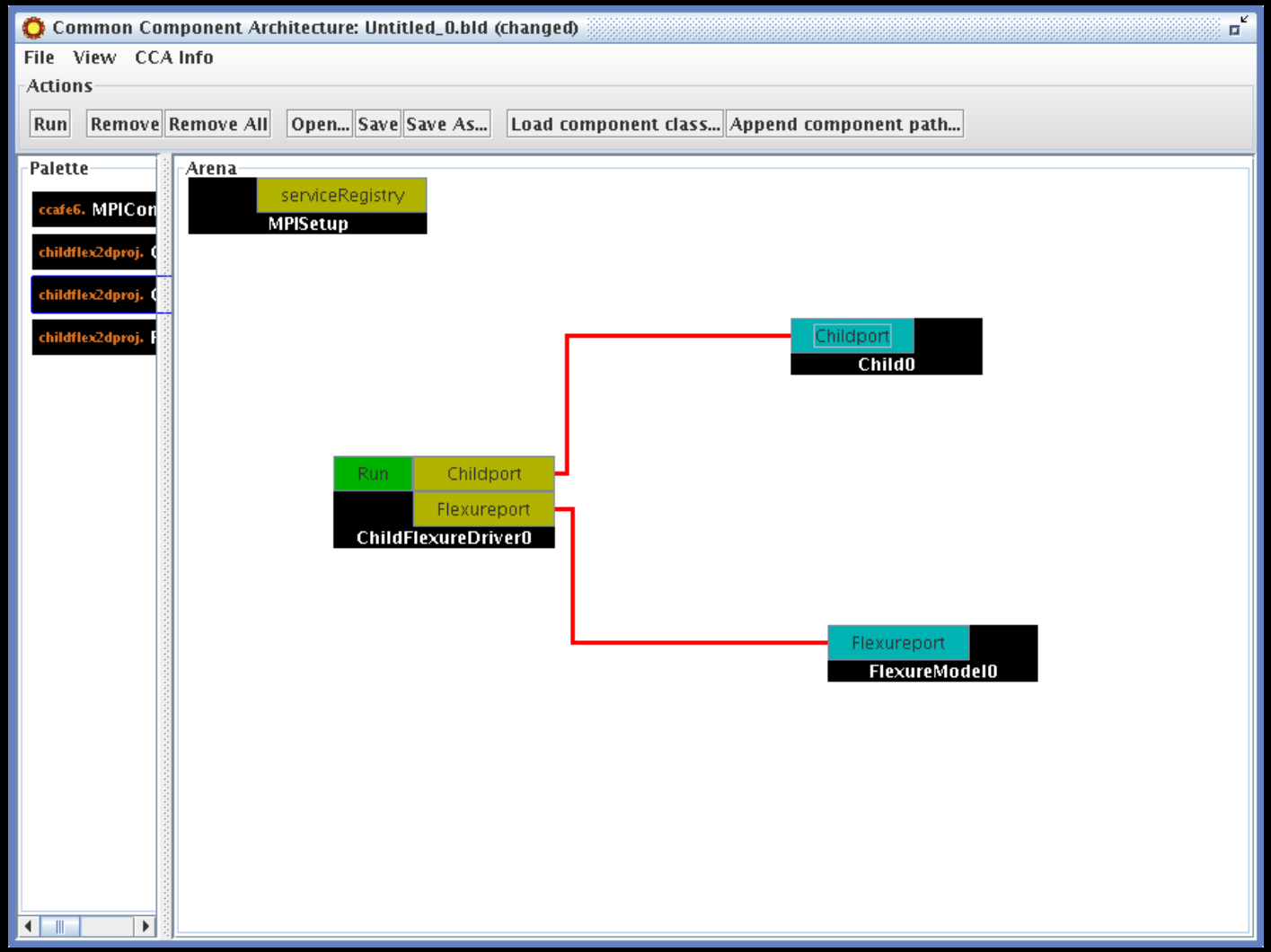
Density
Surface Processes
Flexural Isostasy

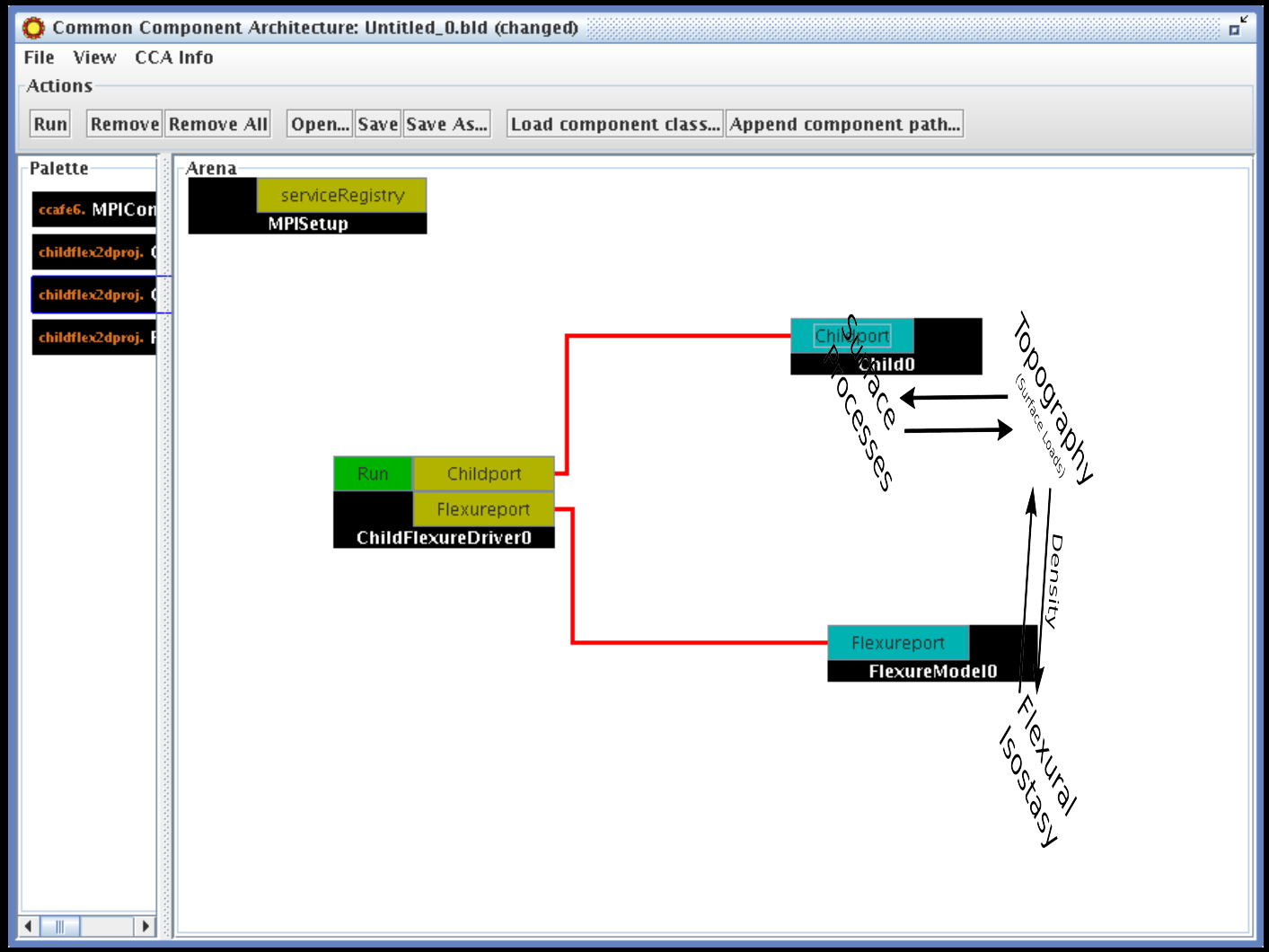
Surface-Isostatic Interactions



Surface-Isostatic Interactions ...as seen by Beach

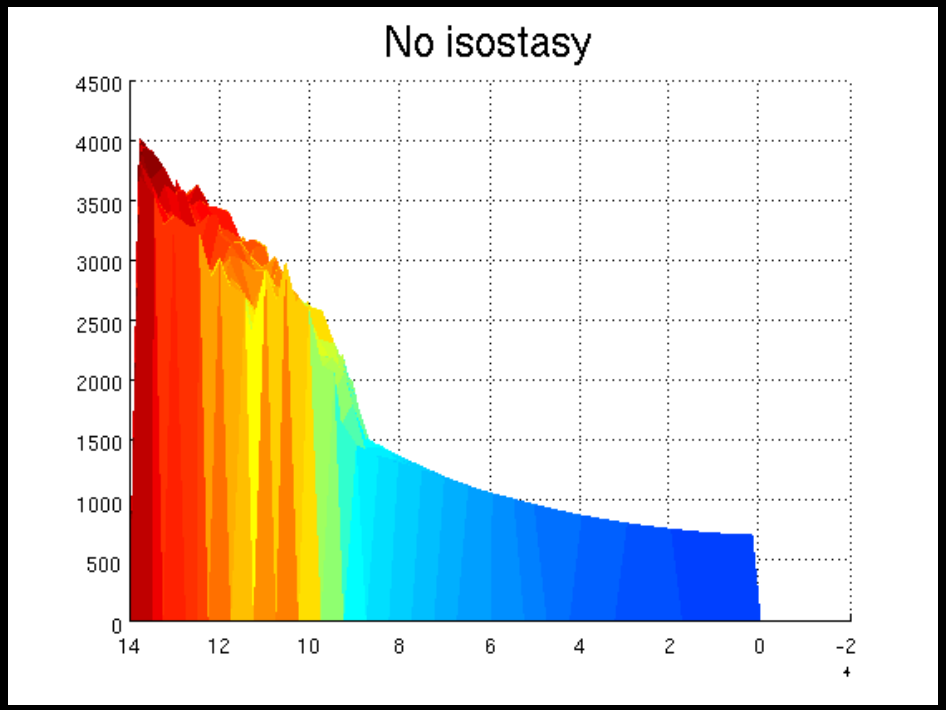


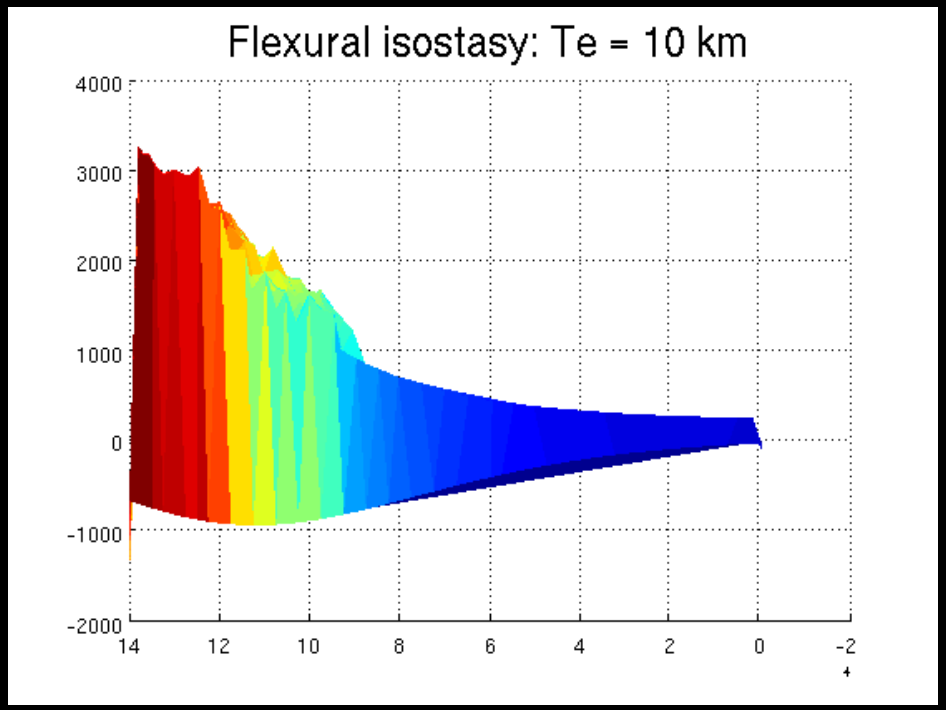
Surface-Isostatic Interactions ...as seen by Beach



Foreland Basins

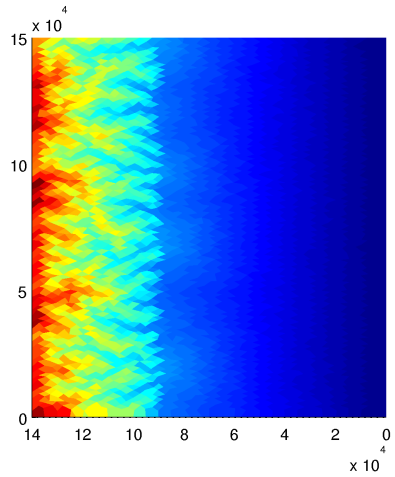
Foreland Basins

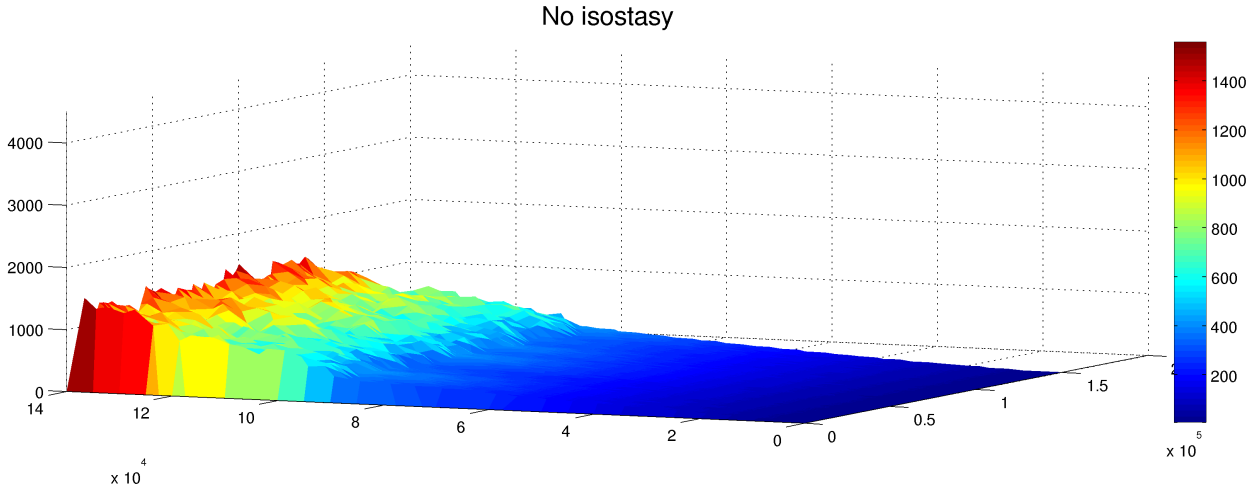


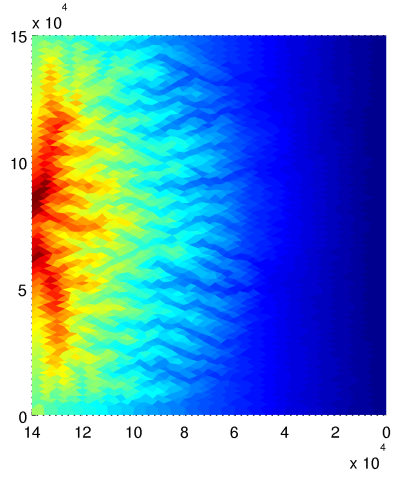


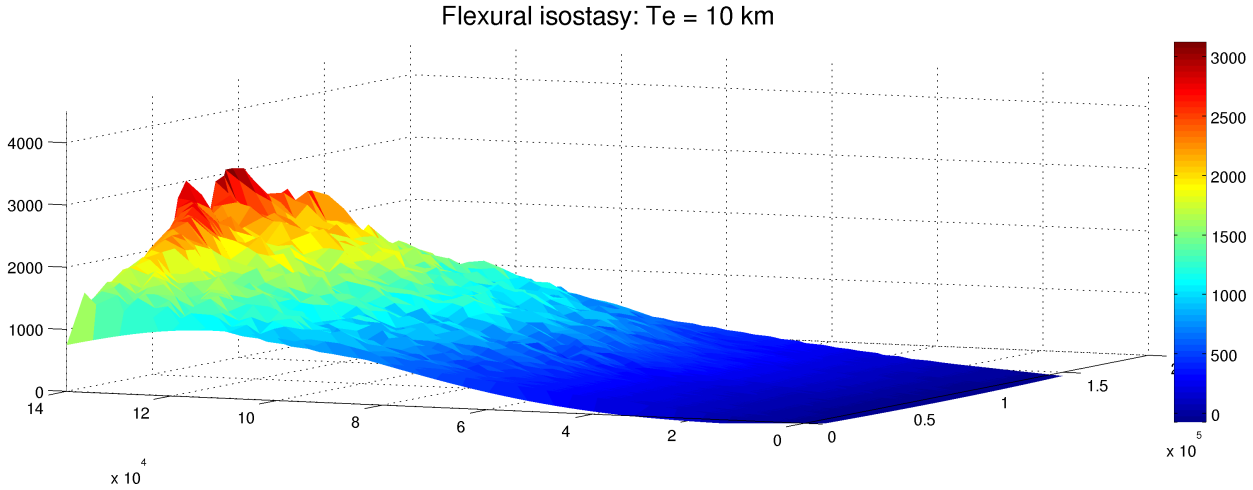
Erosional isostatic uplift of decaying mountain ranges

Erosional isostatic uplift of decaying mountain ranges

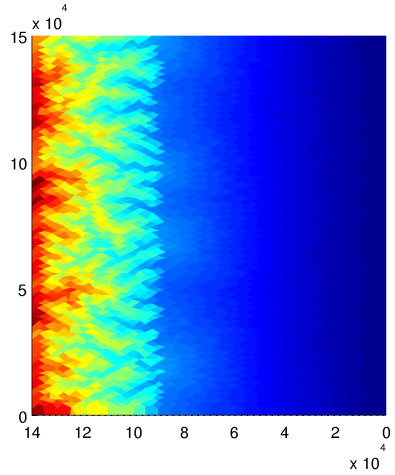


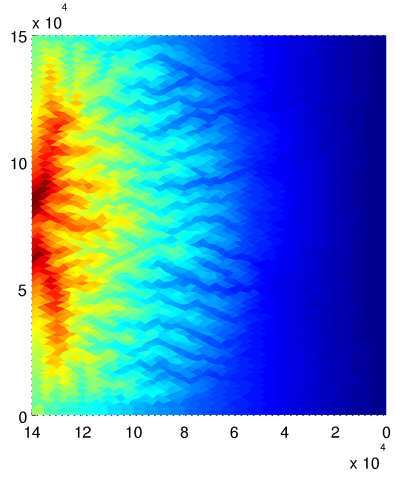


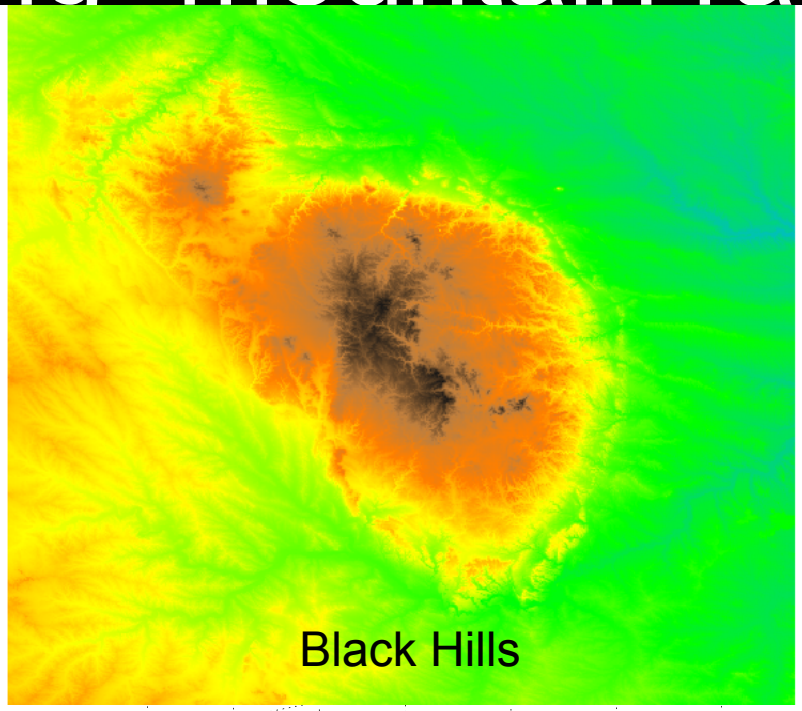


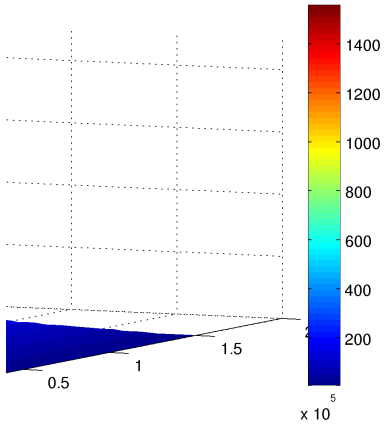


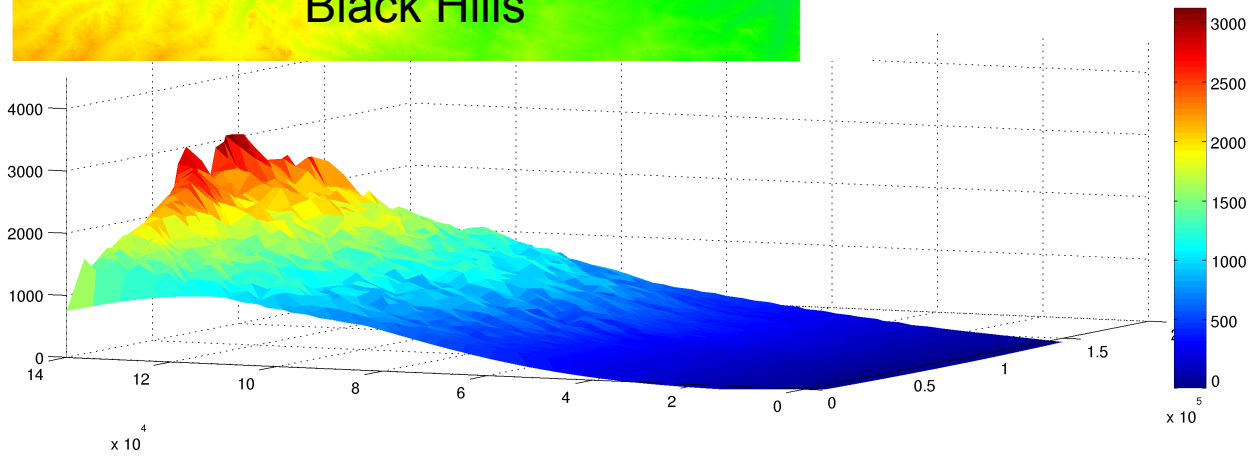
Uplift and relief generation in "decaying" mountain ranges











Couple your models, too!

(ME!)

- CSDMS staff are working to make coupling models be a largely automated plug-and-play process