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Geoscientific Model Development Discussions
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Interactive comment on "Open-source modular solutions for flexural isostasy: gFlex v1.0" *by* A. D. Wickert

Anonymous Referee #1

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I find Wickert's manuscript suitable for publication. This is an excellent manuscript and a valuable contribution to the field. I just have minor comments to the manuscript:

More relevant:

1. The implementation is of course continuous. However, some users would wonder to what extent they can model very steep gradients in flexural rigidity, and narrow weak zones of very low elastic thickness (major fault zones or crustal discontinuities). The application example contains such weak zone (ridge) but as the author clearly states, it sorts of low pass filter this sharp boundary. It is important to explain to the reader to what extent gflex can approximate major faults or zone of weakness inside the plate and what their response would be. This is particularly important for the non-modellers.

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2. Delta rho is included in equations 1, 2 and 4. However it is not clear what this term is. It is only until pp. 4258/line 15 that rho_f is mentioned. It would be important to explain the meaning of rho_delta (rho_mantle - rho_filling) and the way it can be used to model different scenarios (marine vs. sedimentary basin, etc.).

3. Can variable rho_f (density of infilling) be modelled in gflex? Page 4260/line 15 says yes, but it is not sure how this can be accomplished. Can variable rho_f be defined as input?

4. Figure 5 is rather confusing. It does not completely explain how the different boundary conditions in Figure 4 can be related to different geological processes (line 5 of p. 4255). It is not clear also what the role of figure 5b is ("provides a contrived field of variable elastic thickness"??). Is that the elastic thickness distribution used in 5c and 5d? It does not seem so: for example in 5d the upper right mountain belt load produces more deflection than the lower left one. One would expect the contrary for the elastic thickness distribution in 5b.

5. p. 4255/lines 25 to 29: This sentence is not clear.

6. p. 4256/paragraph lines 13-24: Periodic boundary. Not clear. I read many times this paragraph, but still I don't understand how to model a continuous mountain belt with the Periodic boundary.

Minor edits:

p. 4246/line 24: change "of Earth" by "of the Earth"

p. 4247/line 9: change "Analytical" by "The analytical"

p. 4248/line 15: change "and may" by "which could"

p. 4249/line 8: remove "greatly"

Eq. 5: What is kei?

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p. 4252-4253: Is the long sentence at the end of p. 4252 and ending at line 4 of p. 4253 necessary? It is rather confusing and in my opinion does not contribute much to the discussion.

p. 4260/line 13: "use repeat forward modeling" is awkward. Please consider changing. Also not clear how gflex can be used as a flexural backstripping tool.

p. 4262/line 15: "presents cause" is awkward.

Figure 5c: What is "Dirichlet0" to the left of the scale bar?

Figure 6: Caption: Clearly indicate a, b and c: a. before "The ungridded". b. before "The gridded". and c. before "Finite difference"

Figure 6: scales of x and y axes in a, b and c are quite different. This can be misleading.

Figure 7: Put labels to the scale bars, including units (as in Figure 5).

Interactive comment on Geosci. Model Dev. Discuss., 8, 4245, 2015.