We write this open comment in regards to the posted comment of Reviewer #2. It is, however, by no means a complete rebuttal, and should only be viewed as a supplement to foster the further discussion.

S. Adhikari, E. R. Ivins, and E. Larour.

We thank Reviewer #2 for many insightful comments and additional references that will add to the value of the paper.

We note however the following comment:
"*My comments are related to theoretical and modeling part of the paper, I do not comment Section 4 on geodetic signatures of ice sheets*."

This is unfortunate because Section 4 describes Figures 3-7 wherein it is very clear that our goals to be realized with this code is to capture short time scale (elastic) effects. As a consequence, any comparison to the glacial isostatic adjustment (GIA) benchmark papers, for example to Hagedoorn et al. (2007), or generally to the benchmark results published in Spada et al. (2011) is not suitable. We are currently working on a revised Section 1 that will help clarify these points. In addition, we note here, that incorporation of the altered linear momentum balance in rotational feedback identified in the new theoretical paper by Martinek and Hagedoorn (2014) is not possible.

The reason that we have taken this simple (elastic) approach in this first paper (v1.0) is that a good part of the ice sheet modeling community now calls for this feature to be explored. This is especially true as the higher-order ice-flow models (including full 3D Stokes and higher-order 3D Blatter/Pattyn) attempt to simulate present-day observed *change* – a feature that is extraordinarily difficult to do. The original exposition of the theory in James Clark's PhD thesis of 1977 (and subsequent work) was to explore the sea level equation (SLE) (and later rotational feedback in Glenn Milne's thesis) in the context of RSL data that would constrain GIA models. Consequently, many of the references to the existing literature in our Discussion paper demand reference to GIA theory. Perhaps this was confusing for Review #2 and this is unfortunate. We bare some responsibility for not having made our assumptions more explicitly clear in Section 1. The nature of our focus is shorter in time scale than GIA by three orders of magnitude.

Most of the requests (referencing and some clarifications) can be accomplished straightforwardly.

We can propose the following (in blue) to be added to the Introduction (Section 1) to provide this clarification.

Our main goal is wed computations of spatially varying sea level over the global oceans that are driven by rapid changes in ice sheet mass balance or terrestrial water storage. The focus of ISSM has been to compute 3-D Stokes flow simulation of ice dynamics with data assimilation (Larour et al. 2014). The more recent focus of ice sheet modeling is to deal with changes that have occurred during the modern observing era using data from both space and terrestrial observations (e.g., Joughin et al., 2010; Schlegel et al., 2015). Simulation of changes in grounding line positions (e.g., Rignot et al. 2014) and velocity fields (e.g., Mouginot et al., 2015) of major outlet glaciers require kilometer-scale model resolution. Space gravimetric and ground based crustal deformation data are also relevant to mass balance estimation over drainage basin to continental scales (e.g., Sasgen et al., 2013; Bouman et al., 2014) and should also be accounted for. A primary goal of mass change simulation is to provide a basis for forecasting future changes on decadal time scales. Incorporating geopotential changes and solid earth deformation into the simulations allows grounding line positions to be influenced by changes in ocean-land contact position and the geometry of ice shelf pinning points. However, such incorporation implies global scale simulation and especially appropriate are solutions of the sea level equation as is often realized in global viscoelastic glacial isostatic adjustment (GIA) models (e.g. Clark, 1977; Hagedoorn et al., 2007).

Konrad et al. (2015), for example, have employed the sea-level feedback for ice sheet – ocean – viscoelastic solid earth interaction over a full glacial cycle of more than 100,000 years using the shallow ice approximation with 40 km horizontal scale resolution. For simulation of present-day ice stream and grounding line dynamics within ISSM a full Stokes representation of the stress tensor is needed and a horizontal resolution that is higher by an order of magnitude than employed by Konrad et al. (2015). The new ISSM-SESAW code is designed to treat the full (elastic) solid earth deformation and sea level coupling on a global scale, and yet retain the resolution and higher order capabilities of full Stokes ice flow. The main limitation of this current version of model is that the time scales must be on the order of few decades for the elastic approximation to be valid.

To further clarify, we are happy to revise the title as follows (bold fonts are added):

ISSM-SESAW v1.0 mesh-based computation of gravitationally consistent sea level and geodetic signatures caused by cryosphere and climate driven mass change **on an elastic rotating earth**

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