1 Editor Comment #1

The responses to the referees were thorough and thoughtful, and the changes to the paper reflect these responses. I am grateful in particular to the review from referee #1, whose understanding of the issues at hand regarding reverse-mode operator overloading is far far beyond my own. As the issues raised seem to be acknowledged and addressed, I believe the amendments are appropriate and sufficient.

I raise one small point which I would like the authors to consider or comment on before publication, and also make an additional minor suggestion. The authors are free to ignore as I will still allow publication.

– In response to referee 2 the authors have referenced Goldberg et al 2016, but i think the reason for its mention by referee 2 was not the fact that it is source-to-source but that it implements the fixed-point algorithm of christianson (1994), which does make use source-transformed code, but solves a slightly different fixed-point problem for the adjoint of the velocity solver, which is distinct from the reverse approach used here. I am not sure whether this would even be possible with OL, but outwith that I just want to flag that the source-to-source approach was not the innovation to which the referee referred.

– A very small point: I have recently learned that the canonical reference for the in-text equations at lines 236-7 is: Mike B. Giles. Advances in Automatic Differentiation, chapter Collected Matrix Derivative Results for Forward and Reverse Mode Algorithmic Differentiation, pages 3544. Springer Berlin Heidelberg, Berlin, Heidelberg, 2008

We thank the editor for his work editing this manuscript and catching issues that we had not previously dealt with. In response to comment 1, indeed the intent of our inclusion of Goldberg 2016 was to refer to the introduction of source to source AD in ice-flow models, which we have now modified to Goldberg 2013, which is more appropriate. As to comment 2, we thank the editor for this information, and we now reference Giles 2008 for equations at line 236.