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Interactive comment on "Regional modeling of the Shirase Drainage Basin, East Antarctica: Full-Stokes vs. shallow-ice dynamics" *by* Hakime Seddik et al.

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The manuscript "Regional modeling of the Shirase Drainage Basin, East Antarctica: Full-Stokes vs. shallow-ice dynamics" by H. Seddik et al. presents simulations of the Shirase Drainage Basin performed with two different stress balance analyses in order to investigate the impact of the choice of stress balance approximation. The simulations are initialized using an inverse method and full-Stokes stress balance in order to match the observed surface velocities and infer the unknown basal friction. The same basal friction is used for both full-Stokes and the shallow-ice approximation, and simulations based on three different scenarios are run for 100 years.

I am concerned about the novelty of this paper. As stated by the authors in the paper, the Shirase glacier is "one of the fastest flowing glaciers in Antarctica" and its

flow is "dominated by sliding". However, the authors also explain that the shallow-ice approximation "assumes that grounded ice flow is governed only by ice pressure and the vertical shear". Using the shallow-ice approximation for modeling such a glacier is not valid here is therefore absolutely no reason to compare full-Stokes and shallow-ice simulations for this glacier. The shallow-ice approximation has been developed 30 years ago and has been extensively used, but is known to be valid only on slow moving areas where the motion is dominated by vertical shear. Fast flowing glaciers are dominated by basal sliding and lateral shear cannot be neglected as it provides significant resistance to the flow. It was therefore expected that the shallow-ice approximation would not perform well compared to full-Stokes on this glacier. The conclusion of this paper suggesting that "careful consideration must be given to the representation of ice flow physics when attempting to model the dynamics and evolution of ice sheet areas containing ice streams and outlet glaciers" is not novel.

Comparing different ice flow approximations is not new, and has been studied for at least a decade, on a number of idealized geometries (Hindmars„ 2004; Gudmundsson 2008) and real glaciers (Morlighem et al., 2010; Seddik et al., 2012; Furst et al., 2013), so the domain of validity of the different stress balance approximations is well known and there is nothing new added in this paper. Finally, the simulations performed in this manuscript rely on the Elmer/Ice software, that was recently used to develop a dynamical coupling between full-Stokes and the shallow-ice approximation (Ahlkrona et al., 2016). Applying this new coupling method to the Shirase Glacier and comparing its performance and accuracy to a more traditional full-Stokes model would have been of greater interest for this study.

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