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Interactive comment on "Model calibration for ice sheets and glaciers dynamics: a general theory of inverse problems in glaciology" *by* M. Giudici et al.

Anonymous Referee #2

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The paper entitled "Model calibration for ice sheets and glaciers dynamics: a general theory of inverse problems in glaciology" by Giudici and colleagues discusses the resolution of Inverse Problems in glaciology.

Overall, the manuscript is well written and clear, but I am concerned about the novelty of this paper. There is nothing new in terms of Inverse Problem theory. There is a very limited application to ice flow but most of the text is very general and can be found in textbooks.

1 General Comments

The purpose of this paper is to introduce a *conceptual framework* to unify different notations and to facilitate the definition of Inverse Problems and their properties in the field of Glaciology. Even though the paper is supposed to remain general, many aspects that are (presumably) new to the field are not fully developped. For example, the authors claim that "some basic mathematical properties are not fully considered in the applications" of Inverse Problem, but it is not clear what they are (ill-posedness vs stability? Identifiability? etc), and these aspects are hardly discussed in the paper so it is not clear what this paper brings to the community.

The application, based on the simplest ice flow model (isothermal SIA) does not add any value to the paper. A more in-depth analysis of the adjoint method for ice sheet models could have been interesting but this manuscript does not address any specificity or difficulty related to the use of SIA for modeling ice flow.

p 5520: "At the authors' knowledge, no test has been conducted in glaciological sciences with different hypotheses of pdfs." This statement may be true but it is not done here either.

2 Minor comments

- p. 5517 line 19: symmetric and positive definite
- p. 5518 line 23: I would suggest the author do not use $\mathcal{O}$ for the objective function as it is most commonly used in Landau notation. $\mathcal{J}$ is more common.
- p. 5519 line 4: "the the algorithm"

- p. 5521 line 27: spell out Standard Deviation (SD) the first time the acronym is used

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Interactive comment on The Cryosphere Discuss., 8, 5511, 2014.