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Interactive comment on "Ice bridges and ridges in the Maxwell-EB sea ice rheology" *by* Véronique Dansereau et al.

Anonymous Referee #3

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General comments: This paper aims at examining the validity of the Maxwell-EB sea ice rheology to reproduce the ice bridge phenomena which often appears at the narrow straits like Nares Strait. The major purpose of this study is placed on the first application of this rheology to the geophysical scale sea ice phenomena. Resultantly, they found that this rheology can reproduce the real ice bridges which occurs at the narrow straits. Overall I feel that this paper is well written based on sound science and certainly contributes to the development of sea ice dynamics, especially for the behavior of the brittle sea ice. Therefore, my comments are only minor. General comments area as follows: 1) It would be helpful to explain more about the advantage of the Maxwell-EB rheology compared with the traditional elliptic curve rheology. The authors pointed out the capability to represent the extreme localization of damage and deformation (P4L13). However, there is a possibility that it comes just from the horizontal resolu-

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tion of the grid cell in the model. I mean that the traditional plastic rheology might be able to reproduce the phenomena if finer grid cells are used. Thus I want to know why they consider the continuum elasto-brittle rheology should be more appropriate than the continuum viscous plastic rheology for this phenomena, and whether this rheology can be applicable to the general sea ice conditions. 2) Intuitively my feeling is that the floe size distribution of sea ice should also play an important role in the brittle ice rheology. Therefore, in the question at P17L7-8 it would be natural that the change in floe size distribution may also contribute to the phenomena. What do you think? 3) On the whole, I am somewhat concerned about why the authors did not pay so much attention to the horizontal scale. For example, the scales of ice bridges seem to be different depending on the straits. Accordingly the mechanism might be different depending on the regions. Could you explain how the Maxwell-EB rheology influence the results depending on the scales. Although the description on the scale dependence (P19L17-25) is interesting, in general it seems that the localization of deformation depends on the grid cell size. Could you explain why this property is independent of resolution?

Specific points: *(P1L2)"on geophysical scales" I wonder if we can assume ice bridges and ridges to be on a geophysical scale. It would be preferable to describe the specific phenomena like "ice bridges on a few tens of kilometers". *(Figure 1) The red dotted line in Fig.1b is hard to see. Please make it more prominent. In Fig.1c there are two red dotted lines. I guess the northern one should be deleted. *(P5L17) Please insert "Hibler" *(P8L9, Eq.3) I think "A" is not needed. *(P17L4) Please replace "than" by "that". *(P19L10) I agree, but there are some discrepancies in the slope of the thickness pdf around 1 m. Is that a negligible problem? *(P19L18) In the equation, h·âĹĞu should be hâĹĞ·u. *(P21L11-12) "prescribing a cut-off for biaxial compressive strength... appears unnecessary" I could not understand this. Can you add some additional explanation? *(P23L10) "Hibler" is missing.

That is all. Faithfully yours.

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