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Discussions

Interactive comment on "Hydroelastic analysis of ice shelves under long wave excitation" *by* T. K. Papathanasiou et al.

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The authors wish to thank the anonymous referee for his/her comments and for bringing to their attention the related work by Sturova et al (2010). The particular reference is of great interest to the authors, as it introduces nonlinear shallow water hydrodynamics, and will be mentioned in the revised version of the paper to follow. The authors agree that a full 3D model will yield more interesting results and will be able to provide more realistic representations of the actual bathymetry variations and ice shelf geometry. Let us mention that such a 3DFEM simulation tool is currently under development. Regarding the present analysis some general remarks are:

1. It is important to stress that the present study aims in the development of a simple

tool, able to estimate the response of floating, slender formations under long wave excitation. By imposing a fixed edge boundary condition, a crude simulation of a static grounding line is performed and in turn, the analysis constitutes a first step in the hydroelastic modelling of an ice shelf. The derived results appear to produce, at least qualitatively, a response compatible with physical intuition and the hydroelastic response of slender structures. A range of physical phenomena, such as wave reflection, hydroelastic dispersion, bending moment variation etc., are reproduced. In the present analysis, the bending moment profiles along the strip are studied. This choice is justified by the direct link between bending moment and normal stresses. Hence, bending moment distributions are able to illustrate the stress state within the formation. It was thus of interest to detect possible critical points in the sense that bending moments attain maximum values there, as analyzed in the present work. The identification of a large magnitude tensile zone for example, is paramount when considering crack opening phenomena in materials that are inherently imperfect (voids, notches, etc.), like sea ice. A fact that the authors found to be interesting was the very weak dependence of the maximum bending moment value location on the excitation wavelength, during the phase of wave entry in the hydroelasticity dominated region. Similar observations have been reported for the frequency domain hydroelastic analysis of shore-fast ice (Squire, 1993). Another interesting aspect examined is the nature of the dependence between this location and the ice shelf thickness.

2. The authors would also like to mention that the present model employs a fixed end (at x=0) in order to simulate the ice shelf ground line, as previously mentioned, while Sturova et al (2010) is devoted to the study of a freely floating flexible strip. The physical relevance of a floating cantilever to the simulation of ice shelves is a topic with its own significance and several different constrain conditions have been examined in the literature, as discussed in the manuscript (see references therein). In addition, in the work by Sturova et al (2010) bending moment distributions within the floating strips are not examined.

3. For the simulation of the seabed topography, the authors referred to the relative literature. In Brunt et al (2011) it is stated, citing Le Brocq et al (2010), that the water column depth in front of the ice-shelf is $\sim$150m while it increases to 800m within 100km form the ice shelf front. In our study, we have used a linear variation between the values 150 and 800 m ranging over 100km, in order to consider a smoothed, mean approximation of the actual seabed profile.

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