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Interactive comment on "Wave-ice interactions in the neXtSIM sea-ice model" *by* Timothy D. Williams et al.

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We thank the reviewer for their comments.

1. *Material fails when Mohr circle touches the failure envelope. . . Formulas (18f,g) interpret σ_N and τ as pressure and maximal shear stress. I don't think that it is correct interpretation of the Coulomb-Mohr criterion.* The reviewer is correct in general, but in this situation where $\sigma_{12} = 0$ it is fine to use σ_{11} and σ_{22}. However, we have clarified this point by defining the principal stresses explicitly.

2. *The ice failure in continual sea ice models is not similar to ice failure in flexural strength tests. In the last case the ice is broken by vertical crack due to the bending. It is observed in all tests. In the first case there is damage accumulation,*

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but ice is still represented by continuum. I don't think that it is a good idea to join criterions for large and small scale failure processes even if they look similar. In fact Mohr-Coulomb failure has been observed on many scales (eg. Schulson *et al.*, 2006), with the size of the failure envelope (the cohesion) depending on the defect size, which corresponds to the scale considered. Thus the small scale cohesion was of the order 10^5–10^6 Pa, while the large scale cohesion was of the order 10^3–10^4 Pa. Note however that we do not have a single merged failure criterion for both the floe and the mesh scales, but in fact have two independant criteria. What may have led to some confusion, is that in some of the experiments, we applied a rudimentary MIZ dynamical model by setting the damage parameter d to a high value so that the ice was effectively in free drift (unless it was converging, when the ice pressure P was activated). This d parameter was also the same one changed if the large scale stresses left the large-scale failure envelope. We clarify this in the text.

References

SCHULSON, E. M., FORTT, A. L., ILIESCU, D. & RENSHAW, C. E. 2006 Failure envelope of first-year Arctic sea ice: The role of friction in compressive fracture. *Journal of Geophysical Research: Oceans* **111** (C11), c11S25.

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