

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2022-75

Anonymous Referee #2

Referee comment on "A collection of wet beam models for wave–ice interaction" by Sasan Tavakoli and Alexander V. Babanin, The Cryosphere Discuss.,
<https://doi.org/10.5194/tc-2022-75-RC2>, 2022

My apologies to the authors for getting to this review later than I anticipated when I accepted the job. The delay is especially unfortunate as there seems to be a fundamental error in the theoretical framework of the study that means I cannot recommend revisions that give a pathway to publication.

The authors are proposing a model for wave propagation in ice covered water that includes wave radiation forces (added mass and heave damping), which they say are absent in most models. However, this is not correct as others (e.g. Squire, Meylan and co-workers) have developed many models that include radiation forces (none of which are referenced). Their models of elastic ice floes contain the rigid body modes of heave and pitch (in 2D) as well as elastic modes (see e.g. Meylan & Sturova, 2009, Journal of Fluids and Structures). Here, the authors have attempted to incorporate radiation forces directly into a dispersion relation for the floating ice but its implementation appears to be incorrect. Consider the damping term, which should express the transfer of energy from the body motion to radiating waves, so that no energy is lost from the wave–ice system. It should not, as it does here, induce an imaginary component of the wavenumber and hence wave energy dissipation.

The term in the dispersion relation used to represent heave radiation is identical to that derived from the Robinson–Palmer model, which has been used by many previous authors and shown to be capable of giving reasonable predictions of wave attenuation (again, lots of references missing). Therefore, key findings, such as “decay rates were observed to be poorly predicted if the fluid-based energy damping is not taken into account”, must be reinterpreted in the context of the RP model and lose their novelty.

Aside from the issues with the radiation force, the paper comes across as contributing yet more models of waves in ice covered waters with parameters tuned to particular datasets but without the general predictive capabilities needed for improved understanding of the wave–ice system. It is not surprising that adding more tuning parameters allows for better agreement with observations. Advances require connections between the parameter

values and the ice properties associated to the different datasets.