The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC2
https://doi.org/10.5194/tc-2021-83-RC2, 2021

Comment on tc-2021-83

Anonymous Referee #2

Referee comment on "A probabilistic model for fracture events of Petermann ice islands under the influence of atmospheric and oceanic conditions" by Reza Zeinali-Torbati et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-83-RC2, 2021

This study presents a probabilist model of iceberg fracture based on a series of ice islands generated from calving events from the Petermann ice tongue with the goal of stepping towards providing a real world practical operational forecast model. The authors analyzed the role of wind speed, air temperature, ocean current speed, water temperature and something called the wave energy index along with mean air temperature and sea ice concentration.

As someone who works largely on the mechanical side I don't have experience with the operational side or the statistical framework. Someone who works more closely on that side of the field will have a better idea of the appropriateness of the methodology and relationship to prior work. Overall, however, I don't see any obvious objections to the statistical tests or procedures used. A minor comment is that it would be helpful to relate the probabilistic model more closely to process level models of iceberg decay, although that may follow in subsequent work.

Overall, I only have a few minor comments.

1. How reliable are the inputs fed into the model? We are presented with a probabilistic model driven by inputs. Reanalysis and wave forecasts all have strengths, but also uncertainties. Hence the question from a non-expert as to whether the uncertainty in the model model inputs small enough to be neglected?

2. The analysis considers wave energy, but is it also possible to consider wavelength in addition to amplitude? The wavelength of ocean swell relative to the flexural wavelength of the ice island could be important in determining if bending stresses are large enough to fracture the island. In fact, modest swell events are sufficient to breakup the sea ice pack when the ocean swell as an appropriate period, but long wavelength swell penetrates the sea ice pack with minimal effect.

3. Can the authors provide a sentence or two providing the motivation and sensitivity for selecting the prior probability distribution? My own experience with Bayesian analysis is that selecting on appropriate prior can be tricky and, unless there is a large amount of data, the prior can play a role guiding predictions. That is not to say that this is the case here, but a few sentences describing the motivation and sensitivity may be useful.

4. I had a hard time initially interpreting Figure 3 and others. I think what we are supposed to do is compare the figure on the left with the figure on the right to see the enhancement of fracture events at warm ocean/atmosphere temperatures compared to the frequency of observations of warm ocean/atmosphere temperatures. This is quite convincing after contemplating the figures. I wonder if stepping readers not used to this type of plot through what we are supposed to see would be helpful. Alternatively, would it be more useful/intuitive to plot the ratio of the left and right panels to show the enhancement of fracture events in warmer conditions relative to the occurrence of these conditions? In a plot of this type, values close to one would imply that fracture events are as likely to occur as the frequency of observations. Values large compared to one would indicate that fracture events are more likely to occur than the frequency of observations and values less than one would imply that fracture events are less likely to occur relative to the frequency of observations.

Line 71 extra space in “w ave”—>wave