We thank you for your kind comments and suggestions. We address your concerns below.

1 Methods

1.1 Strain parametrisation

Using the location of the extremum strain as the location of fracture is indeed arbitrary. It comes with the simplicity of yelding an absolute answer to the breakup point question. As this location is phase-dependent, We believe that the extensive randomisation we set up mitigates the effects of this choice on the FSD.

1.2 Relationship between fracture location, ice and wave properties

We have not attempted to establish such a relationship. We meant to focus on the emerging distribution, rather than on demonstrating results that could be applied to single floes. Even though Having precise, deterministic results connecting ice mechanical properties and a prescribed wave forcing would be captivating, it feels less in line with moving to larger scales, which are inherently stochastically driven.

1.3 Young's modulus

We chose the value of 6 GPa in line with previous studies (Kohout and Meylan 2008; Williams et al. 2013). We do not attempt to evaluate its impact on our results.

2 Monochromatic forcing

For the right-boundary semi-infinite floe, strain is embedded in an envelope, as shown in Kohout and Meylan (e.g. 2008) and displayed in Figure 1. For finite floes, the free edge boundary condition makes the strain go to 0 on both edges. Within this envelope, strain being a superposition of propagating, attenuated and evanescent modes, oscillates with a wavelength close to the main propagating mode. It is exponentially attenuated, in the direction of propagation, in relation with the chosen viscosity; no attenuation exist for zero viscosity simulations. The amplitude of these oscillations is proportional to the wave amplitude, hence it diminishes with successive wave reflections.

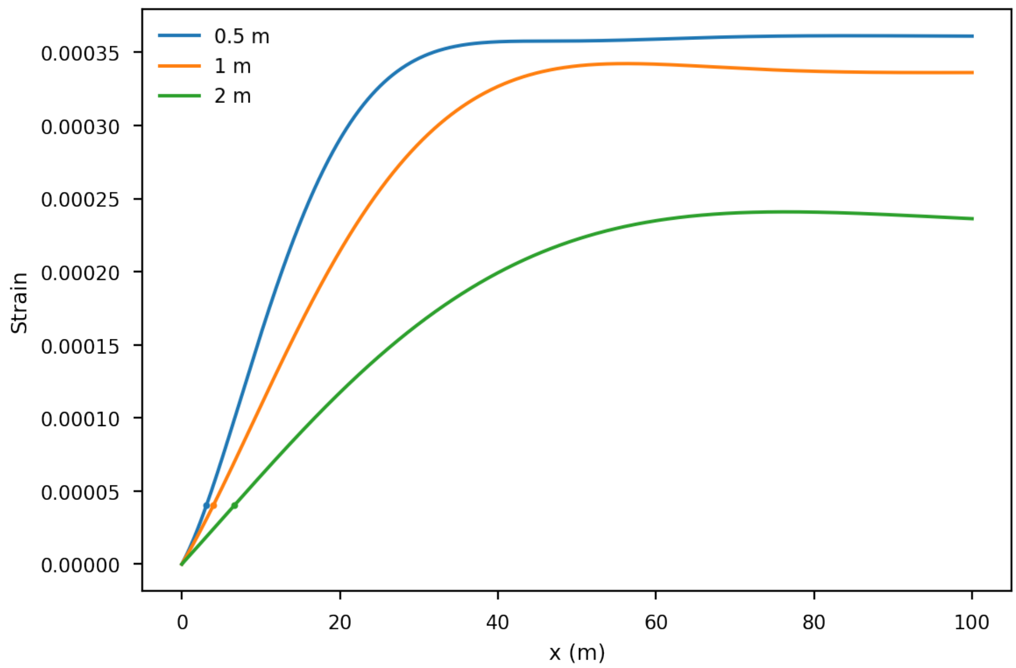

Figure 1: Along-floe strain envelope evolution, for various ice thicknesses, $T = 8\,\mathrm{s}$, $a = 50\,\mathrm{cm}$. The first stress in excess of our reference strain threshold $\varepsilon_c = 4 \times 10^{-5}$ is located by a dot on each line.

3 Main comment

Displayed distributions are indeed so-called number FSDs. The same analysis can be applied to areal FSDs. If a relationship is known, or assumed, between metrics of length and floe area, going back and forth between the two is straightforward. In order to not make such an assumption, we stuck to displaying number-based results.

We present a comparison between number FSD and areal FSD in Figure 2. We obtain the second by assuming floe area to be directly proportional to the square of floe length (which holds for e.g. rectangular or elliptical floes with constant aspect ratio). It can be shown that if a random variable X follows a two-parameter lognormal distribution, then powers of X also follow lognormal distributions, whose parameters depend on the original parameters and the power used. If X follows a three-parameter lognormal distribution, then powers of X follow linear combinations of lognormal distributions; the larger the location shift, the further these combinations would be from a pure lognormal. Therefore, if the floe lengths, when considering their frequency of observation, are lognormally distributed with a small shift, we expect the areal FSD to be close to lognormal as well.

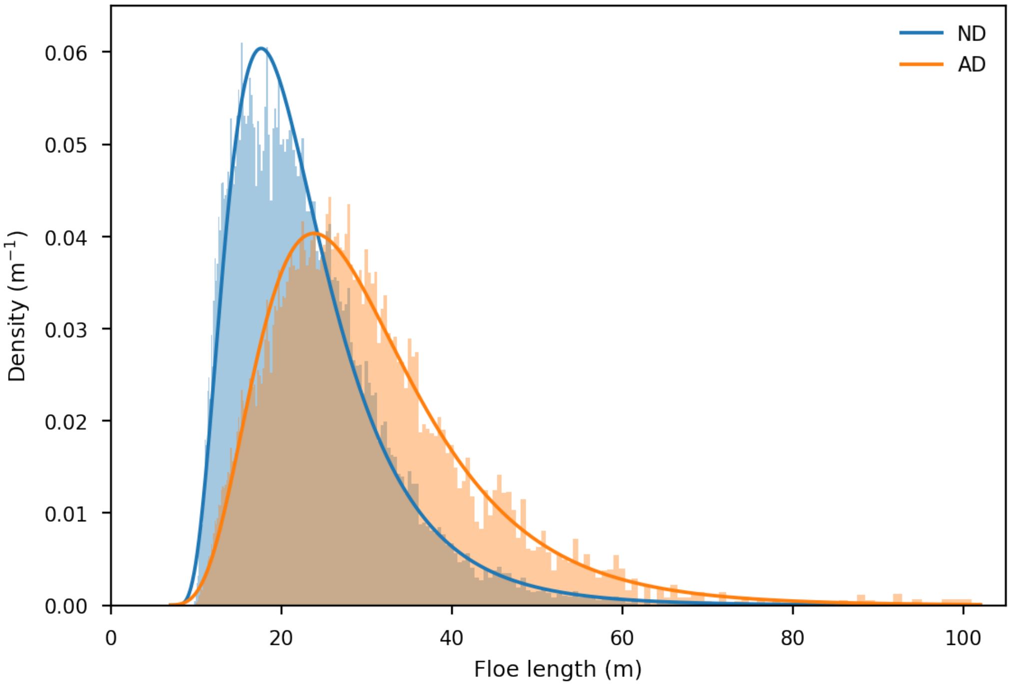

Figure 2: Comparison between number (ND) and area (NA) FSDs, and overlaid lognormal fits.

4 Forecast based on fitted parameters

We do not attempt to fit analytical trends to the lognormal parameters. Their evolutions with respect to the model physical parameters suggests that it would be a reasonable exercise to do so and we will consider it.

5 Discussion and conclusion

This omission is due to a a submission timing. We do cite Dumas-Lefebvre and Dumont (2020), and we will reference Dumas-Lefebvre and Dumont (2021) in the revised manuscript.

References

Dumas-Lefebvre, E. and D. Dumont (2021). “Aerial observations of sea ice break-up by ship waves”. In: *The Cryosphere Discussions* 2021, pp. 1–26. DOI: `10.5194/tc-2021-328`.

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