Comments on paper tc-2020-134

The work is correctly done, but it may be a little overly enthusiastic in applying the conclusions of the analysis to ship operations in ice. The problem analysed in the paper is one in engineering; the stress field around a void and/or inclusion in a large plate under stress. A ship moving through an ice field under pressure is a much more complex problem.

The work merits publication but the conclusion that the ship creates a stress concentration by breaking a channel might be couched in a more conditional manner. Experience generally shows that if the channel does not close, the ship is experiencing little or no pressure. The rate of channel closing and closing distance is proportional to the ice pressure that the ship feels. A longer open channel behind the ship is an indication of lower ice pressure, not higher.

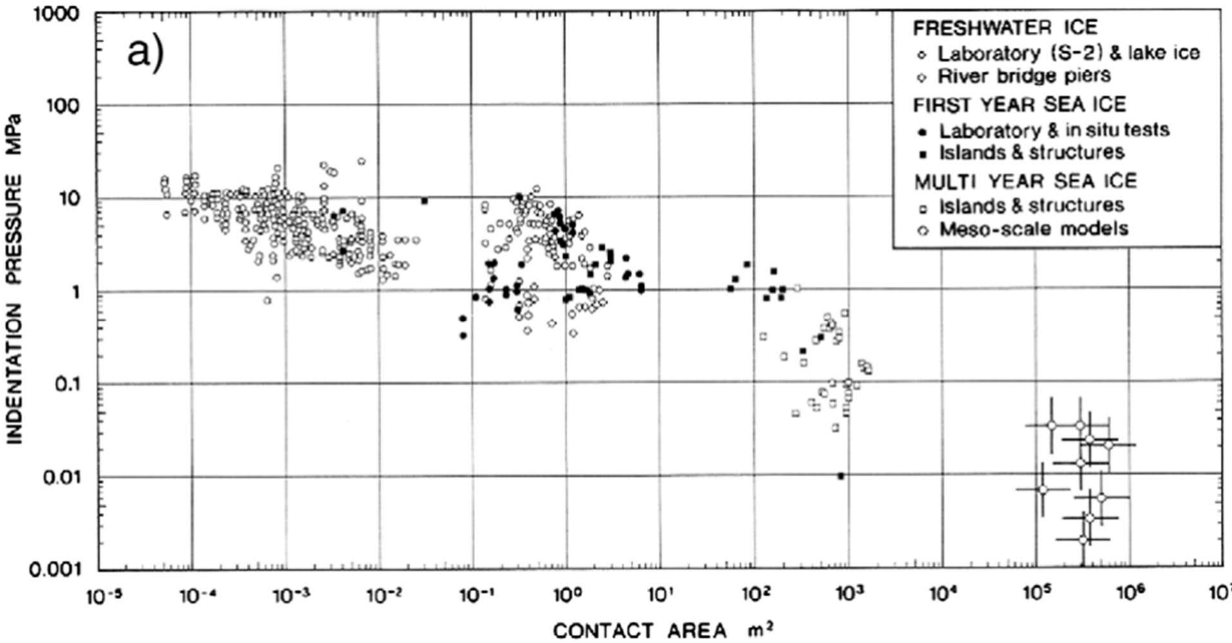
Some specific corrections, improvements or comments:

- Larger font on some of the plots in figures would help readability.
- For Fig. 1 add the surface wind scale to panel b).
- Line 51; the author should be Loset?
- Line 175; would it complicate Fig. 2 to also show M_i and M_c on it?
- Line 211; Figure 4 a) and b) look very similar to results of finite element analysis of an elastic plate with a crack or void.
- Line 113; stress concentration at the tips of the lead and zero normal pressure on the boundary of the lead translate to the maximum and minimum pressures in Figure 4 c). I looks like the probability is greater than 1 for pressure 10 kN/m, check the y-axis scale. For the 10 m grid size the 28 cells that border on the lead versus the 512^2 – 40 cells in the ice field give a 28/262104 (1.07E-04) probability of zero pressure. This doesn't seem to agree with Fig. 4 c).
- Figure 5 presents results of experiments with refrozen lead and ridged ice in addition to the 1 km lead. Not surprising is the result that there is no change of zero stress on the lead boundary or stress concentration at the tips of the lead. It seems that doubling the ice thickness from 1 to 2 m, Figure 4 versus Figure 5, the maximum stress at the tip of the leads is increased. Any explanation? Is it fair to compare maximum pressure in Fig. 6 b) with $P^* = 20$ kN/m^2 for a 1 km long lead with Figure 5. Both are for 2 m ice thickness.
- For Figure 8 add a label to the x-axes, resolution and units of m. The maximum pressure of Figure 8 a) agrees with that in Figure 5 c), about 38 kN/m in both cases.
- The pressure field in Figure 9 seems reasonable given that a relatively stiff object (the ship) is placed at one end of a long cavity (lead). Your analysis only considers pressures, the ice also deforms and the further from the tip of the crack (lead) the greater the closing of the lead and thus higher lateral pressure.

The results presented in Figures 9 and 10 are quite consistent with the analysis model of a stiff object (ship) at the end of an elongated cavity (lead) in a more compliant medium (ice field). The results are consistent with stress analysis around inclusions. The analysis is correct, but it may be premature to draw conclusions about applying the results to operation of a ship in pressured ice.

There is literature in the Arctic engineering field that considers scale effect of ice pressures. The authors could look to this literature as they continue working in this field. See for example;

Sanderson, T.J.O., 1988. Ice Mechanics Risks to Offshore Structures. Graham and Trotman, London, UK.



Croasdale, K.R., 2009. Limit force ice loads – an update. Proceedings 20th POAC Conference, Paper POAC09-030, Lulea, Sweden.