Response to the Comments of Reviewer3

For the landfast sea ice in the Prydz Bay of East Antarctic, the flexural strength and uniaxial compressive strength were measured in field and in cold lab considering the influence of ice temperature, ice crystal size, loading rate and loading direction. Moreover, the brittle-ductile transition of sea ice in the uniaxial compression tests were discussed based on the experimental data. The measured results were analyzed comprehensively and compared with the literatures well. Some valuable data were obtained and can be applied in the engineering.

We would like to thank the reviewer for the helpful comments, based on which the manuscript has been revised accordingly. We have addressed the comments each below.

Some comments and suggestions are listed below for considerations.

Comment: Lines 153-154, How were the error propagations determined for the flexural strength, effective (elasticity) modulus, compressive strength and strain rate based on Eqs.(5) and (6)?

Response:

We will delete the *Section Uncertainty analysis* in the revised version. In the original manuscript, because the flexural strength, effective elastic modulus, compressive strength and strain rate are indirect measured variables, we had intended to estimate the uncertainties of these variables through error propagation equations. However, we found that we had missed the precondition that the direct measured variables used to derive indirect variables must be independent (e.g. the force and sample size are correlated). So, we will delete the section about uncertainty analysis.

Comment: “the effective modulus” should be “the effective Young’s modulus” or “the effective modulus of elasticity”.

Response: Thanks. We will correct it all in the text and figures.

Comment: Lines 180-184, the minimum flexural strength of mixed ice (511.3kPa) is higher than that of columnar ice (305.3kPa). This is quite different to the maximum and mean values. What is the main reason for the measured results?

Response: It is because of the differences of sea ice porosity. The sea ice porosity is

76.1–120.6‰ with an average of 90.6‰ for mixed ice, and is 43.3–168.6‰ with an average of 88.6‰ for columnar ice. Therefore, the minimum flexural strength of mixed ice (511.3 kPa) is higher than that of columnar ice (305.3 kPa); the maximum flexural strength of mixed ice (845.9 kPa) is lower than that of columnar ice (1119.7 kPa); the mean flexural strength of both types of samples is similar (687.9 vs. 698.8 kPa). We will also add the above explanation in the revised manuscript.

Comment: In Eqs.(9) and (10), please listed the dimensions for ice thickness h, the effective beam length r and the radius of loaded area c. Please check the other equations.

Response:

(1) The ice thickness was taken as 1.3 m, which is the thickness of congelation-ice layer of the ice block.

(2) Equations (9) and (10) work reliably when the loaded radius is not large enough compared with the characteristic length (L_c) of sea ice ($L_c = \left[\frac{EH^3}{12k(1-\upsilon^2)}\right]^{\frac{1}{4}}$), and with sea ice porosity increasing from 40 to 260‰, the characteristic length decreased from 16.0 to 11.6 m; therefore, the loaded radii were selected as 2–10 m.

(3) As the effective beam length is an intermediate parameter, its dimensions were not shown in the text but will be given in the Fig. 14 in the revised version.

(4) Equations (9) and (10) just give the general method to calculate the extreme fiber stress in a cracked ice sheet under a uniformly distributed load. While it is Fig. 14 that shows the load that can be supported by landfast sea ice varying with different load radii. So, the dimensions of these parameters are given near Fig. 14.