Response to RC2

Thanks for your time and constructive comments on the manuscript "Seasonal and interannual variations in the landfast ice mass balance between 2009 and 2018 in Prydz Bay, East Antarctica". We will consider each comment carefully and incorporate practically all of them.

Specific comments:

L74-75, Is it "the deployment of the ice mass balance buoy" or "the ice mass balance buoy" permit the continuous monitoring of the sea ice mass balance. Suggest rewrite to "The ice mass balance buoys (IMBs) permit the continuous monitoring of the sea ice mass balance and their deployments are human resources economy.

When the IMBs started to deploy? Please add this information.

Reply: We will rewrite this sentence and make it clearer. Actually, we want to say "The ice mass balance buoys (IMBs) permit the continuous monitoring of the sea ice mass balance and their deployments since the end of the 1990s in both Arctic and Antarctic provide a crucial tool for monitoring sea ice changes".

L85, Fig. 1: Enlarge the red stars symbols in Fig. 1a.

Can you rotate b) and c) 180º to let stations on the upper right and the sea ice or sea ice/ocean on the lower left?

There are two red stars in Fig. 1b. Are they same as in Fig. 1a?

L133, Label "the Russian Progress II station" on Fig. 1.

L231, where is the Vestfold Hills? Can you label it in Fig. 1?

Reply: Thank you for your comments. The red stars in Fig. 1a indicate the Chinese Zhongshan Station and the Australian Davis Station, while the red stars in Fig. 1b indicate the Chinese Zhongshan Station and the Russian Progress II Station. They are not the same. To make Fig. 1 clearer, we will modify this illustration, including to separate Fig. 1a into two pannels, enlarge the red star symbols in Fig. 1a, rotate Fig. 1b and Fig. 1c as suggestion, label "the Russian Progress II Station" and "Vestfold Hills" etc.

L115, Table 2, Add a column for the type of IMB (CRREL-IMB or SIMBA) deployed

Reply: We think you are referring to Table 1. We will add a column for the type of IMB to this table following your suggestion.

L223, From Fig. 3d, the wind are dominated by easterly wind and ESE wind at ZS, and dominated by NE, and NNE and ENE at DS station.

Reply: Thank you for pointing this out. The wind forcing at ZS is characterized by katabatic winds, of which, winds from the east, ENE and ESE are dominant, with the frequency of 38.9%, 22.8%, and 11.7%. The wind forcing at DS is largely driven by passing synoptic systems, with the dominant wind direction from NNE to ESE, accounting 66%. In addition to the distribution of wind speed, we will also add the distribution of wind direction to Fig. 3d.

L265, Fig. 4, No lines for ZS2014 in Fig. 4a.

Reply: The topmost temperature thermistor of ZS2014 was just placed on the snow–ice interface at deployment as a result of an inaccurate operation. The snow depth of ZS2014 could not be retrieved from the temperature profiles and the in situ measurements were used instead. Only 9 observations of snow depth were made during the operation period of ZS2014. In Fig.4a, these snow depth measurements are shown as blue hollow dots, but not a line. We will add this information in the caption of Fig. 4.

L315, Fig. 6b, is it difficult to see the temperature change in S1 and S2, please change another color for them. Or add one figure for temperature gradient? This is related to your statement in L348-349.

Reply: We will add a subplot of temperature gradient as Figure 6c so that the temperature change can be clearly identified during the typical winter warming events, S1 and S2.

L358, "This temporal lag …. within the ice column". Give a time for this temporal lag change".

Reply: During S1 (mid July), this temporal lag was about 3 days and it reached 7 days by late August and early September (S2). We will specify this temporal lag change in Section 3.4.

L365, I disagree with "the basal ice growth was primarily regulated by F_c and F_w". From Fig.7, the basal ice growth was also regulated by F_l. So please also discuss the Fl in the manuscript.

Reply: In the formula of heat balance at the ice base, F_l is defined as the equivalent latent heat flux and calculated based on the ice growth/melt rate. Thus, the F_l is actually directly determined by the sea ice growth rate, rather than playing a regulation role. We will make the expression clearer.

L402, "For a site", point out this site is which site in Table 3

L406, the same site, I think you are pointing to S1 in Heil (2006) and Heil et al. (2011). Please add this information in your text.

Reply: "For a site close to the coast near ZS", this site refers to the site closest to the coast in Section 3 and the site SIP in Table 3, and also the same site of ZS2013a, ZS2014 and ZS2015. "Similarly, at DS…from the period of 1957-2009 obtained at the same site", the same site here refers to site S1 in Heil (2006) and Heil et al. (2011). To make the expression clearer, we will add these information in Table 3 and in the Section 4.1 as suggested.

L429-443, Your LFI mass balance results are from the IMBs point measurements. The point measurements are more related to small-scale processes. How are you related the small-scale results to local-scale, regional-scale? Can you discuss this a little bit?

Reply: We will add some discussions on the representativeness on our measurements and how to upscale the derived results.

L448-451, Obviously your description is around DS. Could you add this information clearly in the text?
Reply: This part does describe the effect of snow layer on the LFI thickness near DS. We will specify this location information in the Section 4.2.

L452, the largest increase in the simulated LFI thickness, as I see from Fig. 8, occurred at ZS2010(Fig. 8c), not ZS2013b (Fig. 8e). Can you re-check your results?
L490, using same y-axis ticks in all the subplots for Fig. 8.
Reply: In Fig. 8, the y-axis ticks are different, which would be misleading that the largest increase in the simulated LFI thickness occurred at ZS2010. In fact, when the effect of snow was not considered, the largest increase in the simulated LFI thickness at ZS2010 was 0.23m, less than that at ZS2013b (0.35m). To avoid this misunderstanding, we will use the same y-axis ticks in Fig. 8 as suggested.

L470-471, Please make sure that you refer to the right Figures, Fig. 7 or Fig. 8? In Fig. 7i and 7j, one can see the larger influence of F_w near ZS than near DS. But you are comparing with and without the oceanic heat flux, Fig 8 might be the right figure you refer to.
Reply: We want to illustrate the oceanic heat flux exerts a larger influence on the mass balance of the LFI near ZS than near DS, which could also be seen in Figs. 7i and 7j. We will rewrite this sentence to make the expression clearer.

L472, Make the sentence to concise. Such as rewrite as "which leads to small contributions to the oceanic heat flux to the LFI mass balance there."
Reply: To make the expression clearer, we will rewrite this sentence as "which leads to small oceanic heat flux and its small contribution to the LFI mass balance there."

L475-479, It seems that your increase or decrease of simulated thickness is compared to AT_obs or AT_mean. Please clarify this in your text.
Reply: To assess the effect of the oceanic heat flux on the LFI growth, we compared the evolution of the ice thickness estimated by taking into account the oceanic heat flux using Eq. (4) to those estimated ignoring this flux. To identify the impact of snow cover on the LFI mass balance from the perspective of the thermal insulation effect, we used the AT obtained from the year of observation (AT_obs) instead of Ts for the LFI thickness calculation. The forcing using AT_obs actually ignores the attenuation effect of snow cover on air temperature. We will make the expression clearer.

L533, "upward shift" or "downward shift", please recheck. From Fig.2a, the snow-ice interface was downward shift.
Reply: It is a mistake. We will correct it.

L555, not only distribution of snow but also redistribution of snow. Please add this information in your text also.
Reply: Good point. We will add the mechanism of snow redistribution to explain our results in the revied manuscript.

L67, “Of these” can be remove.
L69, Suggest move “the third largest bay around the Antarctic continent” after L67 within the Prydz Bay.
L72-73, “Largely as a result of discontinuous observations associated with logistic difficulties” can be rewritten for concise, e.g., “Due to logistic difficulties for regular observations”
L106, remove “observed” or “record”
L249, remove “obtained” and replace “synchronously” with “synchronous”.
L318, replace “; the values” with “which”
L370, replace “;, this drove” with “which drove”
L461-462, This sentence can be rewritten as “This difference indicates that the LFI at ZS was more influenced by other factors, such as the oceanic heat flux and katabatic wind, compared at DS.
L523, remove “explaining” before “why”
Reply: All the grammatical mistakes and inappropriate expressions will be revised as suggestions.