Others have observed and discussed the seasonal influence of black carbon in melting snow (e.g. Flanner et al, 2007; Doherty et al., 2010, 2013; Dou et al., 2017). Here the authors propose a new method to estimate meltwater scavenging of black carbon using field measurements made near Barrow, Alaska. The idea is to eliminate the need for repeat sampling at sites by collecting just one profile during the melt season, and assuming mass conservation to estimate the scavenging efficiency.

Some comments and questions:

1. Figure 1 shows locations of sites far from Barrow that are not used to support your new technique for estimating BC scavenging efficiency. I do think that referencing these extra sites: South Korean Antarctic Ocean expeditions 2010 -18; 3rd Chinese Arctic Expedition; Hiking through the North Pole; Dye 2 etc) adds to the primary focus of your paper (i.e. meltwater scavenging of BC). I think it would be less confusing for readers if these references were not included.

2. Not all readers will be familiar with your field measurements near Barrow, Alaska (Dou et al., 2017). It would be useful to expand on details of those measurements here. Also in the abstract it would be important to state specifically that Elson Lagoon and Chukchi Sea are in the vicinity of Barrow, Alaska.

3. I do not follow your eqn. 1, which you mention comes from Flanner et al (2007). Their eqn. 3 assumes mass rate of change of BC in layer 'i' is proportional to its mass mixing ratio multiplied by a scavenging factor, which appears to be quite different to the one you are using.

Instead, it might be better to follow the method described by eqns. 2, 3 and 4 in Doherty et al., (2013), which shows how measurements of m_B (average original mass per unit volume of BC before melting), and m'_B (average mass per unit volume in the near surface snow can be used to calculate an average scavenging efficiency. In your case. you could use the method you propose to calculate $m_B = h_1\rho_1 C_{B1}$, and calculate m'_B from your measurements of C_{Bsfc} h_{sfc} and ρ_{sfc} in the near surface snow after melt has started (from your Table 2).

4. I am confused by the data presented in Tables S1 and S2 and how they have been used to construct Figs. 2, 3, & S1. Some questions:

(i) are there 3 different sites at Elson Lagoon that were sampled in 2015 only, and another 3 different sites at Chukchi Sea that were sampled in 2017 and again in 2018?

(ii) if so, are data for the first site at Elson Lake shown in Table S1: BC concentrations (ng/gm) of 0.31 in the ice layer and 1.72 in the overlying snow layer measured on May 18. Does that imply melt had started by that time? On May 31, an average value of 14.9ng/g was measured in the near surface snow. What is the density and thickness of the surface layer?

(iii) For the first site at Elson lake in Table S2: C_{B1}=1.1, and presumably C_{B2} = 1.72; C_{Bice} = 0.31 and C_{Bsfc} = 14.9. What is the density and thickness of the surface layer?

When were the measurements of h_1, ρ_1 and C_{B1} made?

(iv) Perhaps it would be less confusing if the tables were combined with relevant data (depths, densities, concentrations for Elson Lake and Chukchi Sea) and included as a single table in the main text.

5. It would be good to mention some of the limitations of the method – for example, (i) a melt-season ice layer may not form in regions of strong melt; (ii) the model does not account for influxes of BC from snowfall during the melt season; (iii) the model provides an estimate of the average seasonal scavenging efficiency but does not capture temporal variations in efficiency.