

Interactive comment on “Investigating the Impact of Aerosol Deposition on Snow Melt over the Greenland Ice Sheet Using a Large-Ensemble Kernel” by Yang Li and Mark G. Flanner

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We appreciate the reviewer’s perspective that numerical modeling should be guided and constrained by measurements, but we note a couple of clear counter-arguments to the reviewer’s suggestion. First, planning and executing a field mission to Greenland that covers a full annual cycle and various locations is well beyond the scope of this study, not to mention beyond the allocated funding on supporting grants for this work and beyond current capabilities of our lab. Second, our study simulates key quantities that are not directly observable, namely runoff perturbations from the entire Greenland Ice Sheet. The absolute runoff flux from Greenland is estimated only

C1

through indirect measurements and techniques, such as subtracting calving estimates from gravitational-based estimates of mass balance (themselves uncertain), and hence the absolute annual estimates are uncertain by at least a factor of two. Estimates of Greenland-wide runoff *perturbations* from BC deposition, which are small compared with total absolute runoff, would be impossible to directly observe with current observing capabilities. Modeling is therefore required to derive estimates of this nature. We do cite multiple observationally-constrained estimates of BC deposition flux to Greenland (e.g., Polashenski et al., 2015) and place these estimates in the context of our simulated values. Uncertainty in deposition is another reason why we chose to simulate such a huge range of deposition fluxes – so that future estimates of BC deposition (derived from either measurements or models) can be extrapolated to Greenland-wide melt perturbations. In short, we agree with the reviewer that more observations of BC deposition to Greenland would be useful, but the types of measurements that would provide constraint of the nature suggested by the reviewer are well beyond the scope of this study.

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C2