Tidewater glaciers are largely responsible for controlling future global sea level contributions from the Greenland Ice Sheet. However, several critical components of tidewater glacier systems are still poorly understood, which limits our ability to form predictions of future sea level. In particular, we lack a clear understanding of the subglacial hydrologic system beneath Greenlandic tidewater glaciers - particularly within the main trunk and near the terminus - and its time-evolving relationship with surface melt production, submarine melting at the terminus and glacier dynamics. Cook et al. present an exceptional paper that uses modeling solutions to help constrain many of these important and outstanding questions.

The analysis reveals a richly detailed subglacial hydrologic system beneath Store Glacier, including the contributions of both distributed and channelized drainage, and evaluates its sensitivity to surface meltwater and its impact on plume melting and basal water pressure. The authors make a convincing and novel case that the wintertime]system is under appreciated and that summertime surface meltwater production is weakly correlated with plume melting, but strongly correlated with basal water pressure. In short, these results are critical to our understanding of the largely unseen subglacial system and its impact on tidewater glacier dynamics.

The manuscript and analysis is well written, logical, and clear. The conclusions are well supported by the model and the authors carefully acknowledge model limitations and instances when the model is not well equipped to answer certain questions. The authors could improve their discussion and, perhaps, analysis of the seasonal evolution of the subglacial hydrologic system and plume dynamics at the terminus. I have a couple of suggestions and potential figure ideas that could improve this narrative and strengthen the paper, which are detailed below. I've also included suggestions for several other minor edits. Overall, I would enthusiastically recommend this paper for publication after only minor revisions.

High level questions and suggestions

To what degree do plume locations - and corresponding melt rates - vary within a season across the terminus front? The authors comment that the "location of strong convection-driven summer plumes varies as points of discharge from the hydrologic system evolve." To my knowledge, this is an important open ended question, and further analysis would be an interesting addition to the paper. A simple figure (e.g., heat map of the vertical submarine terminus face) showing the evolution of discharge points (i.e., the time and space integration of their location over the summer) would be instructive.

In addition, it would be great to more explicitly connect the vertical panels in figure 4 to map-view features modeled in the distributed and/or channelized system. For instance, why are the largest plumes unassociated with the main channel and sheet flow drainage on the northern and southern glacier margins?

Another important addition would be to show the development of the subglacial hydrologic system (i.e., growth of the aggregated channel area and distributed flow) in the time series shown in figures 7 and 8. This would allow for a more complete view of the degree to which meltwater drives these systems and, in turn, basal water pressure and melting at the terminus. The time evolution of these relationships is an important aspect that perhaps the present model can shed light on.

Minor revisions

Page 4, line 10: This is a nice opportunity to motivate why the stable nature of Store is beneficial for the current modeling effort.

Table 3: Please clarify why the average runs do not have “max” time steps.

Page 11, line 10: It would be helpful to the reader if the authors annotated the 3 branches and other relevant features within the subglacial hydrologic system directly in figure 3.

Page 12, line 25: Please specify observations showing flotation.

Figure 4: It would be beneficial in all figures to expand the scale bar to be larger and more legible. It would also help to include a horizontal and vertical scale bar to provide the readers with relevant distances important to the results.

Figure 5 and 6: A scale bar denoting distance - or model domain coordinates - would be helpful here.

Page 17, line 2: “a s” might be a typo?

Great paper - really enjoyed it.