I think the authors' huge efforts to address my previous comments. The current version of the paper has improved a lot in terms of the model descriptions and the analyses of the model results. However, the paper still needs certain improvements in (1) model descriptions (2) results analyses in Section 3.1; (3) and the Conclusion.

For the model description, specific comments include:

(1a): For Section 2.1, the main goal of this section is to provide a way to "estimate" the Hydraulic diameter Dh. The main assumption is that Dh, a characteristic size of subglacial conduits, does not change too much over a certain period. With such an assumption, the Qw in Equation 1 can be estimated using a time-averaged value of discharge during the period. And the pressure gradient can be estimated from the Shreve potential gradient. With these two pieces of information, the Dh in Equation 1 can be approximately estimated and kept unchanged in other conditions. Though the paper finally achieves this goal in lines 109-111, I suggest the authors add the key motivations and assumptions of this Section at the very beginning of the Section, which will improve the readability of section 2.1.

(1b): Section 2.3.1 need improvements in two aspects: better descriptions for the grid and its sizes/area etc, donor, receiver, and the final linear combinations used for equation 18, 19, and 21; better descriptions for the routing schemes for equations 18-22. First, Section 2.3.1 is trying to obtain distributed values for hydraulic potential, water discharge, sediment discharge, and till height in a 2D domain. In a 2D domain, any grid (with grid id i) has multiple neighboring grids that can exchange potential/discharge/height to its donor grid. And how much exchanged is further affected by the grid size and the approach to calculating gradients between neighboring grids. In short, such a process is similar to the numerical discretization process and usually very complex. In this paper, lines 174-178, 184-185, 190-191, 192-193, 196, and 197 aim to describe these processes, however, are not successful, in my perspective, to explain how the grid size, weights, and equations (18.19,21) are organized together. To help clarify the equations in this section, I suggest the authors sketch to carefully describe mesh, donor, receiver, and variables defined at each donor grid in a 2D grid domain and then use this sketch to improve the description for equations 16-22. To draw such a sketch, the authors can check figure 3.1.1.1 or 3.1.1.2 at this link: http://www.thevisualroom.com/finite_volume_method_3.html. In this sketch, it is necessary to clarify the following definitions: lambda, nr, wr,j, phioi, phioj in Equation 18; delta, nd, wd,j, Qwi, Qwj in equation 19, lambda and nd, Qsi, Qsj in equation 21, and Hi, mti in equation 22. With the clarification of these terms in the sketch, section 2.3.1 will become clear.

For the result analyses: in Section 3.1.2, the texts in the paper are not consistent with the Figures shown in Figure 4. In Figure 4 caption, it says "a) Seasonally varying water discharge (Qw) increases from year 10 to 20, while till height (H) decreases. b) Annual sediment discharge (green) increases over with increasing melt". However, Figure 4b sediment discharge does not show an increasing trend, but shows a "decrease, increase, and then decrease" trend. A similar problem occurs for figures 5b,d,f at lines 257-258. In the author's response, the author mentioned this may be caused by using an old version of the manuscript, the authors are suggested to carefully re-exam all results in Section 3.1.2 to make sure the texts in the current version agree with the figures.

For the Conclusion section, the main problem is the Conclusion is not supported by quantitative evidence. The Conclusion in the current version has 4 paragraphs: the first one introduces the 2D model; the second one discusses the limitation, the third one discusses the future work, and the last one has two sentences commenting on the results and two sentences discussing further work. From my understanding, a

Conclusion should include what you did and what you have discovered, and provide quantitative evidence to support your discovery. The first paragraph did describe the 2D model, which is good. But no quantitative evidence to support your discovery makes the Conclusion very weak. Also, limitation and future work should NOT be the main texts in the Conclusion because they are not the 'Novel contribution' of the paper. Therefore, I believe the Conclusion section requires significant improvement, which needs to provide concrete QUANTITATIVE evidence to support the main Conclusions of the paper.

Other specific comments are listed below for reference:

Line 88: change hydraulic gradient to hydraulic pressure gradient

Equation 1: maybe change Ψ to $\Psi(x, y, t)$, which helps to clarify the pressure gradient is a time-dependent and 2D distribution variable.

Equation 2: can you a sketch the angle β in Figure 1 or 2?

Line 96: change "establish" to "estimate" or "approximate"?

Line 98: change "we call the source percentile" to "which is called the source percentile".

Line 97-98: How the surface melt and resulting discharge control the subglacial conduit diameter is a complicated problem. Could you add a few citations to support this assumption, if any?

Line 103: I think Qw is the instantaneous discharge, while Qw* is a representative scale of the instantaneous discharge. What is the "total instantaneous amount"?

Line 96-104: some of the texts here are confusing. Qw is the water inside the subglacial conduits. Without considering ice melting inside the conduit, such water should be discharged from surface melting, therefore, I would say water in the conduit equals the surface melting into the conduit, based on mass conservation, therefore, Qw = mw. In general, the surface melting varies with time, so here you assume mw is estimated by Qw* which could be a time-averaged value over a certain period (hours to days as mentioned). In thinking in this way, it is logical converting equation 1 to equation 3. However, lines 96, 99-100, and 103-104 cause confusion. I would suggest revising the texts between 96-104 to better reflect the logic as I suggested above.

Line 99-102: Two variables, sa and sp are introduced. And further explanations are added. However, these two variables are not used in Equations 3 and 4. They may be not useful to help us understand why equation 3 could be derived from equation 1, but may confuse readers. I suggest removing this information from lines 96-104.

Line 109: is Dh a function of x and y?

Line 109: Add one sentence at the beginning of this paragraph: With the data of representative surface melting rate Qw* and the static hydraulic pressure gradient, a representative hydraulic diameter Dh can be estimated. For a given short period, such a Dh is assumed time-independent and used in Equation 1.

Line 124: How does this conversion happen? Do you mean Qs = Qs~/w?

Equation 6: What is the necessity to use Qs~ rather than Qs? Trying to use variables as less as possible, if existing variables are sufficient to tell the story. Revise equation 6a to a formula of Qs but not Qs~.

Equation 15: what is the difference between τ in Equation 11 and τ_b in equation 15? Do they equal to each other?

Equation 15: does $\sin\alpha = \nabla z_s$?

Line 172: What is the purpose of flow routing? Is it used to distribute water potential at different cells?

Line 172: change “multicell routing scheme” to “2-D distributed routing scheme”?

Line 174: what is a “regular grid”? square grid or rectangular grid? Also, the result in Figure 3 shows an irregular distribution, please clarify this.

Line 174: What do "fluxes" mean? Is water flux driven by pressure gradients?

Line 175: Not sure what is a “stack” in Table 3. It is better to draw a 2D sketch to visualize st, nd, and nr for a single cell. See major comments 1b.

Line 175-178: These sentences describe the process of numerical discretization. The value of the cell, i.e., a stack defined here, is a linear combination of the values of certain variables of neighboring cells. There are different types of numerical discretizations and thus result in different linear combinations. As different combination means different discretization schemes have different accuracy, so it is generally required to describe what discretization schemes are used. The current sentences are very general descriptions of the discretization principle. Please refer to the major comment 1b to better describe this part.

Equation 18: In lines 176-177, you defined donors and receivers, why did you only use the information of potential from receives, i.e., summation from 1 to nr in Equation 18. Here the wr,j is determined by discretization schemes. How do you calculate this?

Line 186-187: It is very hard to understand this sentence by reading just words. You have to provide a figure to describe what is donor, receiver, edge length, etc. This is a typical practice for papers that involve numerical discretization algorithms. Also, for 1D grid, it only has one edge length. But for 2D grid, it has two edges and thus two edge lengths. For the regular grid, if the grid is square, then we can say it has only one edge, but if it is rectangular, it has two edges. As your paper is a 2D model, please make sure if you use a square grid or not.

Line 188: you mentioned “beginning at the based and moving up to the glacier”, does this sentence mean the calculation is performed along a line from the base to somewhere? What does "flow paths evaluated in the routing scheme mean? You need to provide a sketch to carefully describe these details.

Equation 19: So you are applying the routing scheme to calculate a distributed discharge for water? Again, what is δ, $w_{d,j}$,? And why you only calculate summation over donor cells? These really require a detailed figure to describe this. Combining equations 19 and 18, there have too many variables, it is impossible to accurately understand the meaning and how you calculate without a detailed sketch. By the way, as you give $\dot{m_{w,\iota}}$ different value for different cell, so do you mean you prescribed a distributed meltwater source term along a certain line?

Line 192: What is $\overline{Q_{s,\iota}}$? Where does this term come from and why you need to calculate this term? Most importantly, how are equations 20a-c derived? The term "like-wise" does not explain how this term is derived.

Line 195: Need a figure to describe what is λ? What is a response length scale? And where is this come from?

Line 196: how is equation 21 derived? Why Qsi = $\lambda Q_{s,i}$ + …?

Line 198: Need to define cell area?

Line 215: Need a figure to show where the edge cells are.

Section 3.1 title: You only have one synthetic case. Use a singular form

Line 235: It is better to reproduce and visualize the synthetic glacier geometry in your paper.

Line 238: what is "laterally"? You haven't defined any coordinates here, so no way to understand "laterally".

Equation 23: What is the unit of T? For 0, is the unit K or C?

Line 249: o is not the same as Celsius (oC).

Line 255: Figure 4 appears earlier than Figure 3.

Line 256-257: In Figures 5b,d,f, each figure has two lines. One is purple and another one is yellow. So which line is the "Daily-averaged sediment discharge"? However,both curves in 5b,d,f shows complex behaviors. For purple lines b and f, they show decreasing, increasing, and decreasing trends. For d, it shows an increasing, constant, and decreasing trend. The yellow lines show more complex behaviors. In short, figures 5b,d,f show different behaviors compared to what you say at line 257 (decreases until....). Please carefully analyze the figures and make your text descriptions consistent with your figure.

Line 264: How do you define mean till height?

Line 295: Can you elaborate on the 4 time periods?

Line 314: add (see red stars in Figure 7a-c) after "… till height H0 of 2.5 cm".

Line 319: Why is the data a constant within each year? For example, the data is constant between late 2011 - late 2013?

Line 319: From Figure 7a,b,c, What is the absolute error for the optimal run (red star case)? Is the value 62,600? I can not see it clearly from the y-axis in Figure 6a.

Line 325: change "short-lived' to "short-lived period".

Line 325: This claim needs supporting evidence. From Figure 8a, you can identify the peak values for the sediment discharge. Meanwhile, you can obtain the corresponding water discharge. You can calculate a correlation between the two values. If the correlation coefficient is high, then this claim is supported.

Line 328: what is "high on the glacier"?

Line 340: check “and thus, glacier, conditions”.

Line 390: check “This is especially so”

Line 398: Can you explain this sentence more? Also, Figure 10 appears only once in the whole paper, do you need to explain the meaning of Figure 10 more?

Conclusion section: The Conclusions are all qualitative descriptions or perspectives or future plans. No quantitative metrics or summaries are included. In my view, a Conclusion section written in this way is not a solid Conclusion. The Conclusion needs quantitative evidence to support it. Please try to summarize the paper and provide quantitative metrics to support your Conclusion.

Line 405-407: From my understanding, the main contributions are two: (1) proposed a 2D subglacial sediment transport model; (2) reproduced certain phenomena reported in previous work. The first paragraph (403-407) describes the first contribution, but the contribution for the second key point is vague. As mentioned in the first paragraph, there is a "need" and the model reproduced "many observed processes". However, in this conclusion section, it is not clear what the "need" is and what processes are reproduced. The authors should explicitly summarize the key findings in the paper and use the summary to support your "Conclusion".

Line 408-412: this is the limitation of the model, which is not a “Conclusion”.

Line 413-419: These sentences belong to the future work. However, future work is not the work done in the current paper, it is not necessary to add these in the "Conclusion". They can be merged into the "Limitation" section.

Table 2: As mentioned in the paper, some of the parameters are adopted from other papers. For all the parameters not measured by the present paper, a reference is required. Potential audiences will need accurate references to verify how each of these parameters is derived.

Figure 4: the captions are not consistent with the Figure. For example, the green line in Figure 4b shows a decrease, increase, and then decrease behavior. But the caption here says "increases". Please have a careful check for all the figures and captions. The main text need further check if the Figure and captions are changed.