

## Response to the reviewer's comment

We thank the editor and reviewers for reviewing our manuscript and considering our work. We appreciate their interest in our research and their constructive comments have enabled us to improve the manuscript, to better highlight the main results and to strengthen the demonstration that has led us to develop a new conceptual model of the hydrogeological functioning of glacierized catchments.

### Reviewer Report of Xuegao Chen, reviewer1:

The authors have done a good job implementing comments from the first round of revisions which has improved the manuscript. Overall, the general idea of the work is interesting and the paper is streamlined. The main strong points of the paper are two. First, it provides new data about aquifer systems in four south-eastern outlet glaciers. The monitored groundwater level, aquifer temperature, EC and calculated hydraulic conductivity and specific yield give an overall picture of the local hydrogeologic condition. Second, it gives quantitative information on the recharge process from the glacier to the aquifer based on the watershed water balance. The glacial melt recharge has a significant impact on the groundwater dynamic. I think the manuscript can be recommended for publishing and I wish them success in their research.

We are grateful to Dr. Xuegao Chen for his appreciation of our work.

### Anonymous reviewer 2

This manuscript tries to understand and characterize the hydrogeological system including the recharge, geometry, and hydraulic parameters in a glacier feed region. The main contents are based on new observations, and a hydrogeological conceptual model of the system is proposed by analyzing the existing and new data. However, I am confused at the current structure of the manuscript and there are no interconnections among different part. As a result, I could hardly get what the authors want to emphasize. The current version seems like a part of a report. I recommend a rejection at current stage and my comments are listed as below:

(1) The title is “a hydrogeological conceptual model of aquifers .....”, However, this model is finally proposed in the discussion part with the initial introduction of the concept framework. The structure, validation, and the performance are missing the manuscript.

The structure of the manuscript has been re-worked and improved, taking into account this major comment. Paragraphs linking the sub-sections provide a clearer understanding of the step-by-step reasoning behind the construction of the conceptual hydrogeological model.

(2) The research gap, motivation are not clearly stated in the introduction part. I could hardly get the main point that the authors want to deliver to the readers.

The introduction has been rewritten to better present the state of the art in this particular context, the scientific questions we wish to answer, the main advantages of the study site, and the type of new data that has been collected and brought together with that available to be able to propose a conceptual hydrogeological model of the glacierized catchments.

(3) The authors need to provide a detailed explanation on how the “new data” assists the analyses.

Until now, the role of the underground compartment in glacial watersheds has been little studied. Very few studies provide data on the geometry of aquifers, their hydrodynamic properties, or their piezometric records. This is even less the case if a confined aquifer, deeper than the detrital aquifer, is to be considered. The originality of our study lies in our ability to collect new data on the aquifer systems that make up the site studied. We can thus describe the geometry of the system. Analysis of the piezometric records shows not only recharge by glacier meltwater, but also vertical exchanges between the two aquifers, via an aquitard. These data, combined with those on subglacial melt flows and estimates of recharge in proglacial zones, enable us to draw up a complete hydrological balance for this type of environment. The rewriting and reworked structure of the manuscript should make it easier to understand the stages of our argument and how our new data contributes to it.

(4) Most of the subtitles need to be revised, for example. 5.1.2 “in the plain”, 4 “new data” (5) The authors need to re-organize the manuscript and clearly point out the main research question that needs to be addressed.

As mentioned in point 1), the structure of the manuscript has been reworked, including the subtitles. The plan is now as follows (modified or added subtitles are underlined in yellow):

## **A hydrogeological conceptual model of aquifers in catchments headed by temperate glaciers**

### **1. Introduction**

### **2. The study area**

#### 2.1. Climate context

#### 2.2. Glaciers context

#### 2.3. Geological context

### **3 Methodology**

#### 3.1 New Data

##### 3.1.1. Aquifers geometry

##### 3.1.1. Aquifers dynamics and properties

#### 3.2 Data Analysis

##### 3.2.1. Glacier melt and effective rainfall

##### 3.2.2. Hydrodynamic properties of aquifers

### **4. Hydrodynamic characterizations of the aquifers**

#### 4.1. Groundwater level

#### 4.2 Temperature

#### 4.3 Electro-conductivity

#### 4.4 Slug tests

### **5. Results**

#### 5.1 Recharge estimation

##### 5.1.1 Estimation of subglacial water flows and spatial distribution

##### 5.1.2 Estimated effective rainfall in the proglacial area

#### 5.2 Aquifers characteristics

##### 5.2.1 Thickness and temperature of geological formations

##### 5.2.2 Aquifers hydraulic conductivity

##### 5.2.3 Aquifers storage coefficients

#### 5.3 Aquifers dynamics characteristics

### **6. Hydrogeological conceptual model of glacierized catchments**

### **7 Conclusion**