Response to Reviewer 2:

We much appreciate the reviewer for the positive and valuable comments to help the revision of the manuscript. All issues raised by the Editors and reviewers are addressed in the revised manuscript and the responses to all comments were given in below (highlighted in red font).

Major issues:

1. Although the ESSD aims to provide high quality datasets for the earth science field, it is still a scientific journal to present the new results, knowledge and understanding based on obtained dataset, rather than simply describing the measurements of datasets. The manuscript in this stage seems like a field experiment report, but lack the critical analysis for datasets, the knowledge indicated from datasets and understanding implicated from datasets.

For example, the groundwater level variations from four well groups indicate that deeper depth has the larger variations (over 15 m) of groundwater head (Figure 3), which implicates the mountainous groundwater level particular in high elevation would be very sensitive to changes in land surface or hydrogeology structure (thawing permafrost will reshape the hydraulic connectivity). All of these observations are worthy of in-depth analysis and discussion.

Therefore, I would like to suggest restructuring the section 3 and 4, presenting the data with a clear result analysis and discussion part, to demonstrate how these data help improving understanding for surface-groundwater interactions of Tibet Plateau, and what insights to provide for other alpine regions.

Response: Thanks for your suggestion. Indeed, all of the observation data are worthy of in-depth analysis and discussion since we present the systematic information for groundwater level, ground temperature, precipitation, river discharge, chemistry and isotopic compositions of different water bodies at the catchment scale. These data are critical for understanding the groundwater flow and its interaction with surface water under impact of freeze-thaw process, and also other hydrological cycle-related issues such as biogeochemical processes. However, the aim & scope stated by the ESSD journal is "Earth System Science Data (ESSD) is an international, interdisciplinary journal for the publication of articles on original research data (sets), furthering the reuse of high-quality data of benefit to Earth system sciences. …**Any interpretation of data is outside the scope of regular articles**" (https://www.earth-system-science-data.net/about/aims_and_scope.html). Thus, the main purpose of this manuscript is to provide the high-quality datasets for understanding the surface-groundwater interactions on the TP and for exploring the different kinds of groundwater flow-related issues. If we add discussion part, we would inevitably have to interpret the data, which is outside the scope of regular articles in the ESSD. However, we still revised our manuscript to clearly present the monitoring system design, the method for data collection, water sample preservation analysis etc. We also present the results for spatiotemporal change of groundwater level, ground temperature, and river discharge, chemical and isotopic compositions in the catchments. The other results for the lithology of the aquifer and the mineralogical compositions were also included.

2. The authors give detailed descriptions for observed process, but lack a clear scientific objective for experimental design. Readers will be wondering, such as, why they put wells in those four locations, why they collected samples from western tributary…

Thus, a clear objective corresponding to measurement should be need, which will strongly demonstrate the significance of the study and datasets.

Response: The overall rule for the field monitoring system design is that the system could be used to obtain the different kinds of hydrological and hydrogeochemical data from various hydrological component of the catchment such as glacier-snow melt, groundwater, tributary and main stream along the flow path, and during the different freeze-thaw periods. With these data, it is possible to explore the hydrological process and its associated biogeochemical processes under effect of freeze-thaw process at catchment scale. The motivations for designing monitoring systems were added in the revised manuscript. One set of cluster well is located in the permafrost zone, so that the groundwater level, temperature, chemical and isotopic components of different waters in permafrost zone could be monitored. Due to the harsh and difficult field condition, the drilling instruments can't be transported to other sites in permafrost zone during our field study. Thus, only one set of wells in permafrost were drilled. The three sets of cluster wells in seasonal frost zone were designed to locate in the recharge, flow through and discharge zone of the sloping piedmont plain. With this design, it is possible to understand the aquifer system in both permafrost and seasonal frost zone, connection of flow and associated solute transport from permafrost zone, to seasonal frost zone, and further to catchment outlet.

Specific issues:

1. Title: "research on groundwater flow and its interactions with surface water" is so general that easy to lose readers who hope to find relevant datasets. Moreover, the manuscript lacks the in-depth analysis of how these data indicate the groundwater flow and surface-groundwater interaction. So I would like to suggest a direct and clear title, such as "Dataset for alpine groundwater levels and hydrogeochemistry in northern Tibetan Plateau".

Response: Please refer to the response to major comment 1. Interpretation of the dataset to understand the groundwater flow and surface-groundwater interaction is out of the journal's scope. We revised the title to "Multi-year dataset for groundwater level, temperature, and chemical and isotopic compositions of different water bodies in an alpine catchment on the northeastern Tibetan Plateau, China" in the revised manuscript.

2. Lines 58-59: Actually there are some groundwater studies focused on TP, and need to be included.

Yao, Y., et al. (2017). "What Controls the Partitioning between Baseflow and Mountain Block Recharge in the Qinghai-Tibet Plateau?" Geophysical Research Letters 44(16): 8352-8358.

Yao, Y., et al. (2021). "Role of Groundwater in Sustaining Northern Himalayan Rivers." Geophysical Research Letters 48(10).

Response: We have cited the above paper in the revised manuscript.

3. Line 94: "Groundwater level and ground temperature changes are also explained". Explain what? Maybe it is better to use "show".

Response: Change was made as suggested in the revised manuscript.

4. Line 100: Since the whole manuscript did not mentioned the significance of this study for the Heihe River, I would like to suggest highlighting that this is a typical case for permafrost regions or headwater areas of TP.

Response: The selected catchment (Hulugou catchment) as one of the typical headwater catchments of Heihe River Basin in northeastern Tibet Plateau is addressed in the followings. Some of the following information was given in the appropriate locations of the manuscript.

(1) The Hulugou catchment, located in the headwater region of the Heihe River (HR), has a drainage area of 23.1 km^2. The HR headwater region is composed by many small catchments including Hulugou catchment. We have examined the catchments in which the water directly discharge to the Heihe River in the headwater region based on field investigation and remote sensing data, and 34 catchments have been identified with an total area of 1978.5 km^2. Among them, 28 catchments have an area within a range from 10 to 100 km^2, which means Hulugou catchment has a comparable size with most of the catchments. This would be helpful for quantifying the annul flow discharging from these catchments.

(2) The Hulugou catchment is representative of a series of topography features, including glacier, permafrost, and seasonally frozen area (Chen et al., 2014). Groundwater and surface water is directly recharged by the glacier-snow meltwater, and the aquifer is a complex condition affected by both permafrost area and seasonally frozen area. These phenomena are common in the catchments of the HR (Chen et al., 2006; Cheng and Jin, 2013; Cuo et al., 2014).

(3) The Hulugou catchment is a topographically closed catchment, with bedrock outcropping in the south mountains, and thick and widely spread Quaternary loose sediments depositing in the north piedmont alluvial plain. This kind of "mountain-piedmont plain" catchment is common in the headwater region of the Heihe River. The moraine deposits-talus-alluvial-pluvial deposits complexes form the main groundwater aquifers in the HR basin and play an important role in regulating groundwater discharge.

Reference

Chen, R., Song, Y., Kang, E., Han, C., Liu, J., Yang, Y., Qing, W., and Liu, Z.: A cryosphere-hydrology observation system in a small alpine watershed in the Qilian Mountains of China and its meteorological gradient, Arct. Antarct. Alp. Res., 46, 505-523, https://doi.org/10.1657/1938-4246-46.2.505, 2014.

Chen, Z., Nie, Z., Zhang, G., Wan, L., and Shen, J.: Environmental isotopic study on the recharge and residence time of groundwater in the Heihe River Basin, northwestern China, Hydrogeol. J., 14, 1635-1651, https://doi.org/10.1007/s10040-006-0075-7, 2006.

Cheng, G. and Jin, H.: Permafrost and groundwater on the Qinghai-Tibet Plateau and in northeast China, Hydrogeol. J., 21, 5-23, https://doi.org/10.1007/s10040-012-0927-2, 2013.

Cuo, L., Zhang, Y., Zhu, F., and Liang, L.. Characteristics and changes of streamflow on the Tibetan Plateau: A review. J. Hydrol.-Reg. Stud., 2, 49-68. https://doi.org/10.1016/j.ejrh.2014.08.004, 2014

5. Line 104: should be "annual averaged precipitation"

Response: Change was made as suggested in the revised manuscript.

6. Line 107: Since the daily discharge is much highly varied, I would like to convert the volume unit of (m^3/day) to depth (mm/year).

Response: According to the comment, we have converted the volume units of (m^3/day) to runoff depth (mm/year).

The sentence read now as:

"*The discharge of the catchment was approximately 567.7 mm/year in 2012 (Chen et al., 2014a; Chen et al., 2014b).*"

7. Line 121: Should be "good hydraulic connectivity"

Response: Change made as suggested.

8. Line 124: Since the precipitation involves the snow, this should be revised as "the aquifer is recharged by rainfall, melt water from glaciers and snow".

Response: Change was made as suggested in the revised manuscript.

9. Line 126: How low of the vegetation coverage? This should provide a percentage value at least. And this sentence is inconsistent with the following descriptions on vegetation coverage in line 135 (shrubs) and 147 (meadows). All these three parts should be combined and presented in consistency and with a clear percentage.

Response: We have combined these three parts and consistently presented the vegetation coverage with a percentage value in the revised manuscript.

The sentences read now as:

"Alpine meadow is the main vegetation type and the vegetation coverage is ~80 % in the permafrost zone (3500–4200 m a.s.l.) (Chen et al., 2014; Yang et al., 2015). In the seasonal frost zone (below 3500 m a.s.l.), the vegetation is dominated by alpine meadow and alpine shrubs, and the vegetation coverage is ~95 % (Chen et al., 2014; Yang et al., 2015)."

Reference

Chen, R., Song, Y., Kang, E., Han, C., Liu, J., Yang, Y., Qing, W., and Liu, Z.: A cryosphere-hydrology observation system in a small alpine watershed in the Qilian Mountains of China and its meteorological gradient, Arct. Antarct. Alp. Res., 46, 505-523, https://doi.org/10.1657/1938-4246-46.2.505, 2014.

Yang, F., Huang, L., Li, D., Yang, F., Yang, R., Zhao, Y., Yang, J., and Liu, F.: Vertical distribution of soil organic and inorganic carbon and their controls along topsequences in an alpine region, Acta Pedologica Sinica, 52, 1226-1236, https://doi.org/10.11766/trxb201504220193, 2015.

10. Line 128-129: how about the active layer thickness, 2 m?

Response: The active layer is ~2 m thick. We have clarified this sentence in the revised manuscript.

11. Line 140: Is this unconfined aquifer?

Response: Yes, this is an unconfined aquifer.

12. Figure 1: I would like to suggest adding one or two photos to show your field experiments.

Response: Thanks for your suggestion. We have added the pictures for each typical landform, the well layout, and the core lithology of the borehole as shown below (Fig. 1 and Fig. 2) in the revised manuscript.

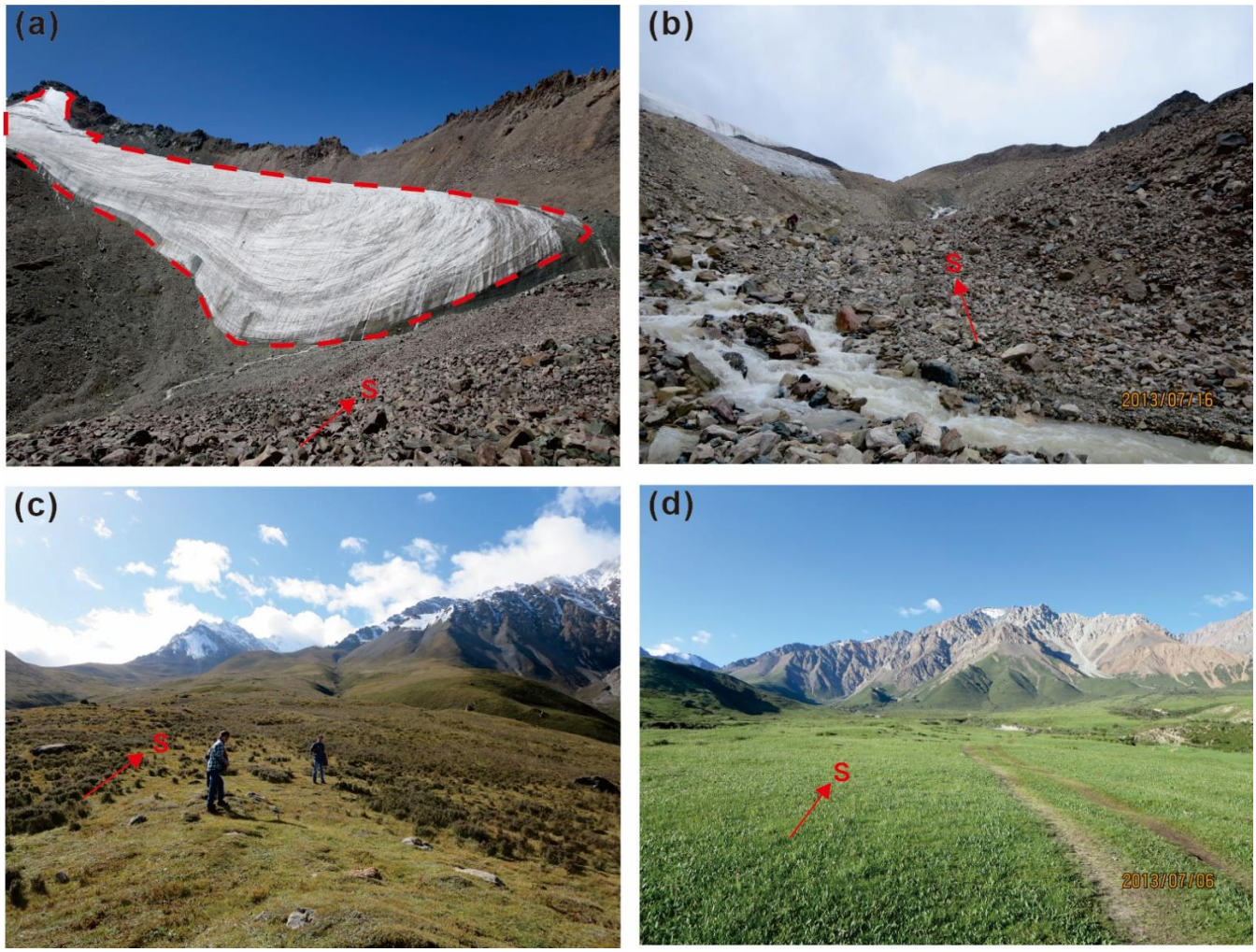

Figure 1. Pictures showing (a) the glaciers in the south of the study area, (b) the moraine sediments in the periglacial zone, (c) the planation surface in the permafrost zone, and (d) the piedmont alluvial plain in the seasonal frost zone.

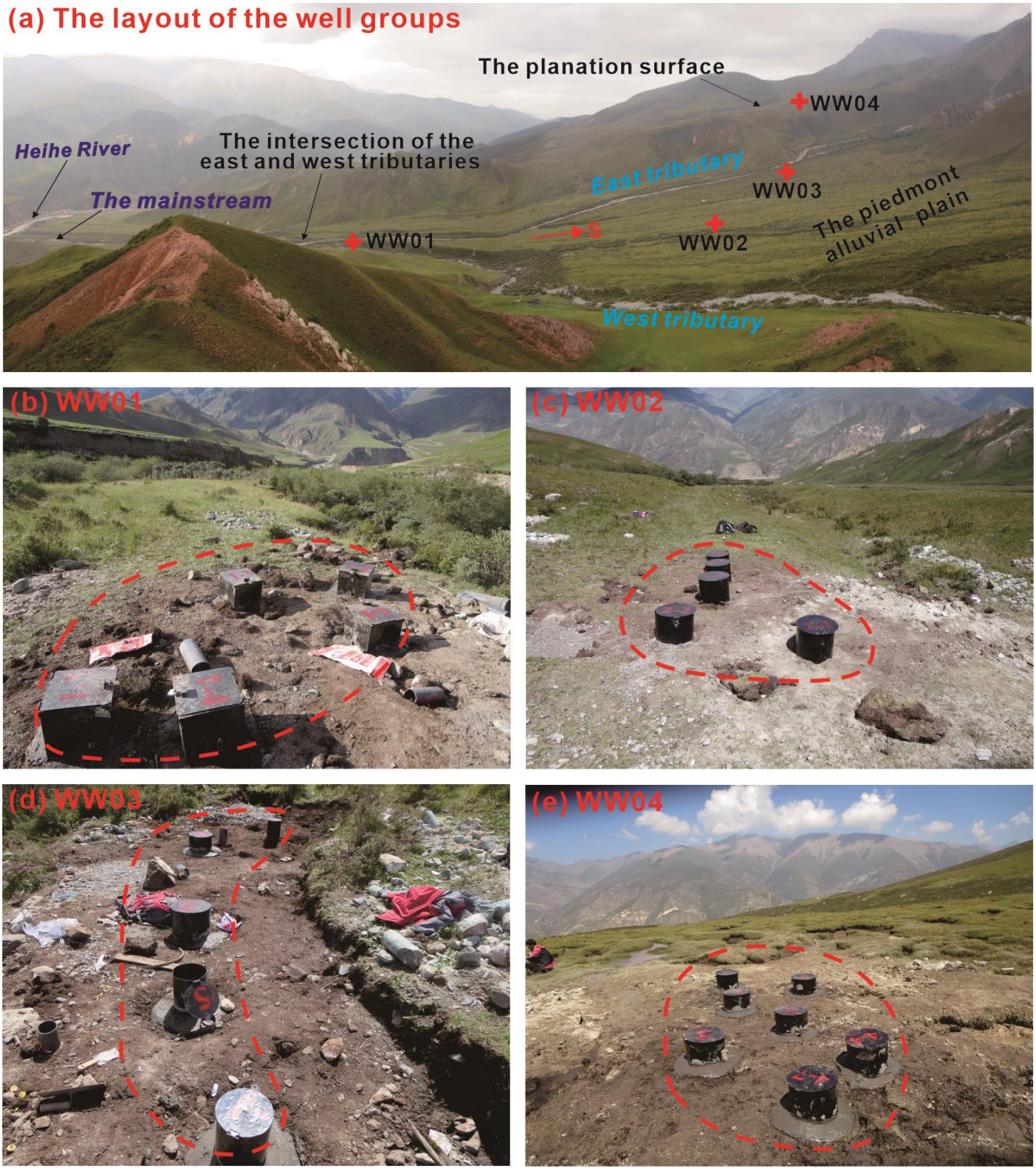

Figure 2. Pictures showing (a) the field scene of of layout all well groups in the study area, (b) the well group WW01, (c) the well group WW02, (d) the well group WW03, and (e) the well group WW04.

13. Line 155: "Well groups" will make readers misunderstanding there are multiple wells in a group. Direct using well would be better, and indicate one well includes multiple boreholes in different depth.

Response: Here we did mean that one well group includes multiple depth-specific wells in a group instead of multiple boreholes in different depth.

14. Line 181: Is this clay layer the top of the confined aquifers?

Response: Since we only have four sets of cluster wells, we are not sure if the clay layer is continuously distributed throughout the aquifer and can't confirm if this clay layer is the top of the confined aquifer. But our groundwater level data don't indicate that the porous media aquifer is the confined aquifer.

15. Line 218-220: Should give a detailed discussion for WW04, because it is the only well in the permafrost area.

Response: We have added a detailed description of well sets WW04 in the new **Section 3** of the revised version. Please refer to the response to the Major issues #1.

16. Figure 3: The caption should note this is "daily variations"

Response: Change was made as suggested in the revised manuscript.

17. Section 4.2 and 4.3: Any results and information we obtained from these part of datasets?

Response: We have added results and information obtained from these part of datasets in the new **Section 4** of the revised version. Please refer to the response to the Major issues #1.