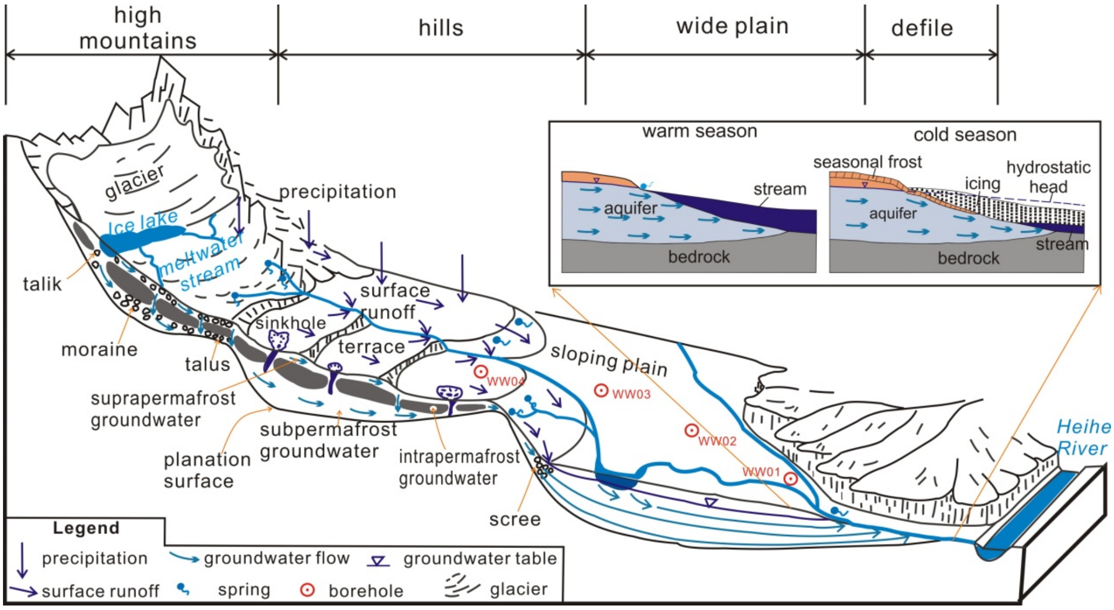
General comment:
The authors studied the role of permafrost in controlling groundwater flow and the hydrological connections between glaciers in high mountain and river in the low plain with hydraulic head, temperature, geochemical, and isotopic data. The paper is generally well written, and should be of very interest to the research community.

Response: We thank the reviewer for carefully evaluating our manuscript and for constructive and helpful comments and suggestions. Our responses to the specific comments are provided in a point-by-point reply given below.

Comment 1: Legend of Fig.12 should be explained clearly, such as the status of runoff (groundwater, surface water) should be depicted.

Response: We have revised Fig. 12 (as shown below) to make it clearer. Since there are many symbols in the figure, it is somewhat inconvenient and unclear if explain them in figure caption. Thus, we added a legend in Fig.12 to explain the meaning of different symbols used in the figure.



Comment 2: The resolution and framework of Fig. 10 should be improved.

Response: The resolution of Fig.10 is already 600 dpi. However, for comparison, we used the same Y-axis scale for three sub-plots (b), (c) and (d). This is the main reason why five lines in sub-plot (c) is too close to distinguish clearly. The sub-plot (c) would have been clearer and more aesthetic if a smaller scale was used for Y-axis. However, given that this figure is designed to show the difference in spatiotemporal variations of $\delta^{18}O$ between three water pools (i.e., shallow groundwater, spring and stream), further providing insights on their hydrology such as response patterns and water sources, this framework can yield more valuable information compared to that with varying scales. For example, as mentioned in the manuscript (P11, L2-5), spring waters showed the smallest variation in $\delta^{18}O$ among three water pools, indicating a weaker linkage with surface water, and probably a larger recharge area or/and a longer residence time (in well-mixed).

Comment 3: The conclusions need to be improved, the author should tell the most important conclusion by the simple statement at this part.

Response: We have revised the section Conclusions to focus on the most important things. The revised conclusions is as following:

Groundwater studies in permafrost area are challenging given the limited infrastructure and the short field season. These conditions favor samples from baseflow discharge and perennial groundwater springs, combined with the use of geochemical and isotope tracers to elucidate recharge conditions and flow paths. We selected a representative catchment in the headwater region of Heihe River, Qinghai-Tibet Plateau as a study site. The study used groundwater head, temperature, geochemical, and isotopic information to determine the roles of groundwater within the permafrost zone for hydrologically connecting waters originating from glaciers in the high mountains to lower elevation rivers.

Our field measurements confirm the co-occurrence of supra-, intra- and subpermafrost groundwater in the headwater regions of Heihe River. To our knowledge, this is the first report on the occurrence of subpermafrost and intrapermafrost groundwater in the region. The moraine and fluvio-glacial deposits on the planation surfaces of higher hills provide a major reservoir for the storage and flow of subpermafrost and intrapermafrost groundwater. The subpermafrost groundwater on the planation surface is interconnected to the surface hydrological processes and recharged by suprapermafrost groundwater and glacier and snow meltwater.

Glacier and snow-meltwater are transported from the high mountains to the plain through stream channels, slope surfaces, and supra- and subpermafrost aquifers. The groundwater under the piedmont plain within seasonal frost zone is mainly recharged by lateral flow from the south mountains and hills and by the seepage of streams, and is discharged as baseflow into the stream in the north gorge. A rapid transfer of groundwater from the south top to the north base of the plain occurs during the high-flow period, while the stored groundwater is slowly released during the low-flow period. This seasonal variation of the aquifer in water-conduction capacity was interpreted by two mechanisms: (1) surface drainage via the stream channel, analogous to "fill and spill" mechanism in hillslope hydrology. The narrowing of aquifer from the wide plain to the gorge led to a relatively high water table near the gorge, preventing it from dropping below the channel bed and maintaining a perennial flow in the downstream. This also explains the rapid transfer of groundwater from the top to the base of the plain and the stable water table in front of the gorge during the high-flow period; and (2) subsurface drainage to an ephemeral artesian aquifer confined by stream icing and seasonal frost. When the stream icing and seasonal frost changes the bottom of the gorge into a confined aquifer during the *cold season, downstream groundwater head rises and the hydraulic gradient between the wide plain and the narrow gorge is reduced. In addition, increased icing constricts the channel cross section, significantly reducing groundwater discharge into the river channel. The second mechanism proposed here explains the slow release of stored groundwater from the plain during the low-flow period. This expanded the existing "fill and spill" mode for catchment and hillslope hydrology."*

Comment 4: Page 11, the value of δ^2H and δ^{18}O indicate that suprapermafrost groundwater had experienced strong evaporation, but the hydrogeochemistry also suggest the suprapermafrost groundwater has rapid flow. It should be explained more clearly.

Response: We have revised this part (P11, L22-27) as suggested to express it more clearly. The revised statement is as following:
The low TDS, Cl^- and Na^- concentrations and the HCO_3-Ca water type suggest that suprapermafrost groundwater had experienced insufficient water-mineral interaction, probably caused by a relatively short residence time. This is supported by the highest ^{14}C activity in the suprapermafrost groundwater among all samples, which was 96.34 pmC and close to the atmospheric value (Clark and Fritz, 1997), and a 15.11 TU ^{3}H concentration, which is an indicator of modern water (Zhai et al., 2013). Though occurring on a relatively flat planation surface, the suprapermafrost groundwater is actually easy to drain because the planation surface adjoins the lower slopes in three directions. Add to that the fact that suprapermafrost aquifer is fairly thin whereas rich in organic matter with high permeability, one can understand why it may have a high renewal rate. However, the enriched ^{2}H and ^{18}O isotopes, along with samples' position relative to the LMWL in the δ^2H vs. δ^{18}O plot, indicate that suprapermafrost groundwater had also experienced a certain degree of evaporation (Figure 8). These two conclusions are not in conflict when considering the high local evaporation (376−650 mm/yr) and shallow suprapermafrost groundwater depth (0−1.5 m below ground). The high groundwater table may also result in very shallow flowpaths for the majority of the water and few possibilities for chemical reactions between the discharging water and the deep mineral soil (Frey et al., 2007; Stotler et al., 2009;Vonk et al., 2015).

Comment 5: The English of the whole manuscript need to be improved.

Response: We have tried our best to edit the English and we have also asked the professional English editing service to polish the English writing.