The authors thank anonymous reviewers for their useful comments, which will help improve the manuscript. Each comment from referees is repeated in black text here; our responses are given in green text and changes to the manuscript are in blue.

Response to Reviewer #1

1. The Introduction should be rewritten to highlight the significance of this study. That is the global map of hydraulic conductivity/permeability lacks realistic data points in TP, such as SoilksatDB (Gupta et al, ESSD, 2020) and permeability database (Gleeson et al., GRL, 2011). This study could fill the scientific and data gaps in a global view.
Gupta, S., Hengl, T., Lehmann, P., Bonetti, S., & Or, D. (2020). SoilKsatDB: global soil saturated hydraulic conductivity measurements for geoscience applications. Earth System Science Data Discussions, 1-26.
Gleeson T, Smith L, Moosdorf N, Hartmann J, Dürr HH, Manning AH, van Beek L P H, Jellinek A M 2011. Mapping permeability over the surface of the Earth. Geophysical Research Letters [J], 38: n/a-n/a.

Many thanks for this comment. A paragraph has been added and the introduction has been modified.

Efforts have been made to develop the global map of permeability (Gleeson et al., 2014; Gleeson et al., 2011), hydraulic conductivity (Gupta et al., 2020; Montzka et al., 2017), groundwater table depth (Fan et al., 2013), groundwater volume and distribution (Gleeson et al., 2016). Nevertheless, due to the remoteness and harsh environment over TP (Yao et al., 2019), the above studies lack reliable in situ data in TP.

`````` The paper is focusing on field hydrogeological, hydrogeophysical surveys, and corresponding datasets, aiming to fill the scientific and data gap in TP from a global view.``````

2. Line 43: Since the hydraulic conductivity is a key parameter for the groundwater system, I would like to suggest using the groundwater model or integrated surface-groundwater model, instead of IHM.

Thanks for this suggestion. IHM has been replaced by integrated surface-groundwater model.

An integrated surface-groundwater model is essential for improving the understanding of different processes quantitatively (Graham and Butts, 2005). To set up an integrated surface-groundwater model, different kinds of data are needed for parameterization of land surface and subsurface, for atmospheric forcing, and state variables are required for model calibration and validation.

3. Line 72: “Some investigations have been done on the TP based on DEMs.” Investigations on what? How these previous works are related to your study? Need to clarify.
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Thanks for this comment. The paragraph has been modified:

Investigations on various fields, such as geomorphology, climate change, glacier, and permafrost have been carried out on the TP based on different DEMs. Zhang et al. (2006) analyzed the geomorphic characteristics of the Minjiang drainage basin with SRTM (Shuttle Radar Topography Mission) data. Wei and Fang (2013) assessed the trends of climate change and temporal-spatial differences over the TP from 1961–2010, with a generalized temperature zone–elevation model and SRTM. Ye et al. (2015) calculated the glacier elevation change in the Rongbuk catchment from 1974 to 2006 based on topographic maps and ALOS. Niu et al. (2018) mapped permafrost distribution throughout the Qinghai–Tibet Engineering Corridor based on ASTER Global DEM. However, different DEMs used in different studies may lead to potential inconsistencies for understanding relevant physical processes. For Maqu catchment, it is crucial to understand the accuracy of different DEMs, since it controls the flow field of groundwater in this mountainous region. Therefore, we evaluate the accuracy of DEMs with a Real-time Kinematic-Global Positioning System (GPS-RTK), which has not been given attentions in many studies over the TP.

4. Line 94: what is the data source for geomorphology and geology? Need references.

Thanks for pointing out this issue. The sentence has been revised:

Based on the field survey of geomorphology and geology, the catchment can be divided into two parts.

5. Figure 1: Since not every reader is familiar with the position of TP, it is necessary to add the position of TP in the China map and its neighboring countries.

Thanks for this suggestion, Figure 1 has been modified accordingly.

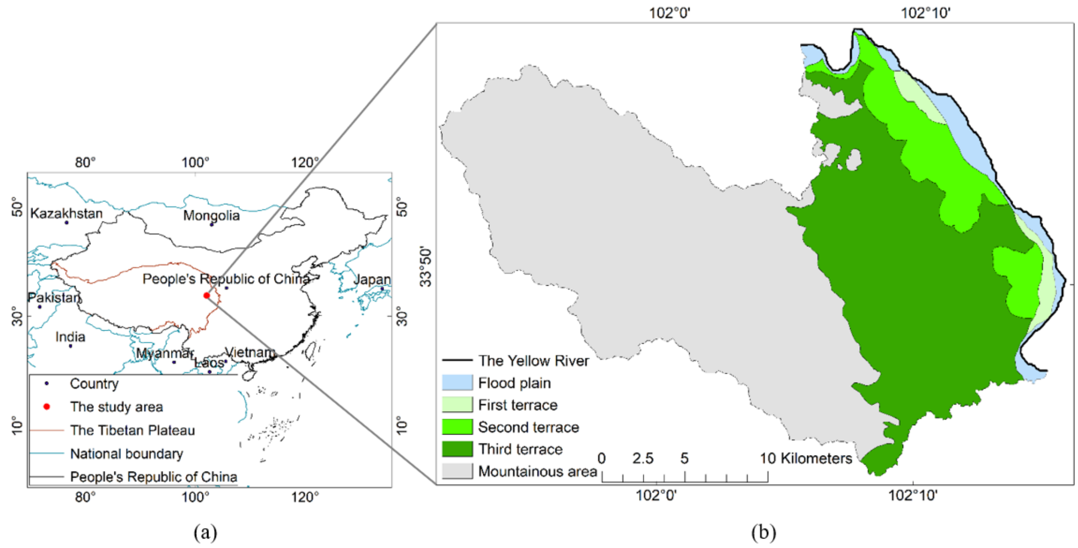


Figure 1. The geographical location of Maqu catchment in the TP and geomorphologic map. (a) The geographical location and boundary of the TP (Zhang et al., 2014a; Zhang et al., 2014b), and the geographical location of Maqu catchment; (b) The geomorphologic map of Maqu catchment.

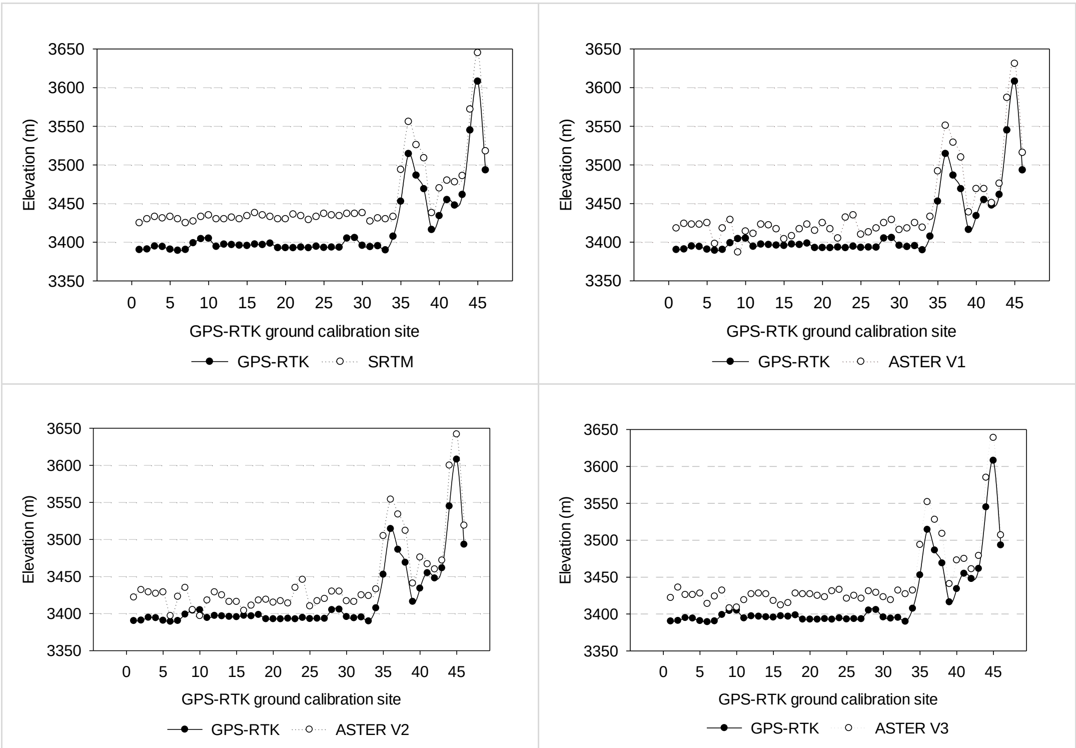
6. Lines 113-120: Authors should give an explanation of workflow for Figure 2 rather than only listing methods. It is redundant to describe the time for each survey because all this information has been listed in Table 1.

Thanks for this comment, this paragraph has been revised:

Figure 2 shows the fieldwork workflow towards establishing a hydrogeological conceptual model, which includes the borehole core lithology analysis, altitude survey, soil thickness measurement, hydrogeological survey, and hydrogeophysical survey (Table 1 and Fig. 2). Yellow boxes in Fig. 2 represent the fieldwork, green boxes represent the results of fieldwork, which finally contribute to the hydrogeological conceptual model shown in a blue box. The obtained information on lithology, soil thickness, and elevation provides basic knowledge in the study area. Hydrogeological measurements of water table depth and hydraulic conductivity provide important input that can be used to deduce the direction and rate of regional groundwater flow. For hydrogeophysical results, magnetic susceptibility ensures the suitability of applying MRS, which provides information on water content and transmissivity. Furthermore, ERT not only provides information on underground resistivity but also integrated with MRS for retrieving water content and transmissivity. The locations of the surveys and measurements are shown in Fig. 3 and Fig. 4.

7. Figure 6: It should redraw Figure 6 using professional tools which are used for scientific graphs in publication format.

Thanks a lot. Figure 6 has been redrawn:



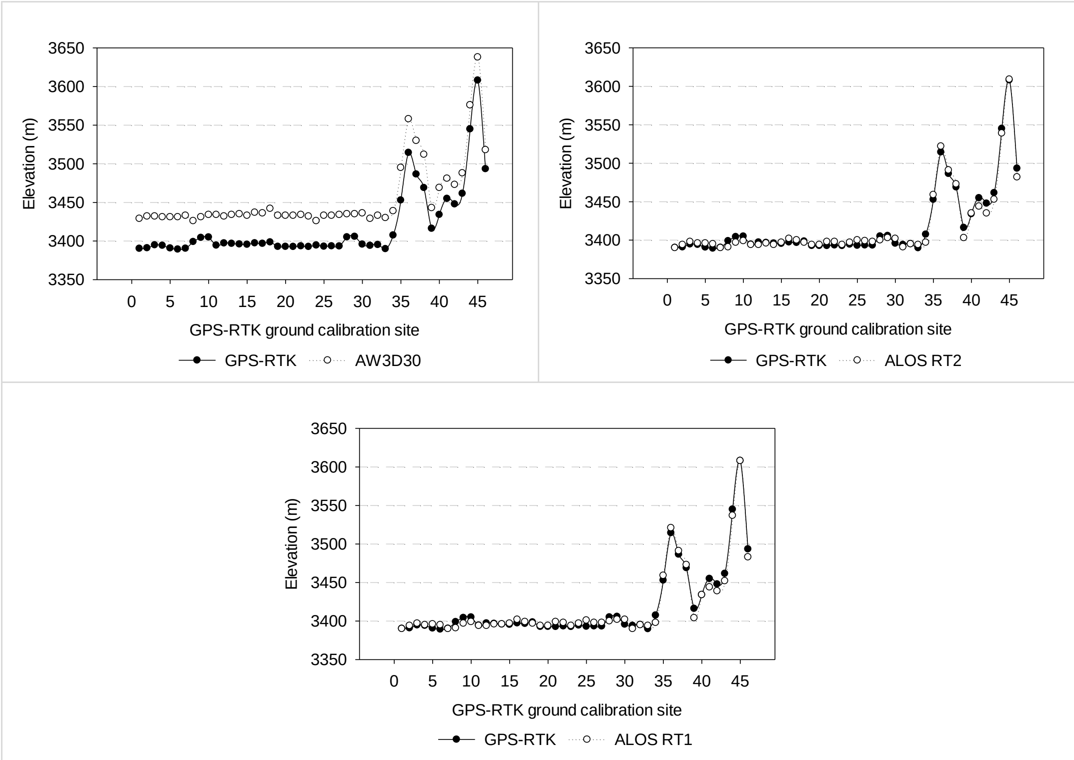


Figure 6. GPS-RTK elevations vs. DEM elevations.

8. Figure 8: There must be something wrong with water table depth (a) and (b). The eastern boundary is the Yellow River, and the elevation is decreasing from west to east, so the value of water table depth is supposed to be big in the western areas and small close to the river. However, the water table depth is 19m near to river while 0 m in the alluvial plain?? Same to Figure 9. Besides, the chromatogram should be changed to better present the gradient of results.

Thanks for the query and suggestion. The eastern boundary is the Yellow River, and the elevation is decreasing from west to east. This is likely to result in big hydraulic heads in the west and small hydraulic heads in the east, so that groundwater flows from the west to the east according to Darcy's law. As for the water table depth, which is the distance from the ground surface to the groundwater table, is not necessarily big in the west and small in the east. The chromatogram has been adjusted to better present the gradient of the groundwater table in Figure 8.
The chromatogram of the 2019 water table depth (m) in Figure 9 has been removed to avoid confusion.

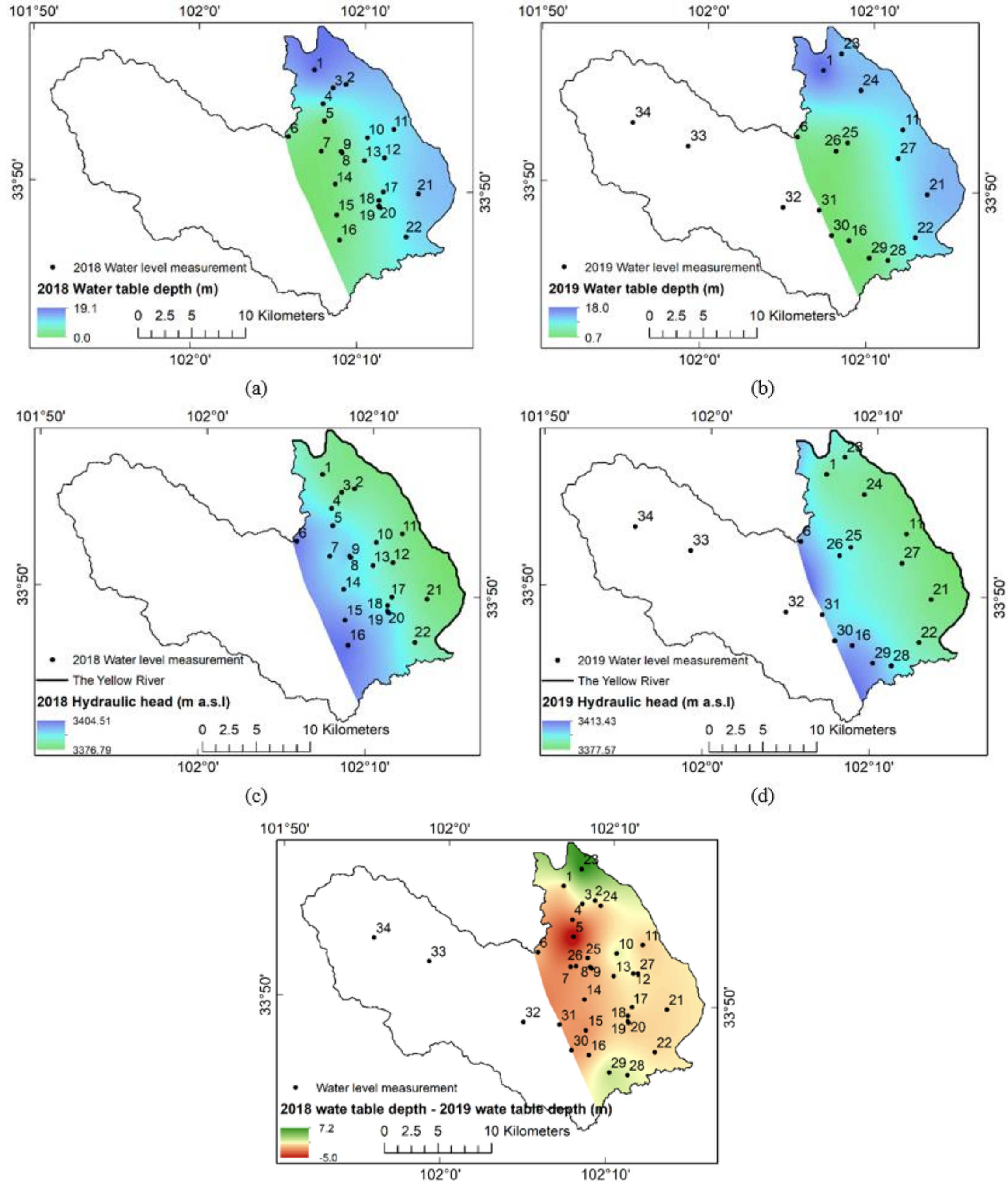


Figure 8. Water table depths (m) and piezometric heads (m a.s.l) of east Maqu catchment. (a) and (b) are water table depths (m) of east Maqu catchment in 2018 and 2019, respectively; (c) and (d) are piezometric heads (m a.s.l) of eastern Maqu catchment in 2018 and 2019, respectively; (e) is the difference (m) of water table depth between 2018 and 2019. Numbers from 1 to 34 are identification numbers of boreholes listed in Table 6.

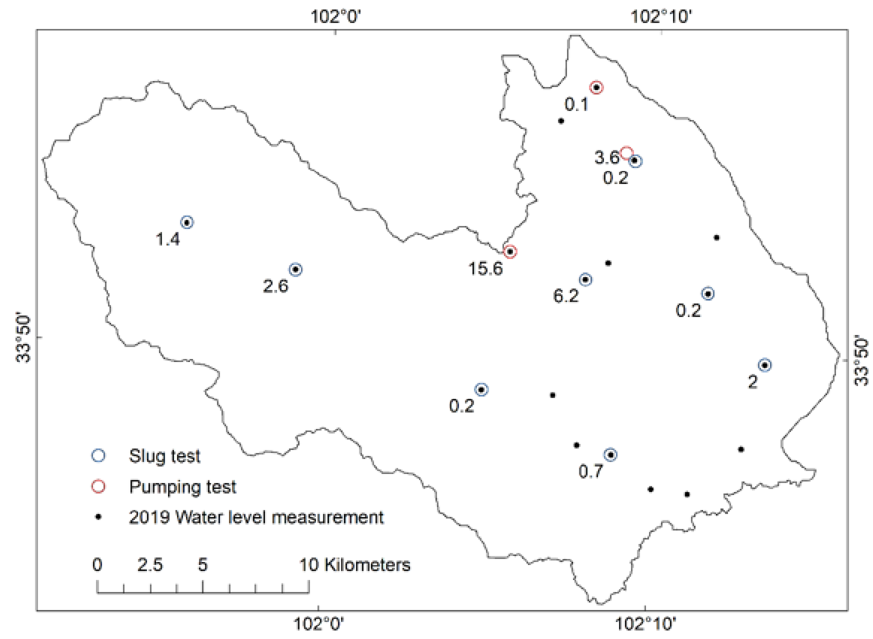


Figure 9. Hydraulic conductivity (m.d^{-1}) obtained from aquifer tests, east of Maqu catchment.

9. Section 4.4.2, Why did authors put equations of aquifer tests in the part of Results and Discussion? This should move to the Method part.

Thanks for this comment. The equations have been moved to section 3.4.2 Aquifer tests part.

3.4.2 Aquifer tests

Aquifer tests, including pumping tests and slug tests, were conducted to obtain aquifer hydraulic conductivity (Fig. 3a). The first pumping test was done in 2017, in the borehole ITC_Maqu_1, where core lithology information is available. The pumping rate was constant 55.6 m^3.d^{-1} measured with a flowmeter, and the pumping duration was about 30 minutes. The pumping rate was limited because the borehole ITC_Maqu_1 could easily collapse if the pumping rate were too high. The water level became stable soon after the start of pumping and was recorded every minute using a data logger (TD–Diver manufactured by Van Essen Instruments, with a range of 10 m). Other tests were carried out in 2019, including two pumping tests and eight slug tests (Fig. 3a). For the two pumping tests with the pumping rate of 31.6 m^3.d^{-1} and 101.52 m^3.d^{-1}, due to practical reasons, only water level recovery data were analyzed. In the eight slug tests, the groundwater level was abruptly lowered by extracting 11.75 L water from the borehole. The water levels were recorded every second or two seconds in slug tests and every five seconds or 20 seconds in pumping tests using a data logger (3001 Levelogger Edge manufactured by Solinst, with a range of 10 m).

The pumping test data acquired from the borehole ITC_Maqu_1 were analyzed using the Boulton (1963) method as follows:

$$S = \frac{Q}{4\pi T} W(U_{AB}, r/D), \qquad (1)$$

where S_D is drawdown (m), Q is pumping rate ($m^3.d^{-1}$), T is transmissivity ($m^2.d^{-1}$), $W(U_{AB}, r/D)$ is Boulton's well-function (dimensionless).

Slug tests data were analyzed using the Bouwer and Rice (1976) method for hydraulic conductivity as follows:

$$K = \frac{r^2 \ln\left(\frac{R_e}{R}\right)}{2L} \cdot \frac{1}{t} \cdot \ln\left(\frac{h_0}{h_t}\right), \tag{2}$$

where K is hydraulic conductivity ($m.d^{-1}$), r is the radius of the borehole casing (m), R_e is the effective radial distance over which the head difference is dissipated (m), R is radius measured from borehole center to undisturbed aquifer (m), L is the length of the screen (m), t is time (d), h_0 is the water level at time 0 (m), and h_t is the water level at time t (m).

Another two pumping test data were analyzed using the Boulton and Agarwal method. Agarwal (1980) defines the recovery drawdown S_r (m) as the difference between the head h_p (m) at the end of the pumping period and the head h (m) during the recovery period.

$$S_r = h - h_p, \tag{3}$$

The recovery time t_r (d) is the time since the recovery started calculated as the difference between the duration of pumping t_p (d) and the time t (d) since pumping started.

$$t_r = t - t_p, \tag{4}$$

Response to Reviewer #2

-section 4.1: better to show the pictures of the core sediment

Thanks for this suggestion. The core lithology and a picture of the core sediment have been added to Figure 5.

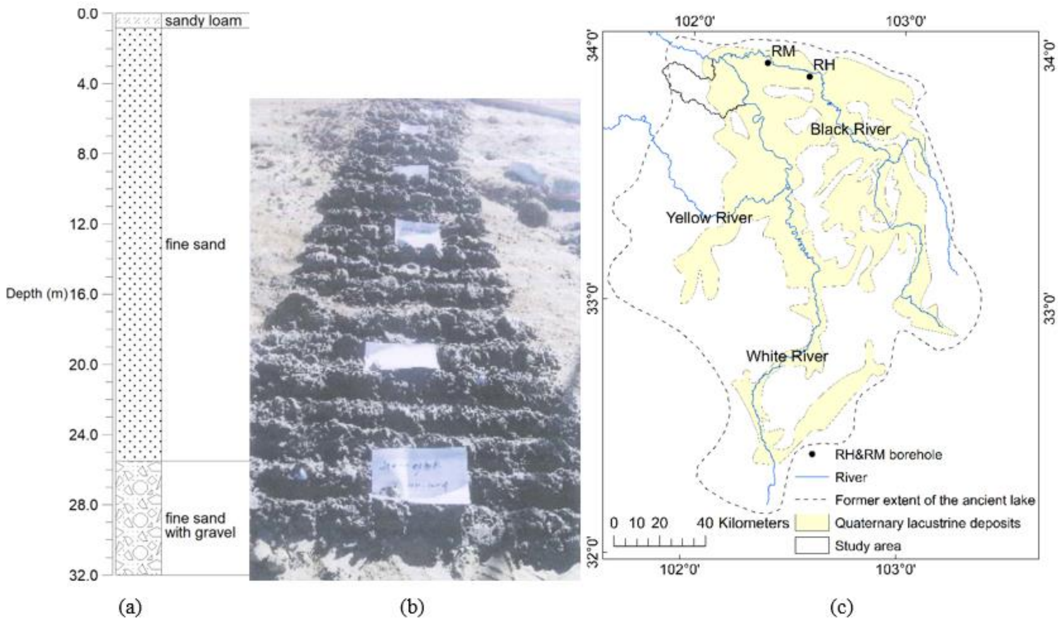


Figure 5. Borehole information: (a) The core lithology of borehole ITC_Maqu_1; (b) A picture of the core sediment when the borehole was drilled; (c) Location of boreholes RM and RH (after Chen et al. (1999)).

-section 4.2: please discuss the potential reason for the different accuracy of the seven datasets.

Thanks a lot for this comment. The potential reasons for the different accuracy of the seven datasets have been discussed and added in section 4.2:

The DEMs' quality can be influenced by several factors, such as sensor type, algorithm, terrain type, and grid spacing. (Hebeler and Purves, 2009). In this study, grid spacings of DEMs are similar except for ALOS RT1, so the main factors that affect the accuracy of the DEMs should be sensor types and algorithms. For SRTM, the issue inherent to the production method is mast oscillations, while for ASTER and AW3D30, the issue is scene mismatch (Grohmann, 2018). As for radiometrically terrain corrected (RTC) products ALOS RT1 and ALOS RT2, the quality is directly related to the quality of the source DEM SRTM which was used in the RTC process. This results in very similar correlation coefficients of SRTM, ALOS RT1, and ALOS RT2, and obvious improvements in RMSE, MAE, and ME (Table 4).

-section 4.3: are there any data, table or figure showing that the soil thicknesses increase from the mountain top to the slope bottom?

Many thanks for pointing out this mistake. The sentence was deleted because the soil thickness is more related to slopes, rather than mountain top or bottom.

4.3 Soil thickness measurement

Results of soil thickness measurements are listed in Table 5 (location shown in Fig.3). The soil thickness decreases as the slope increases, and are within 1.2 m in most cases (Fig. 7).

-Table 5: better to include elevation information also

Thanks for this suggestion, the elevation information has been added to Table 5.

Table 5. Soil thickness measurements, locations of each measurement can be found in Figure 3.

No.	Depth (cm)	Slope (°)	Elevation* (m)	No.	Depth (cm)	Slope (°)	Elevation* (m)	No.	Depth (cm)	Slope (°)	Elevation* (m)
1	39	9	3762	27	71	10	3509	53	102	6	3457
2	45	20	3769	28	90	11	3503	54	102	14	3459
3	28	25	3777	29	>120	5	3493	55	104	6	3460
4	48	16	3784	30	110	5	3488	56	100	13	3462
5	50	22	3783	31	>120	5	3482	57	92	10	3469
6	46	14	3775	32	>107	2	3473	60	40	9	3491
7	39	25	3770	33	>110	4	3479	61	53	6	3480
8	34	41	3757	34	59	13	3488	62	61	15	3478
9	37	22	3750	35	85	13	3491	63	70	7	3476
10	42	19.5	3734	36	60	20	3502	64	63	14	3468
11	23	20	3732	37	92	13	3517	65	61	9	3467
12	52	0	3461	38	38	10	3452	66	87	10	3458
13	42	3	3462	39	41	20	3461	67	60	5	3496
14	35	3	3463	40	76	30	3472	68	63	7	3487
15	38	4	3470	41	55	30	3483	69	68	15	3474
16	50	9	3474	42	32	40	3501	70	87	18	3554
17	40	10	3482	43	80	35	3519	71	30	14	3562
18	38	10	3489	44	27	30	3530	72	85	20	3572
19	42	15	3502	45	49	30	3522	73	41	17	3587
20	37	8	3494	46	52	30	3514	74	83	13	3596
21	40	10	3488	47	43	20	3500	75	67	27	3612
22	30	5	3475	48	44	22	3484	76	63	20	3605
23	30	4	3472	49	30	25	3475	77	>110	20	3593
24	35	4	3469	50	74	14	3470	78	>110	10	3574
25	28	1	3463	51	37	12	3464	79	42	15	3564
26	29	0	3459	52	81	6	3447				

*Elevations were extracted from ALOS PALSAR RT1.

-section 4.4.2: the equations should be described in section 3.

Thanks for this comment. The equations have been moved to section 3.4.2 Aquifer tests part.

3.4.2 Aquifer tests

Aquifer tests, including pumping tests and slug tests, were conducted to obtain aquifer hydraulic conductivity (Fig. 3a). The first pumping test was done in 2017, in the borehole ITC_Maqu_1, where core lithology information is available. The pumping rate was constant 55.6 $m^3.d^{-1}$ measured with a flowmeter, and the pumping duration was about 30 minutes. The pumping rate was limited because the borehole ITC_Maqu_1 could easily collapse if the pumping rate were too high. The water level became stable soon after the start of pumping and was recorded every minute using a data logger (TD–Diver manufactured by Van Essen Instruments, with a range of 10 m). Other tests were carried out in 2019, including two pumping tests and eight slug tests (Fig. 3a). For the two pumping tests with the pumping rate of 31.6 $m^3.d^{-1}$ and 101.52 $m^3.d^{-1}$, due to practical reasons, only water level recovery data were analyzed. In the eight slug tests, the groundwater level was abruptly lowered by extracting 11.75 L water from the borehole. The water levels were recorded every second or two seconds in slug tests and every five seconds or 20 seconds in pumping tests using a data logger (3001 Levelogger Edge manufactured by Solinst, with a range of 10 m).

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where K is hydraulic conductivity ($m.d^{-1}$), r is the radius of the borehole casing (m), R_e is the effective radial distance over which the head difference is dissipated (m), R is radius measured from borehole center to undisturbed aquifer (m), L is the length of the screen (m), t is time (d), h_0 is the water level at time 0 (m), and h_t is the water level at time t (m).

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The recovery time t_r (d) is the time since the recovery started calculated as the difference between the duration of pumping t_p (d) and the time t (d) since pumping started.

$$t_r = t - t_p, \tag{4}$$

Technical corrections-Line 148: change "the data was" to "the data were"

Thanks a lot. Corrected.

The data were intended to be used to evaluate seven DEM datasets (Table 2).

-Figure 9: should "2019 water table depth (m)" be "hydraulic conductivity (m/d)"?

It is 2019 water table depth (m). I put it in Figure 9 because those hydraulic conductivity values were obtained in 2019. Now it is removed to avoid confusion.

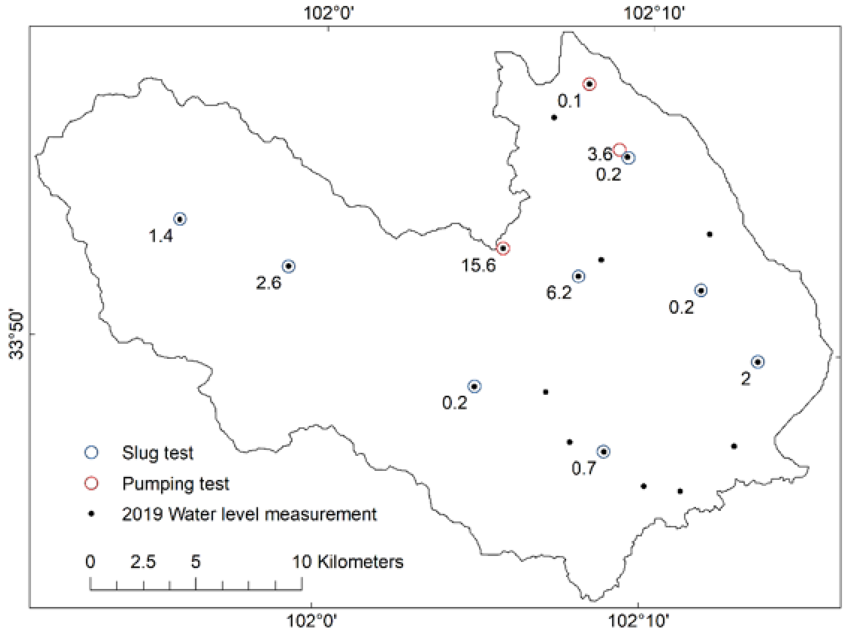

Figure 9. Hydraulic conductivity ($m.d^{-1}$) obtained from aquifer tests, east of Maqu catchment.