We would like to thank you for the very constructive feedback. Below we addressed each specific comment and the manuscript has been updated accordingly. Different font colors represent different things:

Black – comments

Blue – reply

Red – modifications in the paper

1. **Overall**: handled a lot of information from a difficult region, reasonably well-organized and well-written. This reader got the sense of the suite of usual geophysical and hydrologic measurements applied with great effort to this catchment, with better outcomes east vs. west, but overall with mostly tentative initial steps toward a working hydrogeological model. Heroic efforts but mostly to identify what's missing?

Thank you for the comments! What's missing is detailed geometrical mapping of the site's subsurface. The aim of our paper is to present the collected unique data of an hydrogeophysical inveatitagion. To our knowledge, this is the first detailed hydrogeophysical investigation of a cathment on the Tibetan plateau.

To further reduce uncertainties from indirect techniques, ERT, MRS, and TEM, it is important to determine subsurface geometry and its fabric.

Provide an overall status / uncertainty of budget components

Thank you for the comments! The overall uncertainty has been added in the paper in 4.5 Uncertainties section

4.5 Uncertainties

As shown in Fig. 2, direct techniques, i.e. particle size analysis, altitude survey, soil thickness measurement, water table depth measurement, aquifer test, and magnetic susceptibility measurements have low uncertainties. There are random errors for particle size analysis (Wang, 2011), but they are small and not expected to affect the final lithology result (ASTM, 2017), and thus can be neglected. For measured ground surface elevations, soil thicknesses, and water table depths, the uncertainty is supposed to be within a few centimeters considering the accuracy of equipment and errors during the measurement process (Burt, 2014; Cunningham and Schalk, 2011; Rydlund Jr and Densmore, 2012). In terms of hydraulic heads derived from ALOS RT1 in boreholes, the uncertainty not only comes from water table depths measurement, but also from ALOS RT1 which contains the mean absolute error of 4.4 m in the study area based on our results (Table A1). For hydraulic conductivities obtained from aquifer tests, the uncertainty mainly comes from data collection and processing. Though the duration of pumping in the borehole ITC_Maqu_1 did not reach 48 hours, the water levels became steady very soon after the pumping started, so the uncertainty is estimated to be within 25% according to studies from Brown et al. (1995) and Delnaz et al. (2019). For magnetic susceptibility, although the resolution of SM–20 is 1e–6 SI units, the actual reading accuracy is dependant on appropriate corrections, e.g. temperature, shape, volume, effective distance to sensor, etc. The corrections may reach a few orders of magnitudes for volume and up to ± ~50% for shape (Hoffman, 2006). In the case of Maqu catchment, these are so far from the levels at which MRS problem may occur that, corrected or not, the final results will still be below the threshold for concerns.

In terms of indirect techniques, ERT, MRS, and TEM, performances of the raw data could be evaluated with parameters such as S/N for MRS and amount of bad data for ERT and TEM. Knowledge of the subsurface geometry and fabric would lead to the resolution of the main uncertainty issues for inverted data. Because there are implicit modeling assumptions for each method. For example, the assumption for MRS is that the subsurface is made of 1D planar layers parallel to the MRS loop with depth-increasing thickness. We cannot quantify to what extent these assumptions are met, and therefore also to what extent the inversion data are accurate measurements of the site's hydrogeological parameters, thus appropriate uncertainty figures cannot be reliably generated for inverted data. The inverted data, as an illustration of what can be extracted from the raw data, are preliminary results with only inversion RMS errors quantified (ERT and TEM). Lake deposits, being far from the source, should not suffer from the near-source river deposits heterogeneity, but its lithology makes it insensitive to MRS.

To further reduce uncertainties from indirect techniques, ERT, MRS, and TEM, it is important to determine subsurface geometry and its fabric. State-of-the-art airborne electromagnetic technology allows high spatial resolution mapping down to 500 m depth and is probably the most appropriate tool for now (Legault, 2015). After the site geometry is properly mapped and the subsurface fabric is properly understood, optimum borehole drilling locations can be selected. When the detailed geometrical mapping of the subsurface and systematic borehole information are available, the inversion process can be better constrained and improved (Galazoulas et al., 2015; Vouillamoz et al., 2005; Wang et al., 2021).

what works,

Thank you for the comments!

Generally speaking, all the methods work well in the study area, and have confirmed the presence of an unconfined fluvial aquifer within the 250 m below surface and the presence of lake deposits with much finer pores lithology

what works elsewhere but not so well in this particular catchment,

Thank you for the comments!

In Maqu catchment, a near-source river environment, without adequate geometrical mapping, the representativity of the various sampled volumes is unknown as well as whether the sampled volume fits the models used for data inversion. This is much less the case further away from the source where homogeneity and fitting of the model to the actual hydrogeological setting is achieved. In such away-from-source case, pumping tests data may be assumed to be representative of the tested formation while in techniques such as MRS, depth and thickness information may be extracted from the datasets as well as hydraulic estimates. This is an ongoing project and it may become available later if such above-mentioned mapping is completed. Any further similar surveys and borehole drillings would benefit from such geometrical mapping since their precise localization may then be optimized in view of proper data inversion and information gaps filling.

what key uncertainties remain, how one might address those,

Thank you for the comments! This has been explained in the 4.5 Uncertainties section which is shown before.

how users should regard this preliminary data product.

Thank you for the comments!

The data from direct techniques with low uncertainties, as shown in Fig. 2: lithology, ground surface elevation, soil thickness, water table depth measurement, hydraulic conductivity from aquifer test, magnetic susceptibility, can contribute to related global or regional databases where the in-situ data over TP is scarce, or be regarded as verification and validation data for groundwater modeling over Maqu catchment. The data from indirect techniques, ERT, MRS, and TEM, is a rare unique and particularly rich training data source for geoscientists interested in the data processing and interpretation of the particular hydrogeological and hydrogeophysical techniques used here. It is a dynamic set where additional complementary data will gradually add constraints to the inversion processes. For example, a researcher developing new techniques for S/N improvements of some of these techniques will get free and highly relevant data to work with.

2.1 The 'separation' / assignment of data seems confusing at best, counter-productive at worst. Most of the data presented in tables (text and appendices) here should in fact reside in the data set itself.

Thank you for the comments! Table 3 showing borehole core lithology, Table 5 showing measured soil thicknesses, Table 6 showing water table measurements, and Fig. A1 showing aquifer tests data and derived hydraulic conductivities, have been deleted

2.2 A large section, on GPS-RTK 'validation' of various DEMs detracts from their overall focus on hydrogeology and should move to an appendix (for list of DEMs and validation strategy) with actual data in a DEM folder in the repositories. Keep focus on the model and its data needs, put all necessary data in the TP or DANS repositories, put a description of GPS-RTK validation of various DEMs, of interest to some users but not directly related to hydrological parameters, in an appendix with data itself in the repository.

Thank you for the very helpful comments! The content of section 4.2 Altitude survey has been replaced by a summary sentence, and merged with section Water table depth measurement. The original content has been moved to the appendix as you suggested later.

4.3.1 Water table depth measurement

For the altitude survey, ALOS RT1, with a spatial resolution of 12.5 m, performed better than other DEM products across the whole study area and had a higher resolution than the others.

It was the most suitable DEM to be used in this study area for determining water table (WT) depths. For details, see Appendix A1.

There were 22 WT depths measured in 2018, and 18 in 2019 (Fig. 3)······

2.3 Many tables (e.g. Table 6, others) in text report data already included in the repository; no need to duplicate here! No need to include Excel tables here of data already in the repository.

Thank you for the comments! The data of Fig. 6 (showing the measured altitudes v.s. altitudes from 7 DEMs) have been put in a DEM.xlsx, which has been uploaded to the National Tibetan Plateau Data Center.

2.4 If you have data in the repository sorted by folder, refer directly to those folders?

Thank you for the comments! Since the folder is available in the DANS but not available at the National Tibetan Plateau Data Center. I refer directly to the file DEM.xlsx.

Appendix A

A1 Altitude survey

46 ground surface elevations were measured (33 in the flat east, 13 in the mountainous west), and were used to evaluate the accuracies of seven DEM datasets (data available in DEM.xlsx in the National Tibetan Plateau Data Center) and the most accurate one was applied in this study ······

2.5 Very strong reliance on standard geophysical and hydrological proprietary commercial software not helpful, perhaps even unacceptable. Replace one of the data tables (now included in repository data set) with a list of software: free open-access, proprietary, etc. Show open-access options or substitutes for commercial products where those exist. Provide unfamiliar users with a guide to what they could find easily or develop themselves, what licenses they may already have accompanying which instruments, and what they would need to purchase.

Thanks for the helpful comments! A sheet named "Softwares" has been added in the National Tibetan Plateau Data Center.

	A	B	C	D	E
1	Software name	Source	Type	Purchase information	Open-access options or substitutes
2	AquiferTest	https://www.waterloc	proprietary	around USD$1000, see	the trial license allows a 15-day trial, it
3	RES2DINV	https://www.aarhusge	proprietary	prices available at: http	the trial license allows a 2-week trial, i
4	Samovar V6.6	http://www.iris-instru	free open-access		MRSMatlab, see published paper: MRS
5	TEM–Researcher	http://www.aemr.net	proprietary	contact: Tem-Fast@AEMR.net	
6	Surfer	https://www.goldensc	proprietary	$999, see https://www	the trial license allows a 2-week trial, i
7					

... Magnetic susceptibility | ERT | MRS | TEM | **Softwares**

Considering the answer to the question before: how users should regard this preliminary data product, at this step, it is assumed that such interested geoscientists are already 'up-and-running' with respect to the appropriate data processing and interpretation tools. It may be noted that free and in some cases, open-source software exists for several of the techniques used here but their use would often be a full-time job on account of the needed adaptation and improper documentation.

Section 3, Material and methods

Figure 2 - give reader, via text changes (bold, italic, font, etc.), an indication of strengths (low uncertainties) and weaknesses (high or unknown uncertainties) of the various inputs. E.g. from text that follows this reader gets the sense that ‘aquifer geometry’ remains highly uncertain, almost unknown, due to weaknesses of ERT, MRS, etc.

Thanks for your comments. Figure 2 has been modified according to your comments.

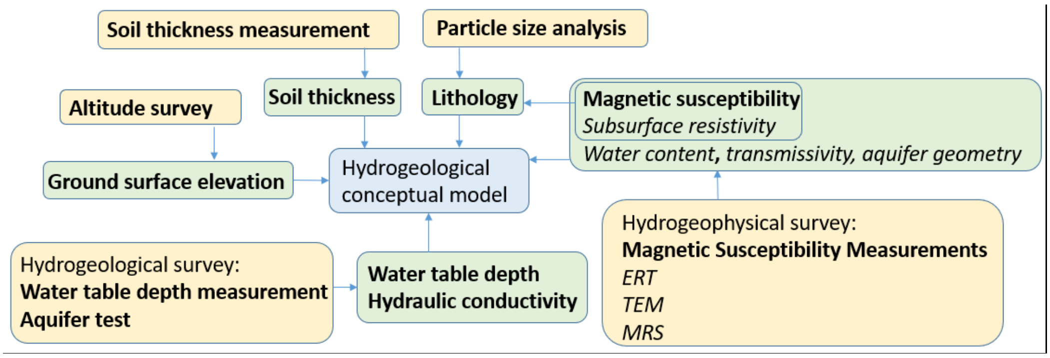


Figure 2. Fieldwork workflow for setting up a hydrogeological conceptual model at Maqu catchment, where italics represent indirect technique (e.g., inversion type of retrieval) with unknown uncertainty, regular bold letters represent direct technique with low uncertainty, and regular letters do not convey uncertainty information.

Highlighted uncertainties or places for needed improvements denoted in this figure will set up discussions (now scattered among various results sections) about impact of future instrument or measurement improvements.

Thank you for the comments! A new section Uncertainties has been added (shown at the beginning of this document in red). The uncertainties were discussed and the way to improve the data reliability was pointed out.

Come back to this figure in conclusion? How close are authors to having a reasonably well-constrained hydrogeological model and with what reliability should readers regard these measurements? Elevations and lithology strong but conductivities and aquifer geometries weak? Or some different combination of relative strengths and weaknesses that the authors should convey?

Thanks for your comments. The conclusion has been modified. This is part of the conclusion:

By combining our dataset with available depth to bedrock dataset, a preliminary hydrogeological conceptual model can be established. If combining our dataset with detailed geometrical mapping of the subsurface and deep borehole information, a more complete and accurate conceptual model can be obtained.

The reliability or uncertainty of each component has been discussed in the new section Uncertainties shown before.

Section 4.2, Altitude survey

Necessary, perhaps skillful, but overall a substantial diversion / distraction from the hydrogeological focus. Authors made the case for accurate elevation data, but entire section could be replaced in this text by this (slightly modified) short summary "ALOS RT1, which performed slightly better than other available DEM product across the whole study area and had a higher resolution than ALOS RT2, was the most suitable DEM to use in this study area. For details, see Appendix XX".

Thank you for the comments!

The entire section has been replaced by the summary sentence and merged with the section Water table depth measurement.

4.3.1 Water table depth measurement

For the altitude survey, ALOS RT1, with a spatial resolution of 12.5 m, performed better than other DEM products across the whole study area and had a higher resolution than the others. It was the most suitable DEM to be used in this study area for determining water table (WT) depths. For details, see Appendix A1.

There were 22 WT depths measured in 2018, and 18 in 2019 (Fig. 3)……

Please define all acronyms (e.g. satellite names).

Thank you for the comments!

The satellite names have been defined in Table 2. Acronyms have been defined in the table in the appendix:

Table 2. Seven DEM datasets.

Number	Name	DEM	Resolution	Source
1	SRTM	Shuttle Radar Topography Mission	1 Arc–Second	USGS
2	ASTER V1	The Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) Version 1	1 Arc–Second	USGS
3	ASTER V2	ASTER GDEM Version 2	1 Arc–Second	USGS
4	ASTER V3	ASTER GDEM Version 3	1 Arc–Second	USGS
5	AW3D30	Advanced Land Observing Satellite (ALOS) World 3D – 30 m Version 2.2	30 m	JAXA
6	ALOS RT2	ALOS Phase Array type L band Synthetic Aperture Radar (PALSAR) low terrain correction resolution (RT2)	30 m	ASF

7	ALOS RT1	ALOS PALSAR high terrain correction resolution (RT1)	12.5 m	ASF

A7 Acronyms

Table A10. Acronyms.

ALOS PALSAR RT1	Advanced Land Observing Satellite - Phase Array type L band Synthetic Aperture Radar - high terrain correction resolution
ALOS PALSAR RT2	Advanced Land Observing Satellite - Phase Array type L band Synthetic Aperture Radar - low terrain correction resolution
AMSR-E	Advanced Microwave Scanning Radiometer for Earth Observing System
ASCAT	Advanced Scatterometer
ASF	Alaska Satellite Facility
ASTER	The Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer
CAS	Chinese Academy of Science
CLM	Community Land Model
CPC	Climate Prediction Center
DEM	Digital Elevation Model
ERT	Electrical Resistivity Tomography
GDEM	Global Digital Elevation Model
GLDAS	Global Land Data Assimilation System
GPS	Global Positioning System
GPS-RTK	Real-time Kinematic-Global Positioning System
GRACE	Gravity Recovery and Climate Experiment
JAXA	Japan Aerospace Exploration Agency
LAPSUS	Landscape process modeling at multi-dimensions and scales
ME	Mean Error
MAE	Mean Absolute Error
MRI	Magnetic Resonance Imaging
MRS	Magnetic Resonance Sounding
NMR	Nuclear Magnetic Resonance
RMSE	root mean squared error
SRTM	Shuttle Radar Topography Mission
TDEM	Time-Domain Electromagnetic
TEM	Transient Electromagnetic
TP	the Tibetan Plateau
USGS	United States Geological Survey
VIC	Variable Infiltration Capacity model
WT	Water Table
YRSR	Yellow River Source Region

Text here refers to Table 4 but relevant information also included earlier in Table 2?

Thank you for the comments! The second column resolution in Table 4 is also included in Table2, The column has been deleted in Table 4:

Table A1. Statistical analysis of seven DEMs in the study area.

DEM	Min Error * (m)	Max Error (m)	Max Error –Min Error (m)	MAE (Mean Absolute Error) (m)	ME (Mean Error) (m)	Correlation coefficient	RMSE (m)
SRTM	22	44	22	35.488	35.488	0.985	35.936
ASTER V1	–17	43	60	24.761	24.010	0.950	26.565
ASTER V2	–8	55	63	27.483	27.140	0.941	30.171
ASTER V3	4	45	41	28.988	28.988	0.962	30.438
AW3D30	25	44	19	36.249	36.249	0.985	36.707
ALOS RT2	–13	8	21	4.592	–0.338	0.985	5.695
ALOS RT1	–12	8	20	4.404	–0.360	0.986	5.477

* Error = DEM value – GPS-RTK value

All of this, including tables and figures, should move to appendix. Convey relatively high reliability factor as a feature of Figure 2?

Thank you for the comments! Texts, tables, and figures, have been moved to the appendix. Yes, as shown in Figure 2 and discussed in the uncertainty section, altitude surveys convey relatively high reliability.

One could retain the locations of GPS-RTK validation points as shown in Figure 3 at the same time as removing text from main narrative to an appendix and data to a DEM folder at the repository.

The locations of GPS-RTK validation points as shown in Figure 3 are retained. The data of Fig. 6 (showing the measured altitudes v.s. altitudes from 7 DEMs) have been put in a DEM.xlsx, which has been uploaded to the National Tibetan Plateau Data Center.

Section 4.3, Soil Thickness
Thickness of weathered layers. e.g depth to bedrock from other studies minus surface soil depths from this study will give a difference equal to the second lower weathered layer? But these calculations will happen later, subsequent to data gathered and described here? With what uncertainty? Plus/minus 1m? 10m?

Yes, depth to bedrock minus soil depth will result in the estimated thickness of the less weathered layer. The section has been rewritten. The calculation and uncertainty has been added.
Based on the measurements, the relationship between the soil thickness and slope can be expressed using the equation:

$$y=-1.1739x+82 \quad (0\leqslant x\leqslant 46) \tag{9}$$

Where x is the slope (°), y is soil thickness (cm). Equation 9 is a regression line from data obtained over residual soils in the west. The measured thickness is a result of in-situ soil forming processes. While in the east, a transported soil is observed, the thickness of which is controlled by different processes from those acting on residual soils. In general, assuming similar geology and except for the valley bottom, equation 9 would apply to the western study area (Fig. 7b).

In the west, under the soil layer, a less weathered layer exists where water can also flow and needs to be taken into account in the conceptual model. In the field, the difference between the less weathered layer and the soil layer is that the less weathered layer contains partially weathered stones. According to the owners of three boreholes located in or near the valley (numbered 32-34 in Fig. 8), their depths are larger than 10 m and do not reach bedrock. By subtracting the estimated soil thickness (Fig. 7b) from available depth to bedrock estimates, for example from Yan et al. (2020) and Shangguan et al. (2017), the thickness of the less weathered layer can be estimated (Fig. 8). In the mountainous west, because the estimated depth to bedrock is often at least an order of magnitude larger than the soil thickness, the uncertainty of the less weathered layer thickness mainly depends on the uncertainty of the estimated depth to bedrock, which is high due to the lack of boreholes for appropriate training (Shangguan et al., 2017; Yan et al., 2020).

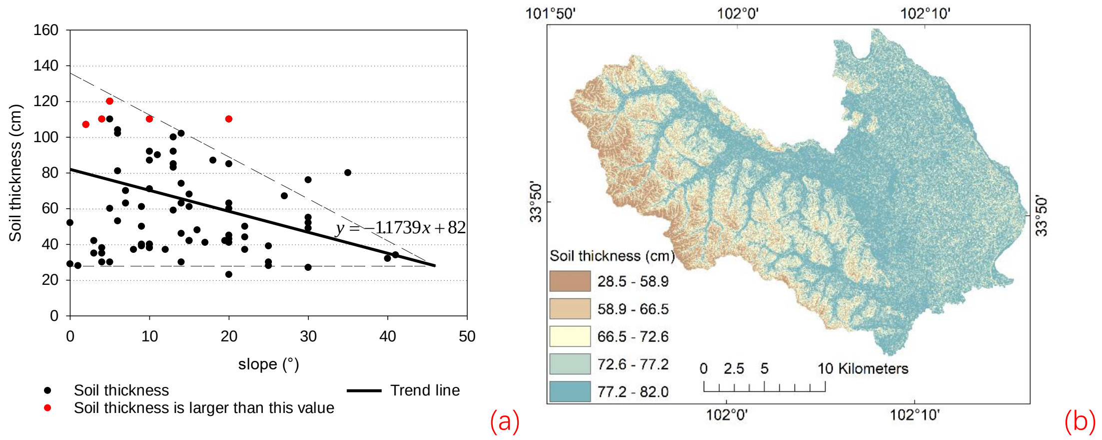


Figure 7. Soil thickness: (a) soil thickness (cm) vs. slope (°); (b) estimated soil thickness using eq. 9.

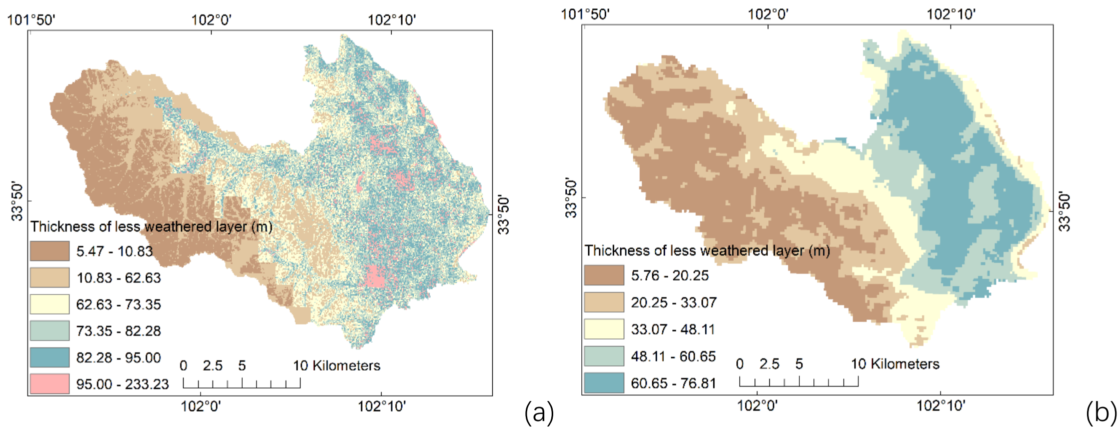


Figure 8. The estimated thickness of the less weathered layer in the west: (a) based on the ensemble model estimated depth to bedrock from Yan et al. (2020); (b) based on the depth to bedrock from Shangguan et al. (2017).

Section 4.4.1, Water table depth measurement

Needs revisions to improve content and references. If “Surfer” and “Ordinary Kriging” represent formal tools, we need to know source, citation, and open availability. This refers to the commercial software ‘Surfer’? Not available to most users.

Thanks for the comments! The content and references have been improved. ‘Surfer’ is a commercial software ‘Surfer’:

There were 22 WT depths measured in 2018, and 18 in 2019 (Fig. 3). In the flat eastern area, the WT depths were interpolated with the software Surfer (https://www.goldensoftware.com/products/surfer) using the default Ordinary Kriging method with the linear variogram model (slope=1, anisotropy ratio=1, anisotropy angle=0)(Cressie, 1990, 1991), which provides reasonable grids in most circumstances.

Text about linear variogram seems to come straight from GoldenSoftware website?

Thanks for the comments! Ordinary Kriging with linear variogram model is a default interpolation method from the Surfer. The linear variogram model describes spatial relationships for the Kriging method. More detailed information on ordinary Kriging and linear variogram model can be found in newly added references shown in the above red lines.

Very standard tool, open access substitutes must exist?

One option is to use the trial license. It’s free and allows unlimited access to all Surfer features for two weeks. Software information and substitutes have been included in a new sheet named “Softwares” as you suggested.

	A	B	C	D	E
1	Software name	Source	Type	Purchase information	Open-access options or substitutes
2	AquiferTest	https://www.waterloc	proprietary	around USD$1000, see	the trial license allows a 15-day trial, it
3	RES2DINV	https://www.aarhusge	proprietary	prices available at: http	the trial license allows a 2-week trial, i
4	Samovar V6.6	http://www.iris-instru	free open-access		MRSMatlab, see published paper: MRS
5	TEM–Researcher	http://www.aemr.net	proprietary	contact: Tem-Fast@AEMR.net	
6	Surfer	https://www.goldensc	proprietary	$999, see https://www	the trial license allows a 2-week trial, i
7					

... Magnetic susceptibility | ERT | MRS | TEM | **Softwares**

Next paragraph induces confusion. Because people in the west use surface water, need/interest in ground water remains low and few wells drilled? As a consequence, few boreholes exist? These are boreholes numbered 32-34 in Figure 8?

Thanks for the comments and sorry for the confusion. The sentence has been modified:

Owing to the fact that most people living in the mountainous west use water from streams (via field survey), the need for groundwater is low, and only few boreholes exist. As such, only three boreholes numbered 32-34 were found in that western area (Fig. 9) and WT depths were measured.

Because of rarity, authors decided to exclude these from interpolation. What interpolation? The 'Surfer' interpolation already mentioned? No details given. First mention of interpolation in this document.

Thanks for the comments. "interpolation" means interpolation of water table depths or piezometric heads in Surfer as mentioned at the beginning of the paragraph.

A good interpolation over a large area needs / uses every point, regardless of isolation? In this catchment, these points deleted for reasons of quality or for reasons of geographic isolation?

Thanks for the comments. The paragraph has been modified:

Normally, a good interpolation of WT depths or piezometric head over a large area needs and uses every measurement. But in this case, a reasonable WT depth map or piezometric head map in the mountainous west will need more than 100 borehole measurements (Hopkins and Anderson, 2016), because the ground surface elevation changes dramatically in the west and so does the groundwater level. The three boreholes are far from enough to provide a reasonable WT depth map or piezometric head map, and, therefore, were excluded from the interpolation. In contrast, the measured groundwater depths (and the interpolation) in the eastern study area can give a reasonable WT depth map or piezometric head map (Fig. 9a and Fig. 9b).

First and only reference to a dam? Here authors assign lower water tables in 2019 vs 2018 to differences in dam storage, but in concluding sentence of the paragraph the authors mention different "control points" as well as different dam storage conditions. Need revision and clarity here!

Thanks for the comments! An introduction about the reservoir has been added in the section Study area.

There is a reservoir in the catchment (Fig. 1c), with functions of grassland irrigation and flood control.

"dam" has been replaced by "reservoir (Fig. 9e)". Sorry about the confusion, the confusing sentences have been removed and the paragraph has been rewritten:

In general, the range of WT depth was between 0.0 m to 19.1 m in 2018 and between 0.7 m to 18.0 m in 2019. In both 2018 and 2019, the interpolated WT depths (Fig. 9a and Fig. 9b) show a similar trend, i.e. the depth increases from the middle of the study area to the eastern boundary. The difference in WT depth in 2018 and 2019 (Fig. 9e) is probably caused by: 1) different positions and amount of control points; 2) the gates were open to reduce water storage in the reservoir (Fig. 9e) in 2019 to facilitate nearby constructions; 3) the interannual variation of precipitation and evapotranspiration. Nevertheless, in both 2018 and 2019, hydraulic heads (Fig. 9c and Fig. 9d) decrease from the middle of the study area to the eastern boundary, meaning that the groundwater flow is from the west to the east with the hydraulic gradient of about 0.002 (dimensionless), recharging the

Yellow River (Fig. 9f). This is consistent with the conclusion from Chang (2009). Ground surface elevations in Fig. 9f were extracted from ALOS RT1, and hydraulic heads were extracted from Fig. 9c and Fig. 9d. Some hydraulic heads are higher than the ground surface elevations as shown in Fig. 9f, which is due to: 1) the accuracy of ALOS RT1; 2) the lack of control points of hydraulic heads.

Final short paragraph of this Section highly redundant. Remove it, or move it to Abstract?

Thanks for the comments!
The final short paragraph has been removed as you suggested.

Section 4.4.2, Aquifer tests
Here the authors accept / use data from isolated rare western stations. Because they do not apply a software interpolation?

Thanks for the comments! There's no interpolation done in this section, it's just presenting the hydraulic conductivities in different boreholes located in the whole study area. An explaining sentence has been added:
Considering the spatial heterogeneity of hydraulic conductivities, they were not interpolated in the study area.

Authors provide and justify a range of hydraulic conductivities (e.g. ranged from 0.1. to 15.6 m per day) but data provided includes only geographic coordinates and raw data, not these derived conductivities. Users will need to make their own conversions?

Thanks for the comments! Aquifer tests data in the repository includes only geographic coordinates and raw data. This is because the detailed calculation processes and derived conductivities are described and available in the paper in detail: the method is introduced in Section 3.4.2. The processing software, assumptions based on field observation, and finally the resulted hydraulic conductivities are described in Section 4.3.2: Users do not need to make their own conversions, they can directly use the derived hydraulic conductivities shown in the paper whenever they want.

Better that authors describe their calculations and provide derived conductivities in addition to raw data, directly in the repository product?

Thanks for the comments! The derived conductivities have been included in the National Tibetan Plateau Data Center. The details of calculation: method, software, assumptions, are described in the paper. So maybe it's not important to include them in the repository.

Section 4.5.1 Magnetic susceptibility
Low values of magnetic susceptibility needed only to assure validity of subsequent ERT or MRS measurements. Provide only a brief sentence of assurance here and refer to text / figures in an appendix as well as data in NTPDC for those who want?

Thanks for the comments! The section has been replaced by a summary sentence, and merged with the MRS section. The original content has been moved to the appendix as you suggested. The figure showing the data has been retained because it's easier to see the locations of each value.

4.4.1 MRS

ERT results were used to establish geoelectrical models for MRS inversion (see Appendix A3). The magnetic susceptibility measurements reveal very low susceptibility in the catchment, ensuring the suitability of applying MRS in the study area (see Appendix A2). ……

Section 4.5.2 ERT

RES2INDV software mentioned here (first mentioned in Section 3.5.2, ERT) represents another proprietary commercial software not available to most readers / users. Perhaps common in geophysical methods but authors need to describe open-access alternatives. Or, we need a list of proprietary software dependencies that covers the entire measurement suite?

Thanks for the comments! For open-access alternatives, one option is to use the 2-week trial license. It's free and easily assessable. Softwares information and substitutes have been included in a new sheet named "Softwares" as you suggested.

	A	B	C	D	E
1	Software name	Source	Type	Purchase information	Open-access options or substitutes
2	AquiferTest	https://www.waterloc	proprietary	around USD$1000, see	the trial license allows a 15-day trial, it
3	RES2DINV	https://www.aarhusge	proprietary	prices available at: http	the trial license allows a 2-week trial, i
4	Samovar V6.6	http://www.iris-instru	free open-access		MRSMatlab, see published paper: MRS
5	TEM–Researcher	http://www.aemr.net	proprietary	contact: Tem-Fast@AEMR.net	
6	Surfer	https://www.goldensc	proprietary	$999, see https://www	the trial license allows a 2-week trial, i
7					

… | Magnetic susceptibility | ERT | MRS | TEM | **Softwares** | ⊕

"Half of the data missing in the filtering process"? What filtering process? Part of the proprietary RES2INDV processing? Are these data flagged? We get no information on data needed to meet various quality control criteria;

Thanks for the comments!

The details about filtering have been added at the beginning of the paragraph now:

For a specific pseudo depth, the values between adjacent points generally vary smoothly. Bad data points can be easily identified as they appeared as outlier points in the pseudosection plot in RES2DINV due to their too high/low apparent resistivity values. The bad data points were filtered out based on the following criteria: (i) having negative apparent resistivity or small apparent resistivity close to 0 Ω m; (ii) having negative/positive pulse amplitude ratios < 0.75 or > 1.33 (a measure of waveform symmetry) (Slater et al., 2010; Wilkinson et al., 2016).

did so much data at so many sites fail? How do these failures affect overall conclusions?

Affects only ERT1? But periodic rainfall occurred at other stations as well?

For ERT1, rainfall occurred during the field measurement, resulted in many bad data points. These failures do not affect overall conclusions, they affect only ERT1. Because ERT1-ERT7 are located at different places, they are independent of each other, and there's no rainfall when conducting ERT2-ERT7.

Overall, ERT measurements seem useful to or necessary for MRS measurements but not useful or reliable in the absence of other depth-resolved lithology information, for example. Authors say "ERT has equivalence problems, i.e., non–uniqueness of inversion results." Provide instead a short sentence assuring that ERT supports and allows valid MRS measurements but put ERT test in a separate Appendix? You already have ERT data in a repository?

Thank you for the comments! The section has been replaced by a summary sentence as you suggested, and merged with MRS section.

4.4.1 MRS

ERT results were used to establish geoelectrical models for MRS inversion (see Appendix A3). The magnetic susceptibility measurements reveal very low susceptibility in the catchment, ensuring the suitability of applying MRS in the study area (see Appendix A2). ……

ERT section also has been modified:

……Nevertheless, like other geophysical methods, ERT has equivalence problems, i.e., non–uniqueness of inversion results. Despite equivalence problems, the ERT method still provides important subsurface information in Maqu catchment where we have little fundamental information. This is a very first investigation in this area, when more lithology information becomes available later, ERT can be better constrained to reflect the subsurface lithology.

ERT data are already in the repositories.

Section 4.5.3 MRS

"at two near MRS sounding sites" - Authors mean at two 'adjacent' sites? Sufficient mention of ERT here, don't need a separate section?

Thank you for the comments! Yes, 'adjacent' is more accurate, thanks. The sentence mentioning ERT has been removed.

Samovar V6.6 mentioned here represents open access software from IRIS instruments (e.g. described in Section 3.5.3) but a few sentences later in this section reader encounters Samovar V11.4? Different software version? Different instrument type? Because authors clearly assign interpretation differences to V6.6 vs V11.4, readers need to know source of those differences?

Thank you for the comments! Samovar V11.4 is the updated version of Samovar V6.6, and has been explained in the paper:

Besides, the invalid values for T2* and T1 may be attributed to the hydrogeological conditions, such as highly heterogeneous lithology or too low signal/noise ratio, and may be eased using an updated version of Samovar V6.6, such as Samovar V11.4 which not only improves the capability of signal analysis, for example, allows optimizing the number of inverted layers, but also adds uncertainty estimation function by incorporating singular value decomposition.

How much “in situ” water is “missing”. 10%? 50%? Not surprising, but how does a reader find this information?

The information about missing water has been added:

MRS has its own limitations in that some of the in-situ water information is missing, and that the current 'window of the technique' is only sensitive to the larger pore fraction of water content. Near-source river environment leads to the unknown mixture of varied lithology. Missing water is unknown, but accounting for a variety of lithology, including fine pore ones, from water table depth (Fig. 9) to the base of the aquifer (50 to 208 m range, see the following TEM section) may lead to well over 50% missed water (Boucher et al., 2011).

“Un-determination”: what does this mean? Not resolved? Under-determined? Other instrumentation or lithological factors?

“Un-determination” has been replaced by indetermination. It means not determined.

We need a much different, much better discussion of sources and levels of uncertainty here; this reader found very little basis to accept any MRS data. Did MRS function effectively or not given these (supposed?, estimated?, measured?) aquifer depths. Not clear that MRS contributes valid information to hydrogeological model, e.g. more/better than borehole estimates. Authors do not provide information necessary to make that determination? By authors own admission, the best they / we can get from MRS remains amount of free water?

Thank you for the comments! They are very helpful! MRS results have been rewritten: Part 1. presenting information about data processing; Part 2. Explain the results; Part 3. Problems. In Uncertainty section (shown at the beginning of this document), uncertainties of all the results were discussed, including MRS. Part 2 and 3 are as follows:

The water content distribution of MRS9–2, MRS7-2, MRS7-1, and MRS4-1 (Fig. A3) extends down to 150 m deep. Except for MRS4-1, soundings MRS9–2, MRS7-2, and MRS7-1 are adjacent, indicating that in the southeast, near the Yellow River, the groundwater extends to more than 150 m depth. So it is concluded that the flat east plays the main role in storing groundwater and the groundwater can extend to more than 150 m depth.

Limiting values of 0.00 ms and 1000.00 ms for T2* and 0.00 ms and 3000.00 ms for T1 are indicators that a valid numerical solution to the measured records (i.e., the inversion) was not reached and no valid outcome is available. Except for invalid values, T1 derived hydraulic conductivity (KT1) ranges from 0.00 m d-1 to 210.98 m d-1, T2* derived hydraulic conductivity (KT2*) ranges from 0.00 m d-1 to 19.64 m d-1. The value of 0.00 m d-1 comes from the estimation of very low water content. Here, an order of magnitude difference is observed between the range of KT1 and KT2*, which is due to the big difference between T1 and T2*. In theory, T1 is less affected by magnetic heterogeneities, thus permits a better estimation of the hydraulic conductivity compared to T2*. However, it is to note that no magnetic disturbance is expected in Maqu catchment (Fig. A1). Furthermore in the case of T1, because two timed delayed responses are compounded, any model mismatch, e.g. the MRS loop sampled volume being significantly different from a layered model parallel to the loop due to near-source river deposit media heterogeneity, can make the measured responses 'doubly' distorted and may not fit a T1 expected response. In both cases, T1 and T2*, a distortion is occurring. Nevertheless, according to specific circumstances, T2*, which is evaluated from rest with a single pulse, may undergo less severe overall distortion. So KT2* and TT2* tend to be more reliable than KT1 and TT1, and should be used for future study. By checking the values of KT2*, it is concluded that there is an unconfined aquifer in the eastern study area. Based on KT1 (and water content results), with a proper threshold to define aquifer and non-aquifer, the aquifer geometry can be defined.

MRS has its own limitations in that some of the in-situ water information is missing, and that the current 'window of the technique' is only sensitive to the larger pore fraction of water content. Near-source river environment leads to the unknown mixture of varied lithology. Missing water is unknown, but accounting for a variety of lithology, including fine pore ones, from water table depth (Fig. 9) to the base of the aquifer (50 to 208 m range, see the following TEM section) may lead to well over 50% missed water (Boucher et al., 2011). Besides, the invalid values for T2* and T1 may be attributed to the hydrogeological conditions, such as highly heterogeneous lithology or too low signal/noise ratio, and may be eased using an updated version of Samovar V6.6, such as Samovar V11.4, which not only improves the capability of signal analysis, for example, allows optimizing the number of inverted layers, but also adds uncertainty estimation function by incorporating singular value decomposition. Nevertheless, in highly heterogeneous environments, the indetermination of some parameters may remain with current technology. In terms of using default inversion parameters, part of the difficulty is in fitting the observed data to a too large number of layers: i.e. partly fitting to the noise component of the records. The heterogeneity of the near-source river environment is also contributing to this difficulty. With more recent tools, like Samovar V11.4, the difficulty can be better handled (Legchenko et al., 2017).

In general, MRS provides preliminary and valuable information on water content, hydraulic conductivity, and transmissivity. Once the geometrical mapping and its fabric have been mapped, groundwater flow parameters, and groundwater storage or volume can be better determined.

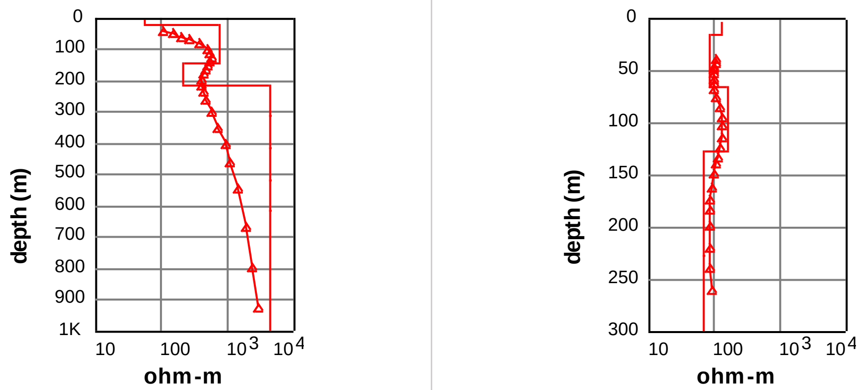
Section 4.5.4 TEM

Based again on a commercial proprietary software TEM-Researcher (e.g. mentioned in Section 3.5.4); can the authors explain or list open-access alternatives?

Thanks for the comments! Unfortunately, this is the only software that we can not find open-access alternatives.

In Figure 13 the linear red lines indicate the initial model with the connected red dots represent the interpolated values?

Thanks for the comments! The explanation of line and triangle in the figure has been added.



TEM8 (RMS error = 9.89%) TEM9 (RMS error = 0.95%)

Figure 12. Apparent resistivity with depth. The red triangles connected by the red line represent the measured apparent resistivity values, and the red line without triangles represents the inverted 1-D geoelectric model.

At best, these represent preliminary data, e.g as the authors say "several additional measurements will be needed in the future". Need explicit uncertainties here!

Thanks for the comments! About additional measurements, the explanation has been given:
To determine exactly what structure it is, and the scope of the structure, further investigation is needed. For example, a systematic high spatial resolution geophysical survey with appropriate depth capability, such as the airborne electromagnetic survey, followed by systematic borehole drilling.

For uncertainties, in the TEM section, it's said that:
The RMS error of the inversion results shown in Fig. 12 is below 2% in the flat area and below 10% in the mountainous area.
And in the uncertainty section, the uncertainties were also discussed.

Section 6 Conclusion
Authors write "data in this paper can be used for future set up of a hydrogeological conceptual model and groundwater modeling which will be presented in follow up papers." Good effort, no doubt, and thanks for an admirable effort to share, but reader never learns how close they got to a useful reliable groundwater model. What are their

priorities for future efforts? Improve instruments / measurements in this catchment? Duplicate work in a second catchment? Focus on modeling rather than observations?

Thanks for the comments! The conclusion has been modified:

Generally speaking, all the methods work well in the study area, and have confirmed the presence of an unconfined fluvial aquifer within the 250 m below surface and the presence of lake deposits with much finer pores lithology. By combining our dataset with available depth to bedrock dataset, a preliminary hydrogeological conceptual model can be established. If combining our dataset with detailed geometrical mapping of the subsurface and deep borehole information, a more complete and accurate conceptual model can be obtained. Furthermore, we will be monitoring the groundwater and surface water in the study area and aim for establishing a long-term monitoring network, which will eventually contribute to the verification and validation of future studies on groundwater modeling over the Maqu catchment.

How do they recommend that potential users consider or use these data? What do they consider strong or adequate? Where (everywhere?) do they recommend future improvements? Can we as users rely on their soil depths, their borehole pumping data, their "unconfined" aquifer conclusions? Authors give users very little basis for confidence in their efforts and their data.

Thanks for the comments! The conclusion has been modified:

The data from direct techniques with low uncertainties, as shown in Fig. 2: lithology, ground surface elevation, soil thickness, water table depth measurement, hydraulic conductivity from aquifer test, magnetic susceptibility, can contribute to related global or regional databases where the in-situ data over TP is scarce, or be regarded as verification and validation data for groundwater modeling over Maqu catchment. The data from indirect techniques, ERT, MRS, and TEM, is a rare unique and particularly rich training data source for geoscientists interested in the data processing and interpretation of the particular hydrogeological and hydrogeophysical techniques used here. It is a dynamic set where additional complementary data will gradually add constraints to the inversion processes. For example, a researcher developing new techniques for S/N improvements of some of these techniques will get free and highly relevant data to work with.