Dear Editor and Reviewers,

Thank you very much for the second round of reviewing our revised manuscript and providing detailed comments regarding to the dataset. The data publication and manuscript have been revised based on the comments made by both reviewers.

Please find below our detailed response to each comment made by the reviewers.

We think that the revised manuscript and data publication have appropriately addressed all the reviewers' concerns and we hope that you can consider it for publication in Earth System Science Data.

Sincerely,

Pei Zhang

On behalf of all co-authors

Response to Reviewer #1

We would like to thank the reviewer for carefully reading our manuscript and providing detailed and constructive comments. In the text below we provide our response to each comment point by point.

Reviewer's comments are in **bold**.

Author's responses are in regular.

Author's additions/modifications in the text are in blue.

I would like to highlight, that the data repository was updated, as well. From my point of view it does now contain all needed data. However, the authors included more specific download links into the revised manuscript. My concerns regarding using URLs to reference data sources still hold. Additionally, the URLs still lack vital bibliographic information like the access date, authors or institution. I would still suggest to further describe the downloaded data properly (e.g. origin, units, aggregation level, quality control, support, licenses) and reference the source properly, so that users do not rely on URLs. Most of this info is already present in the manuscript and adding it to the data repository as well, should be straightforward.

Thanks for the comments and suggestions. The links of the three model-based products and the last verified date are updated in the revised manuscript.

On Page 5 Line 168-172:

"ERA5-land is a reanalysis dataset produced by running land component of the ECMWF (European Centre for Medium-Range Weather Forecasts) ERA5 climate reanalysis (Albergel et al., 2018). ERA5-land provides SM data currently available from 1981 to present at hourly time interval with a spatial resolution of 0.1°, and the data is available from https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land?tab (last verified on 11 March 2021)."

On Page 5 Line 176-180:

"MERRA2 is an atmospheric reanalysis dataset produced by NASA using the Goddard Earth Observing System Model version 5 (GEOS-5) and atmospheric data assimilation system (ADAS), version 5.12.4. MERRA2 provides SM data currently available from 1980 to present at hourly time interval with a spatial resolution of 0.5° (latitude) by 0.625° (longitude), and the data is available from https://disc.gsfc.nasa.gov/datasets/M2T1NXLND_5.12.4 /summary (last verified on 11 March 2021)."

On Page 6 Line 184-188:

"GLDAS-2.1 Noah is forced by a combination of model-based and observation data including Global Precipitation Climatology Project (GPCP) version 1.3, and simulated with the Noah Model 3.6 in Land Information System (LIS) version 7. GLDAS-2.1 Noah provides SM data currently available from 2000 to present at 3-hourly time interval with a spatial resolution of 0.25°, and the data is available from https://disc.gsfc.nasa.gov/datasets/ GLDAS_NOAH025_3H_2.1/summary (last verified on 11 March 2021)."

The descriptions of the dataset catalog entries on the link interface (e.g. Overview, Documentation, Quality assessment, data citation, etc.) are introduced in the user guide of the dataset in the 4TU.ResearchData repository.

4.1 ERA5-land soil moisture product

ERA5-land is a reanalysis dataset produced by running land component of the ECMWF (European Centre for Medium-Range Weather Forecasts) ERA5 climate reanalysis (Albergel et al., 2018). ERA5-land provides SM data currently available from 1981 to present at hourly time interval with a spatial resolution of 0.1°. More information about the ERA5-land product can be referred to Muñoz-Sabater et al., (2018). The data (2009-2019) of volumetric total soil water content for the top soil layer (0-7 cm) in Maqu and Shiquanhe network areas is put in our dataset (Table 8).

Downloading online ERA5-land data through CDS (climate data store) website interface:

1. Register a Copernicus account.
2. Go to the https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land?tab
3. The dataset catalogue entries include the following tabs:
    - **Overview:** It gives a description of the dataset and metadata information (e.g. data description and main variables).
    - **Download data:** It is a download web form.
    - **Quality assessment:** It is a new feature, work in progress (The CDS datasets are assessed by the Evaluation and Quality Control (EQC) function of C3S independently of the data supplier).
    - **Documentation:** It provides links to details documentation about the dataset.
4. Go to the download data tab to select the required data.
    - **Variable:** Select the Soil Water, Volumetric soil water layer 1
    - **Year:** Select 2009-2019
    - **Month:** Select all
    - **Day:** Select all
    - **Time:** Select all
    - **Geographical area:** Select sub-region extraction, Maqu (33.5°-34.25° N, 101.63°-102.75° E), Shiquanhe (32.36°-32.76° N, 79.75°-80.25° E)
    - **Format:** NetCDF
5. Click the **Submit Form** and wait for the request processing (about several hours), until the green button **download** appears, you can click it and download the data.

4.2 MERRA2 soil moisture product

MERRA2 is an atmospheric reanalysis dataset produced by NASA using the Goddard Earth Observing System Model version 5 (GEOS-5) and atmospheric data assimilation system (ADAS), version 5.12.4. MERRA2 provides SM data currently available from 1980 to present at hourly time interval with a spatial resolution of 0.5° (latitude) by 0.625° (longitude). More information about the MERRA2 product can be referred to GMAO (2015). The data

(2009-2019) of volumetric liquid soil water content for the surface layer (0-5 cm) in Maqu and Shiquanhe network areas is put in our dataset (Table 8).

Downloading online MERRA2 data through GES DISC (Goddard Earth Sciences Data and Information Service Center) website interface:

1. Register an EARTHDATA account.
2. Go to the https://disc.gsfc.nasa.gov/datasets/M2T1NXLND_5.12.4/summary
3. The dataset catalogue entries include the following tabs:
    - **Product Summary:** It gives a description of the dataset and metadata information (e.g. temporal spatial, file format, etc.).
    - **Data citation:** To cite the data in publications.
    - **Documentation:** It provides links to details documentation about the dataset.
    - **Reference:** It is data collection reference.
4. Click the button of **Subset/ Get data** on the right of the interface to select the required data.
    - **Download Method:** Select the Get File Subsets using the GES DISC Subsetter
    - **Refine Date Range:** 2009-01-01 to 2019-12-31
    - **Refine Region:** Maqu (101.63, 33.5, 102.75, 34.25), Shiquanhe (79.75, 32.36, 80.25, 32.76)
    - **Variable:** Select SFMC = water surface layer
    - **Time of Day:** Get complete time span
    - **Grid:** bilinear interpolation on GLDAS-2_0.25
    - **Output format:** NetCDF
5. Click the **Get Data** and **Down load links list**, and then the tool like **Chrono Download Manager** can be used to download the data via the links list.

4.3 GLDAS Noah soil moisture product

GLDAS-2.1 Noah is forced by a combination of model-based and observation data including Global Precipitation Climatology Project (GPCP) version 1.3, and simulated with the Noah Model 3.6 in Land Information System (LIS) version 7. GLDAS-2.1 Noah provides SM data currently available from 2000 to present at 3-hourly time interval with a spatial resolution of 0.25°. More information about the GLDAS Noah product can be referred to Rodell et al. (2004). The data (2009-2019) of soil water content for the top soil layer (0-10 cm) in Maqu and Shiquanhe network areas is put in our dataset (Table 8).

Downloading online GLDAS Noah data through GES DISC (Goddard Earth Sciences Data and Information Service Center) website interface:

1. Register an EARTHDATA account.
2. Go to the https://disc.gsfc.nasa.gov/datasets/GLDAS_NOAH025_3H_2.1/summary
3. The dataset catalogue entries include the following tabs:
    - **Product Summary:** It gives a description of the dataset and metadata information (e.g. temporal spatial, file format, etc.).
    - **Data citation:** To cite the data in publications.

- **Documentation:** It provides links to details documentation about the dataset.
- **Reference:** It is data collection reference.

4. Click the button of **Subset/ Get data** on the right of the interface to select the required data.
    - **Download Method:** Select the Get File Subsets using the GES DISC Subsetter
    - **Refine Date Range:** 2009-01-01 to 2019-12-31
    - **Refine Region:** Maqu (101.63, 33.5, 102.75, 34.25), Shiquanhe (79.75, 32.36, 80.25, 32.76)
    - **Variable:** Select SoilMoi0_10cm_inst = Soil moisture content (0-10 cm underground) (kg m^{-2})
    - **Time of Day:** Get complete time span
    - **Grid:** bilinear interpolation on GLDAS-2_0.25
    - **Output format:** NetCDF
5. Click the **Get Data** and **Down load links list**, and then the tool like **Chrono Download Manager** can be used to download the data via the links list.

Table 8. Specification of the model-based soil moisture products.

Data set	Variable	Unit	Spatial	Temporal	Period	Reference
ERA5-land	Volumetric soil water layer 1 (swvl1)	$m^3 m^{-3}$	0.1°	Hourly	1981~	Muñoz-Sabater. et al., (2018)
GLDAS Noah	SoilMoi0_10cm_inst	kg m^{-2}	0.25°	3-hourly	2000 ~	Rodell et al., (2004)
MERRA2	Water surface layer (SFMC)	$m^3 m^{-3}$	0.5° ×0.625°	Hourly	1980 ~	GMAO (2015)

I tried to retrace the download procedure. For the link on p.5 line 163, I ended up on a Chinese page, which redirected to the authority landing page, once switched to English language and thus the issues with URL persists. It would be great, as permanent URLs or DOIs don't seem to exists, if the authors could add the metadata about the downloaded data to the data repository, as well. From my point of view it doesn't make sense to forward to the original publisher of the data to find metadata in this case.

Thanks for the comments. We asked the official website (https://data.cma.cn/) and be told that the online precipitation data is only available to agreement users and does not support sharing currently. Thus the corresponding part in the user guide and manuscript has been revised to explain this issue, and the link still remains for users who have downloading permission.

In the revised manuscript On Page 5 Line 160-165:

"The precipitation data is from two weather stations, i.e. Maqu (34°00'N, 102°05'E) and Shiquanhe (32°30'N, 80°05'E), operated by the China Meteorological Administration (CMA) which provides the near-surface meteorological data of about 700 weather stations in China. The daily precipitation data can be downloaded from https://data.cma.cn/dataService/cdcindex/datacode/SURF_CLI_CHN_MUL_DAY.html that is in Chinese. The data is only available to agreement users, which is not allowed to be shared without permission from the CMA."

In the user guide:

4.4 Precipitation data

The precipitation data is from two weather stations, i.e. Maqu (34°00'N, 102°05'E) and Shiquanhe (32°30'N, 80°05'E), operated by the China Meteorological Administration (CMA) which provides the near-surface meteorological data of about 700 weather stations in China. The daily precipitation data can be downloaded from https://data.cma.cn/dataService/cdcindex/datacode/SURF_CLI_CHN_MUL_DAY.html that is in Chinese. The data is only available to agreement users, which is not allowed to be shared without permission from the CMA.

The URL on page. 5 line 172 now leads to the download page of the data product, however there are still literally hundreds of filter possibilities that one has to or can specify. At the same time, the overall ERA5 product has a DOI linked on that page, which resolves to a landing page, that presents a lot of metadata about the entire ERA5 dataset. My suggestion here would be to specify, which parts of ERA5 were exactly used (and how) and extract the metadata from the ERA5 landing page that applies and add it to the data repository.

For the link on page 6 line 181, the correct data product is found, however, almost 15 thousand satellite images are offered for download, which requires authentication. Therefore, I would again suggest to add necessary metadata from the NASA website to the data repository.

Thanks for the comments and suggestions. The details of filtering and downloading required data and description of the metadata are introduced in the user guide as shown above.

All in all, I think it's just an additional table, or something comparable, that is missing in the data repository. It should give all the available, necessary metadata for the newly added datasets, making the repository usable on its own. The descriptions of the networks are already detailed and helpful. Just chapter 4 of the user information needs to be raised to the same level. Then, the URLs can be removed from the manuscript and replaced by a simple reference to the issuing institution. From my point of view, that would turn the already good data repository into a great one, just like the manuscript.

Thanks for the comments and suggestions. Chapter 4 of the user guide and related parts in the manuscript have been revised as shown above.

Response to Reviewer #2

We would like to thank the reviewer for carefully reading our manuscript and providing detailed and constructive comments. In the text below we provide our response to each comment point by point.

Reviewer's comments are in **bold**.

Author's responses are in regular.

Author's additions/modifications in the text are in blue.

The authors have addressed most of the reviewers' comments and I have one minor comments remaining.

I have asked for more details in the description of the ONLINE dataset. Currently onky few lines. Please improve it for making it more appewling to the users (e.g., adding the table given in the replies to reviewers).

Thanks for the comments, the descriptions of online dataset have been revised in Chapter 4 of the user guide:

4. Online dataset

4.1 ERA5-land soil moisture product

ERA5-land is a reanalysis dataset produced by running land component of the ECMWF (European Centre for Medium-Range Weather Forecasts) ERA5 climate reanalysis (Albergel et al., 2018). ERA5-land provides SM data currently available from 1981 to present at hourly time interval with a spatial resolution of 0.1°. More information about the ERA5-land product can be referred to Muñoz-Sabater et al., (2018). The data (2009-2019) of volumetric total soil water content for the top soil layer (0-7 cm) in Maqu and Shiquanhe network areas is put in our dataset (Table 8).

Downloading online ERA5-land data through CDS (climate data store) website interface:

1. Register a Copernicus account.
2. Go to the https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land?tab
3. The dataset catalogue entries include the following tabs:
    - **Overview:** It gives a description of the dataset and metadata information (e.g. data description and main variables).
    - **Download data:** It is a download web form.
    - **Quality assessment:** It is a new feature, work in progress (The CDS datasets are assessed by the Evaluation and Quality Control (EQC) function of C3S independently of the data supplier).
    - **Documentation:** It provides links to details documentation about the dataset.
4. Go to the download data tab to select the required data.
    - **Variable:** Select the Soil Water, Volumetric soil water layer 1
    - **Year:** Select 2009-2019
    - **Month:** Select all

- **Day:** Select all
- **Time:** Select all
- **Geographical area:** Select sub-region extraction, Maqu (33.5°-34.25° N, 101.63°-102.75° E), Shiquanhe (32.36°-32.76° N, 79.75°-80.25° E)
- **Format:** NetCDF

5. Click the **Submit Form** and wait for the request processing (about several hours), until the green button **download** appears, you can click it and download the data.

4.2 MERRA2 soil moisture product

MERRA2 is an atmospheric reanalysis dataset produced by NASA using the Goddard Earth Observing System Model version 5 (GEOS-5) and atmospheric data assimilation system (ADAS), version 5.12.4. MERRA2 provides SM data currently available from 1980 to present at hourly time interval with a spatial resolution of 0.5° (latitude) by 0.625° (longitude). More information about the MERRA2 product can be referred to GMAO (2015). The data (2009-2019) of volumetric liquid soil water content for the surface layer (0-5 cm) in Maqu and Shiquanhe network areas is put in our dataset (Table 8).

Downloading online MERRA2 data through GES DISC (Goddard Earth Sciences Data and Information Service Center) website interface:

1. Register an EARTHDATA account.
2. Go to the https://disc.gsfc.nasa.gov/datasets/M2T1NXLND_5.12.4/summary
3. The dataset catalogue entries include the following tabs:
    - **Product Summary:** It gives a description of the dataset and metadata information (e.g. temporal spatial, file format, etc.).
    - **Data citation:** To cite the data in publications.
    - **Documentation:** It provides links to details documentation about the dataset.
    - **Reference:** It is data collection reference.
4. Click the button of **Subset/ Get data** on the right of the interface to select the required data.
    - **Download Method:** Select the Get File Subsets using the GES DISC Subsetter
    - **Refine Date Range:** 2009-01-01 to 2019-12-31
    - **Refine Region:** Maqu (101.63, 33.5, 102.75, 34.25), Shiquanhe (79.75, 32.36, 80.25, 32.76)
    - **Variable:** Select SFMC = water surface layer
    - **Time of Day:** Get complete time span
    - **Grid:** bilinear interpolation on GLDAS-2_0.25
    - **Output format:** NetCDF
5. Click the **Get Data** and **Down load links list**, and then the tool like **Chrono Download Manager** can be used to download the data via the links list.

4.3 GLDAS Noah soil moisture product

GLDAS-2.1 Noah is forced by a combination of model-based and observation data including Global Precipitation Climatology Project (GPCP) version 1.3, and simulated with the Noah Model 3.6 in Land Information System (LIS) version 7. GLDAS-2.1 Noah provides SM data currently available from 2000 to present at 3-hourly time interval with a spatial resolution of 0.25°. More information about the GLDAS Noah product can be referred to Rodell et al. (2004). The data (2009-2019) of soil water content for the top soil layer (0-10 cm) in Maqu and Shiquanhe network areas is put in our dataset (Table 8).

Downloading online GLDAS Noah data through GES DISC (Goddard Earth Sciences Data and Information Service Center) website interface:

1. Register an EARTHDATA account.
2. Go to the https://disc.gsfc.nasa.gov/datasets/GLDAS_NOAH025_3H_2.1/summary
3. The dataset catalogue entries include the following tabs:
    - **Product Summary:** It gives a description of the dataset and metadata information (e.g. temporal spatial, file format, etc.).
    - **Data citation:** To cite the data in publications.
    - **Documentation:** It provides links to details documentation about the dataset.
    - **Reference:** It is data collection reference.
4. Click the button of **Subset/ Get data** on the right of the interface to select the required data.
    - **Download Method:** Select the Get File Subsets using the GES DISC Subsetter
    - **Refine Date Range:** 2009-01-01 to 2019-12-31
    - **Refine Region:** Maqu (101.63, 33.5, 102.75, 34.25), Shiquanhe (79.75, 32.36, 80.25, 32.76)
    - **Variable:** Select SoilMoi0_10cm_inst = Soil moisture content (0-10 cm underground) (kg m^{-2})
    - **Time of Day:** Get complete time span
    - **Grid:** bilinear interpolation on GLDAS-2_0.25
    - **Output format:** NetCDF
5. Click the **Get Data** and **Down load links list**, and then the tool like **Chrono Download Manager** can be used to download the data via the links list.

Table 8. Specification of the model-based soil moisture products.

Data set	Variable	Unit	Spatial	Temporal	Period	Reference
ERA5-land	Volumetric soil water layer 1 (swvl1)	$m^3 m^{-3}$	0.1°	Hourly	1981~	Muñoz-Sabater. et al., (2018)
GLDAS Noah	SoilMoi0_10cm_inst	kg m^{-2}	0.25°	3-hourly	2000 ~	Rodell et al., (2004)
MERRA2	Water surface layer (SFMC)	$m^3 m^{-3}$	0.5° ×0.625°	Hourly	1980 ~	GMAO (2015)

4.4 Precipitation data

The precipitation data is from two weather stations, i.e. Maqu (34°00'N, 102°05'E) and Shiquanhe (32°30'N, 80°05'E), operated by the China Meteorological Administration (CMA) which provides the near-surface meteorological data of about 700 weather stations in China. The daily precipitation data can be downloaded from https://data.cma.cn/dataService/cdcindex/datacode/SURF_CLI_CHN_MUL_DAY.html that is in Chinese. The data is only available to agreement users, which is not allowed to be shared without permission from the CMA.