Response Letter to the Referees

Here we provided detailed responses to each of the comments from individual referees. For easy reading, we use blue color text for the response from us. Please note that the line numbers in the response letter refer to the revised main text (clear version).

Referee #1:

In this study, the authors generated a valuable dataset of Large Dams, Reservoirs, and Lakes across China by analyzing all available Landsat imagery in 2019 via GEE platform.

Overall, this manuscript is written well and suitable to publish in ESSD. I recommend a minor revision based on the comments below to improve the quality of this manuscript /data set before publication.

Reply: We were encouraged by your positive statement, and we appreciate your time and effort during the review process of our manuscript.

Specific comments:

1) Line 78: Please confirm the expression of "GlObal geOreferenced Database of Dams (GOODD) V1", which is different from the handwriting in line 165.

Reply: We double-checked the name of dataset, and its full name is "GlObal GeOreferenced Database of Dams". We have updated it throughout the main text.

2) Line 118: Why did the authors choose to analyze the large SWB with area > $1km^2$? What about the area ≤ $1km^2$? Please add one or two sentences to explain it.

Reply: Large water bodies (e.g. lakes and reservoirs) have been the subject of great interest not only because of their water resources roles but also as indicators of anthropogenic impact on water scape change (Yang and Lu, 2014). A number of studies have reported and analyzed the dynamics of large water bodies, for example, Feng et al. (2019) explored the overall characteristics and changes of large SWB during 1984-2015 in China; Zhang et al. (2019) explored the evolution of large lake across China during 1960s-2015. Furthermore, Yang and Lu (2014) analyzed the drastic change in China's large lakes and reservoirs over the past decades.

Thus, in our study, we analyzed the large SWB with area > $1km^2$ and those SWB with area ≤ $1km^2$ were excluded. In the main text, we introduced the importance of large SWB, including large lakes and reservoirs, in the control and management of water resources: "*Surface water bodies (SWB), including large lakes and reservoirs (surface water areas > 1 km^2), play an important role in the control and management of water resources (Yang and Lu, 2014, 2013; Feng et al., 2013, 2019)*" and "*Nearly 50% of the global large dams were built primarily for agricultural irrigation through storing, regulating, and diverting water (Mulligan et al., 2020). Additionally, they are also used* *for hydropower generation, human and industrial uses, and flood peak attenuation (Lehner et al., 2011; Lehner and Döll, 2004; Wang et al., 2021a). Large lakes have been the subject of great interest not only because of their water resources but also as indicators of local climate change and anthropogenic activities (Zhang et al., 2019; Ma et al., 2011; Birkett and Mason, 1995), and they could provide vital ecosystem services for human being, such as alteration of river flow, supplies of irrigation water, fisheries, and abundant valuable mineral deposits, and have disproportionate effects on the global carbon cycle (Ran et al., 2021; Armstrong, 2010; Ma et al., 2011).*" (Line 37-51). In addition, we explained the exclusion of small SWB in the Objective of this study: "*The objective of this study was to produce detailed and accurate maps of open SWB, large dams, reservoirs, and lakes (surface water area > 1 km^2) in China in 2019, the latest year when this study started in late 2020, and those SWB with area $\leq$ 1km^2 were excluded.*" (Line 114-116).

References:

Feng, S., Liu, S., Huang, Z., Jing, L., Zhao, M., Peng, X., Yan, W., Wu, Y., Lv, Y., Smith, A. R., McDonald, M. A., Patil, S. D., Sarkissian, A. J., Shi, Z., Xia, J., and Ogbodo, U. S.: Inland water bodies in China: Features discovered in the long-term satellite data, Proc. Natl. Acad. Sci., 116, 25491-25496, https://doi.org/10.1073/pnas.1910872116, 2019.

Yang, X. and Lu, X.: Drastic change in China's lakes and reservoirs over the past decades, Sci. Rep., 4, 6041, https://doi.org/10.1038/srep06041, 2014.

Zhang, G., Yao, T., Chen, W., Zheng, G., Shum, C. K., Yang, K., Piao, S., Sheng, Y., Yi, S., Li, J., Oreilly, C., Qi, S., Shen, S., Zhang, H., and Jia, Y.: Regional differences of lake evolution across China during 1960s-2015 and its natural and anthropogenic causes, Remote Sens. Environ., 221, 386-404, https://doi.org/10.1016/j.rse.2018.11.038, 2019.

3) Line 127: In the Fig.2a, the DEM or other data could be added as the base map to make this figure look more abundant.

Reply: Good suggestion. We added the DEM data of China in Fig. 2a, and reorganized the Fig. 2b to avoid the coverage by the histogram.

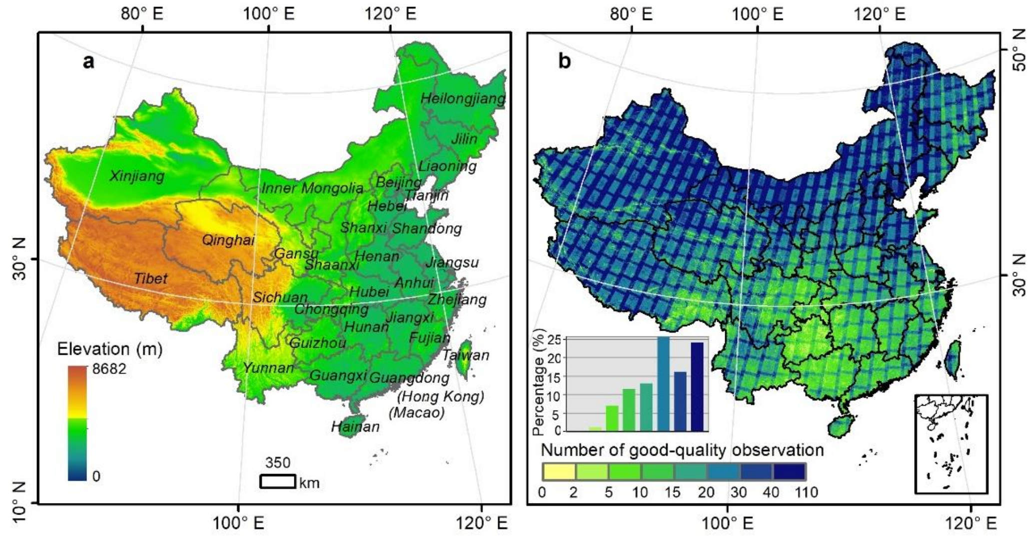

Fig. 2 Spatial distribution of provinces and elevation (a) and numbers of Landsat good-quality observations (b) in China for 2019.

4) Lines 127-132: The content of section 2.1 is a little simple, some information could be added in this part, like geographic or climatic characteristics.

Reply: Done. We added some brief introduction about the geographic or climatic characteristics of China in section 2.1: "*China has great altitude diversity as the eastern plains and southern coasts consist of lowlands and foothills, the southern areas of China consist of hilly and mountainous terrains, the west and north of the country are dominated by basins, plateaus, and massifs, and the southwestern China contains part of the highest tablelands on earth, the Tibetan Plateau (Fig. 1a). Due to substantial differences in latitude, longitude, and altitude, the climate of China is extremely diverse, ranging from tropical in the far south to subarctic in the far north and alpine in the higher elevations of the Tibetan Plateau, contributing to the much more surface water areas in Southwest and Southeast of China than other regions, especially North China (Wang et al., 2020a).*" (Line 136-143).

5) Line 146: In the Fig.2b, part of the background map was covered by the histogram, which could be improved to be more normative and beautiful.

Reply: Done. We updated this figure and is shown in Fig. 2.

6) Line 170: In the Fig.3, if it's possible, the shapefile of dam and reservoir could be symbolized separately.

Reply: In the Fig.3, we showed the spatial distribution of dams and reservoirs from the GOODD, GRanD, and GeoDAR datasets using different symbolizations. Fig.3a-c were the three dam maps using point symbol, and Fig. 3d showed the catchment of each dam of GOODD as it only reported the catchment of each dam rather than the reservoirs. Fig. 3e-f showed the spatial distribution of reservoir from GRanD and GeoDAR.

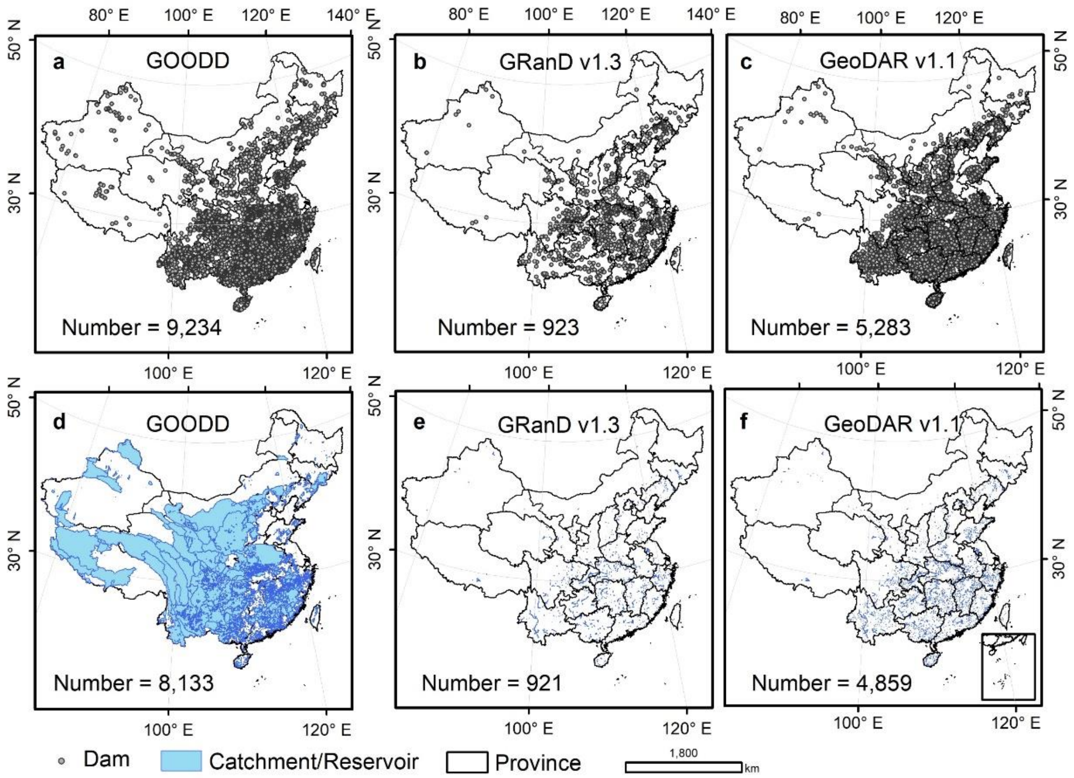

Fig.3 Spatial distribution of dams from the GlObal GeOreferenced Database of Dams (GOODD) (a), the Global Reservoir and Dam (GRanD) v1.3 (b), and the Georeferenced global Dam And Reservoir (GeoDAR) v1.1 (c) datasets. The GOODD dataset reported the catchment of each dam (d) while the GRanD and GeoDAR datasets reported the reservoir information of each dam (e, f).

7) Lines 209-210: As we know, the Landsat 7 ETM+ has problem of stripe, would it effect the generation of SWB? How did the authors deal with this issue? Please give detailed explanation.

Reply: You raised a good question about the stripe of Landsat-7 imagery. In this study, we used the Landsat surface reflectance (SR) images in the GEE platform, and all these images had undergone necessary pre-processing, including radiometric calibration and atmospheric correction. In addition, all the pixels of the stripes in the Landsat-7 have been removed by GEE team (**Fig. R1**), thus, they were not included in our study when we generated the annual water frequency map of China.

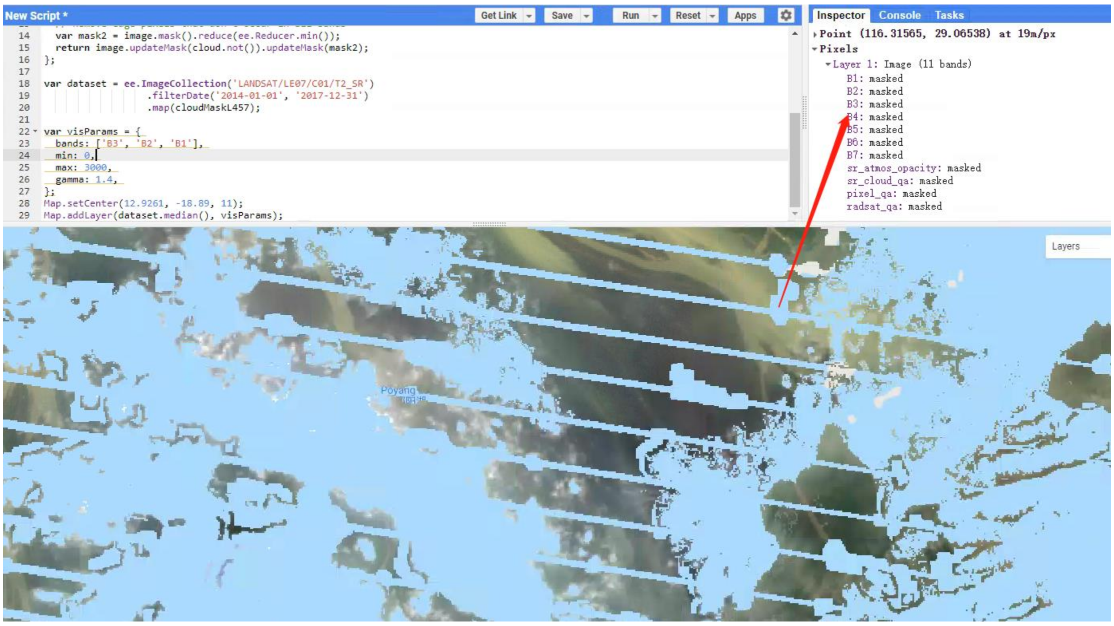

Fig. R1 The pixel values of the stripe in Landsat-7 SR imagery in GEE.

8) Line 221: In the section 2.3.2, when the authors generated the polygons of lakes or reservoirs, how did the authors determine the borderlines between water bodies and adjacent land, especially for mixed land-water pixels? Please give detailed explanation.

Reply: In our study, we first identified SWB through the algorithm of ((mNDWI > EVI or mNDWI > NDVI) and EVI < 0.1), which reduces the effects of mixed land-water pixels on identification of SWB, especially those vegetation pixels, and was widely used to identify and map SWB at the regional and national scales. Second, we generated the surface water frequency map in 2019 using all the available Landsat imagery and the algorithms in Section 2.3.1. Third, the yearlong surface water imagery was generated using water frequency ≥ 0.75. After that, the vector map of yearlong surface water for 2019 was generated based on the yearlong surface water imagery, and was reprojected the Krasovsky_1940_Albers equal-area conic projection and calculated the area of each yearlong surface water polygon within China. Finally, we removed those polygons with area $\leq$ 1km^2 and only reported large reservoirs and lakes with area > 1 km^2 in this study (**Fig. R2**). Therefore, the boundaries of resultant lakes and reservoirs were detected automatically. In order to introduced the work flow for generating lake and reservoir polygons clearly, we added the **Fig. R2** in the supplementary file and improved the introduction of Section 2.3.2.

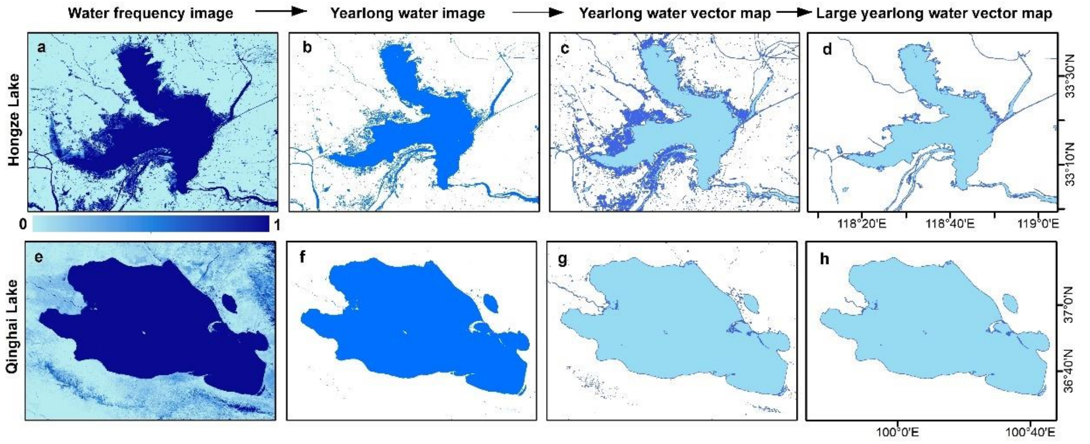

Fig. R2 The schematic diagram of generating the polygons of lakes or reservoirs from water frequency map in the Hongze Lake of Jiangsu Province and Qinghai Lake of Qinghai Province.

9) Lines 240-244: In the section 2.4, is there only "area" in the attribute table? If not, please give more description about the attributes, otherwise, this paragraph is too simple.

Reply: Thanks. Here we reported the area and perimeter of lakes and reservoirs, the ID of corresponding dams and dam/reservoir classes of reservoirs as their attributes (**Fig. R3**). In this revised version, we combined section 2.3.2 and 2.4 into one section and introduced the methods of calculating area and perimeter of each polygon. The introduction of each column of the attributes were shown in the Section of "5. Data availability".

Attributes of lakes

FID	Shape *	ID	poly_area	poly_len
0	Polygon	0	2.561173	16.766622
1	Polygon	1	2.046933	9.651268
2	Polygon	2	2.219894	8.370396
3	Polygon	3	13.330212	55.676937
4	Polygon	4	38.10306	268.454778
5	Polygon	5	35.087878	110.436371
6	Polygon	6	1.479911	25.264502
7	Polygon	7	6.220322	32.306757
8	Polygon	8	20.269402	90.108679
9	Polygon	9	7.880843	50.42397
10	Polygon	10	1.128003	6.014507
11	Polygon	11	1.700841	8.177997
12	Polygon	12	1.727262	11.270981
13	Polygon	13	1.273662	9.44156
14	Polygon	14	1.048149	8.174765
15	Polygon	15	12.686775	43.651212
16	Polygon	16	7.503791	57.605343
17	Polygon	17	81.917412	215.488834
18	Polygon	18	1.060152	4.778265
19	Polygon	19	1.379701	15.202636
20	Polygon	20	1.613516	9.894215
21	Polygon	21	2.622165	13.698355
22	Polygon	22	640.037245	1457.645367
23	Polygon	23	3.573744	14.875817
24	Polygon	24	2.857957	13.760246

Attributes of reservoirs

FID	Shape *	ID	poly_area	poly_len	dam_ID	dam_class
0	Polygon	0	3.338023	20.358279	56	-1
1	Polygon	1	2.642188	11.967802	41	-1
2	Polygon	2	2.345197	16.788014	40	1
3	Polygon	3	1.727991	6.432137	45	-1
4	Polygon	4	2.481339	16.527029	39	1
5	Polygon	5	1.685698	8.485414	16	1
6	Polygon	6	1.505444	11.876958	57	1
7	Polygon	7	7.131356	27.404409	44	1
8	Polygon	8	1.985066	7.905328	42	1
9	Polygon	9	3.280292	42.853447	15	1
10	Polygon	10	3.951754	21.413478	43	-1
11	Polygon	11	2.441946	23.850471	14	1
12	Polygon	12	1.797849	10.512701	46	-1
13	Polygon	13	2.746095	10.981722	47	1
14	Polygon	14	2.745012	18.481081	37	1
15	Polygon	15	3.98678	27.401023	17	1
16	Polygon	16	1.10316	8.293268	38	-1
17	Polygon	17	1.554771	9.160939	58	1
18	Polygon	18	3.555699	13.140496	49	1
19	Polygon	19	2.960084	14.982563	48	1
20	Polygon	20	2.685784	8.564417	50	1
21	Polygon	21	1.816469	7.84277	59	1
22	Polygon	22	2.21384	11.901032	55	-1
23	Polygon	23	1.300648	7.562165	13	1
24	Polygon	24	1.186143	8.571778	51	1
25	Polygon	25	3.025715	18.126664	52	1
26	Polygon	26	1.80524	13.752735	19	1
27	Polygon	27	1.308694	7.887077	18	1
28	Polygon	28	1.193683	7.922579	54	-1
29	Polygon	29	3.074667	13.11458	60	1
30	Polygon	30	6.121569	43.582946	20	1
31	Polygon	31	2.225887	10.124161	53	1
32	Polygon	32	1.100876	6.320478	61	-1
33	Polygon	33	4.56658	21.125573	62	-1

Fig. R3. Attributes of lakes and reservoirs in our dataset.