Monitoring of Glacial Lakes & Water Bodies in the Himalayan Region of Indian River Basins for August, 2017

Morphology &Climate ChangeDirectorate
Central Water Commission
Ministry of Water Resources, River Development & Ganga Rejuvenation
New Delhi

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ABBREVIATIONS

AP	Arunachal Pradesh
AWiFS	Advanced Wide Field Sensor
DEM	Digital Elevation Model
DIFF	Difference
FCC	False Color Composite
GL	Glacial Lake
GLOF	Glacial lake Outburst Flood
HA	Hectare
HP	Himachal Pradesh
J&K	Jammu & Kashmir
LAT	Latitude
LONG	Longitude
LU/LC	Land Use /Land Cover
NRSC	National Remote Sensing Centre
SRTM	Shuttle Radar Topography Mission
UID	Unique Identification
UK	Uttarakhand
WB	Water Body

Executive Summary

Glacial lakes are common in the high elevation of glacierised basin. They are formed when glacial ice or moraines impound water. These lakes normally drain their water through seepage in front of the retreating glacier. Flash floods caused by the outburst of glacial lakes, called as Glacial Lake Outburst Flood (GLOF), are well known in Himalayan terrain, where such lakes are formed due to landslides. Satellite remote sensing based mapping and monitoring of the glacial lakes and water bodies, covering Indian Himalayan region, was taken up. The analysis done for August 2017 and comparison with inventory year of 2009 is presented here.

Based on the current inventory, 415 glacial lakes & water bodies with a water spread area more than 50 ha are monitored. Apart from this, another 62 glacial lakes & water bodies with water spread area in the range 44 to 50 ha also have been monitored. Accordingly, a total of 477 glacial lakes & water bodies were considered for monitoring during 2017.

***The inputs for this report are received from NRSC, Hyderabad**. Cloud free satellite data was available for only 165 glacial lakes & water bodies during August 2017. Water spread areas for the same were computed and compared with inventory area. Among them, 86 have shown decrease in water spread area, 37 have shown increase, 42 have not shown any significant change, while 1 water bodies have dried up. It is also noted that 39 out of 86 have decreased by more than 20% and 9 out of 37 water bodies have shown increase in area by more than 20%.*

1. Introduction

1.1 Background

Glacial lakes are common in the high elevation of glacierised basin. They are formed when glacial ice or moraines impound water. There are varieties of such lakes, ranging from melt water ponds on the surface of glacier to large lakes in side valleys dammed by a glacier in the main valley. These lakes normally drain their water through seepage in front of the retreating glacier. The moraine creates topographic depression in which the melt water is generally accumulated leading to formation of glacial lake. When this lake is watertight, melt waters will accumulate in the basin until seepage or overflow limits the lake level. Such moraine-dammed lakes appear to be the most common type of glacial lakes. The impoundment of the lake may be unstable, leading to sudden release of large quantities of stored water. Failure of these ice or moraine dams as very destructive events has been documented throughout the world. Flash floods caused by the outburst of glacial lakes, called as Glacial Lake Outburst Flood (GLOF), are well known in Himalaya where such lakes had been formed by landslides.

Satellite remote sensing techniques are used to map, inventory and monitor the glacial lakes & water bodies in Indian Himalayan region, which is formed by joining the catchment of rivers draining in India.

1.2 Remote Sensing Technology

Remote sensing is the science of acquiring information about the Earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information. Satellite remote sensing technology contributed significantly to the acquisition of Earth's resources and thus helping for better management of these resources. Satellite remote sensing plays a complementary role to other means of spatial data acquisition i.e., through conventional procedures. Satellite remote sensing offers several unique advantages quick data collection, reliability, more accurate, repetitive collection, geometric integrity and digital storage, which makes it an ideal tool for mapping, inventorying and monitoring the natural resources.

Glaciers and glacial lakes are generally located in remote areas, where access is through tough and difficult terrain. The inventory of glacial lakes using conventional methods requires extensive time and resources together with undergoing hardship in the field. Creating inventories and monitoring of the glacial lakes can be done quickly and correctly using satellite images and aerial photographs. Use of these images and photographs for the evaluation of physical conditions of the area provides greater accuracy. The multi-stage approach using remotely sensed data and field investigation increases the ability and accuracy of the work. Visual and digital image analysis

techniques integrated with techniques of geographic information systems (GIS) are very useful for the study of glacier, glacial lakes.

1.3 Objectives

The objectives of the study are based on the inventory of glacial lakes & water bodies in the Indian Himalayan region using satellite data of the year 2009 (Ref: NRSC Report No. NRSC-RS&GISAA-WRG-CWC-Lakes-May2011-TR255), with glacial lakes having spatial extent greater than 50 ha (during the inventorying year) -

1. Monitoring the spatial extent of the glacial lakes & water bodies on monthly basis during June to October months
2. Monitoring the spatial extent of 2 selected lakes, if required, with high-resolution data on event basis,

The inventory of glacial lakes & water bodies in the Indian Himalayan region using satellite remote sensing has been carried out using base year of 2009 and monitoring has been done for the years 2011-2016. The changes in the current years will be analysed with respect to the year 2009.

This report presents the details on the data used and methodology followed in monitoring of glacial lakes & water bodies in the Indian Himalayan region using satellite data in the month of August 2017.

2. Study Area & Materials

2.1 Study Area

The present study is carried out for the area covering Indian Himalayas. The study area extends across different countries namely India, Nepal, Bhutan and China. The index map showing study area is given in Figure 1.

2.2 Materials

Advanced Wide Field Sensor (AWiFS) data from the Indian remote sensing satellite, Resourcesat-2 has been used in the study for monitoring of glacial lakes pertaining to current month.

2.2.1 Satellite Data - For the purpose of monitoring glacial lakes and water bodies from satellite images, it is preferable to have cloud free satellite images during the time of monitoring. Since the monitoring is carried out during monsoon period, probability of availability of cloud free data is less. Hence all the possible satellite data were browsed and checked for their coverage of the study area and cloud cover. The list of satellite data used for monitoring during August 2017 is given in Table 1.

Table 1. List of satellite data used

S No	Path	Row	Date
1	100	49	02-August-17
2	106	51	03-August-17
3	94	47	15-August-17
4	110	51	23-August-17

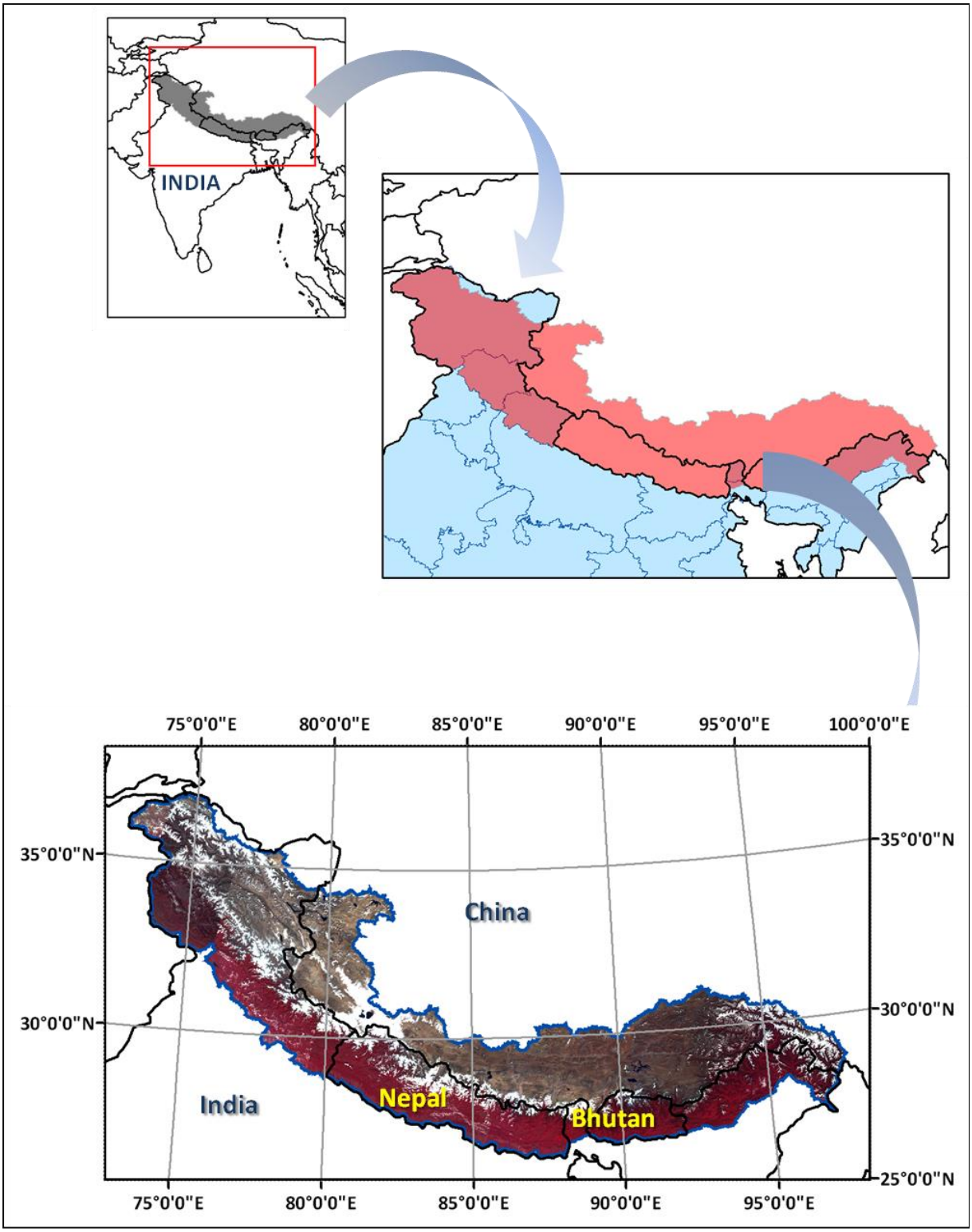


Figure 1. Index map of study area

3. Methodology

The monitoring of glacial lakes and water bodies in the Indian Himalayan region using satellite images involves the following steps.

- Ortho-rectification of satellite data
- Identification & digitization of glacial lakes & water bodies
- Organisation of database

This chapter discusses each of the above steps in detail.

3.1 Orthorectification of Satellite Data

Orthorectification is the process by which the geometric distortions of the image are modelled and accounted for, resulting in a planimetrically correct image. 3D world is imaged by most sensors in 2D and Orthorectification corrects for many of the anomalies resultant from this conversion. Orthorectified imagery is particularly useful in areas of the world with exacerbated terrain features such as mountains, plateaus, etc. The Orthorectification process yields map-accurate images which can be highly useful as base maps and may be easily incorporated into a GIS. The success of the Orthorectification process depends on the accuracy of the DEM and the correction method.

In this study, Orthorectified data generated under AWiFS derived LU/LC project has been used.

3.2 Monitoring of Glacial Lakes & Water Bodies

The glacial lakes & water bodies are delineated based on the visual interpretation of satellite images of Resourcesat2 AWiFS sensor. Identification of features was done through panchromatic mode and/or different colour combinations of the multi-spectral bands namely green, red, near infrared and shortwave infrared.

To identify the glacial lakes & water bodies, different image enhancement techniques are used to improve the visual interpretation. This method is complimented with the knowledge and experience of the Himalayan terrain conditions for inventorying glacial lakes and water bodies. With different spectral band combinations in false colour composite (FCC) and in individual spectral bands, glacial lakes and water bodies can be identified. The knowledge of image interpretation keys: colour, tone, texture, pattern, association, shape, shadow, etc. will also enhance the capability of identifying these features.

The water spread area of the lakes in false colour composite images ranges in appearance from light blue to blue to black. The frozen lakes appear white in colour. Sizes of water bodies are generally small, having circular, semi-circular, or irregular

shapes with very fine texture. They are generally associated with glaciers in the case of high lying areas, or rivers in the case of low lying areas.

The present study proposed to monitor all the glacial lakes & water bodies that are larger than 50 ha in area. Even though during inventory, glacial lakes and water bodies having area more than 10 ha were digitised, monitoring was carried out only for the glacial lakes & water bodies that are larger than 50 ha. The boundary of glacial lakes and water bodies are digitized as polygon feature using on-screen digitisation techniques. The polygons are geo-processed and the water spread area of glacial lakes & water bodies were computed digitally. These steps were repeated for each date of satellite data and water spread area was computed. The maximum water spread area for each water body among the different dates of satellite in the month of August 2017 has been considered for the final analysis of the change in water spread. The following criteria were followed while monitoring the water bodies.

- A change in water spread area within +/- 5% is considered to be no change.
- Partly or fully cloud covered or frozen water bodies have not been considered in monitoring.
- The spatial extent of water spread area during the current month has been mapped and compared with the spatial extent of water spread area mapped during 2009

4. Results

4.1 Results

The monitoring of glacial lakes and water bodies in the Himalayan region of Indian River basins was carried out through interpretation/analysis of IRS satellite images of AWiFS sensor. The basins covered under this study are Indus, Ganga and Brahmaputra. During inventory phase of the study, 433 glacial lakes & water bodies were identified that are having water spread area of more than 50 ha and monitoring was carried out during 2011. However, based on the directions that emerged from the Second meeting of Evaluation and Monitoring Committee for "Inventory and Monitoring of Glacial lakes and Water Bodies in Himalayan Region of Indian River Basin" held on 21-06-2012, the inventory has been updated accordingly. Based on the current inventory, 415 glacial lakes & water bodies with a water spread area more than 50 ha are monitored. Apart from this, another 62 glacial lakes & water bodies with water spread area in the range 44 to 50 ha also have been monitored so that those glacial lakes & water bodies that have shown increase and have water spread area of more than 50 ha could also be monitored. Accordingly, a total of 477 glacial lakes & water bodies were considered for monitoring during 2017.

The Glacial Lakes/Water Bodies has been divided in four categories based on the trend of area i.e. Increased, Decreased, No change and Cloud Covered.

The water spread area for all these glacial lakes & water bodies monitored using satellite data in August 2017 is provided in Table 2. The percentage difference in water spread area with reference to the inventory area is also provided.

5. Conclusions

5.1 Conclusions

The analysis of water spread area of glacial lakes & water bodies monitored in August 2017 was done for only 165 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 86 glacial lakes & water bodies have shown decrease in water spread area, 37 have shown increase, 42 have not shown any significant change (± 5%), while 1 water bodies (Lake ID: 01_52E_001) have dried up.
- 39 out of 86 have decreased by more than 20% and 9 out of 37 water bodies have shown increase in area by more than 20%. The list of such glacial lakes & water bodies is given in Table 3.

Table 5 List of glacial lakes & water bodies monitored during August 2017

Month	Monitored	Increased			Decreased			No Change
August 17	165	> 20%	< 20%	Total	> 20%	< 20%	Total	42
		9	28	37	39	47	86	

Table 2 – Comparison of water spread area during August 2017 with inventory area

Table 2a - GL & WB that have shown INCREASE in water spread

S.NO	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
1	JK_5	01_42H_005	J&K		India	Indus	Gilgit	36.2491	73.3615	2217	52	61.77	18.78	WB
2	JK_120	01_43M_003	J&K		India	Indus	Shigar (Indus)	35.2319	75.6304	2635	208	231.31	11.20	WB
3	JK_149	01_43N_022	J&K		India	Indus	Jhelum	34.6665	75.1793	4234	72	79.34	10.19	WB
4	JK_100	01_43J_022	J&K	Baramula (Kashmir North)	India	Indus	Jhelum	34.1198	74.8307	1580	60	64.02	6.70	WB
5	JK_167	01_43P_002	J&K	Jammu	India	Indus	Ravi	32.6969	75.1456	664	52	60.76	16.85	WB
6	HP_1	01_52D_001	HP	Chamba	India	Indus	Ravi	32.6147	76.0316	1141	688	866.85	26.00	WB
7	JK_187	01_52C_003	J&K	Kargil	India	Indus	Indus	33.1573	76.9843	4479	45	53.51	18.90	GL
8	HP_5	01_52H_004	HP	Lahul and Spiti	India	Indus	Chenab	32.4964	77.5516	4150	46	118.63	157.88	GL
9	CH_3	01_52N_001			China	Indus	Indus	34.1589	79.7794	4961	11564	12187.70	5.39	WB
10	CH_63	01_61G_002			China	Indus	Indus	33.6727	81.3712	4677	1134	1222.77	7.83	WB
11	CH_30	01_61C_002			China	Indus	Indus	33.7511	80.5977	4492	685	741.26	8.21	WB
12	CH_52	01_61C_024			China	Indus	Indus	33.0352	80.5811	4321	4486	4779.79	6.55	WB
13	CH_66	01_61H_001			China	Indus	Indus	32.1188	81.2694	4612	282	317.66	12.64	WB
14	CH_386	03_62O_041			China	Brahma putra		29.511	83.4443	4959	206	232.48	12.85	WB

S.NO	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
15	CH_383	03_62O_038			China	Brahmaputra		29.6047	83.3773	4889	124	148.18	19.50	WB
16	CH_385	03_62O_040			China	Brahmaputra		29.5824	83.3556	4888	107	131.57	22.96	WB
17	CH_377	03_62O_032			China	Brahmaputra		29.6893	83.1901	5007	49	64.24	31.10	WB
18	CH_313	03_62K_009			China	Brahmaputra		29.8405	82.7835	5058	250	275.59	10.24	GL
19	CH_321	03_62N_004			China	Brahmaputra		30.6681	83.6252	5166	878	977.58	11.34	WB
20	CH_396	03_71C_003			China	Brahmaputra		29.8666	84.624	5395	47	50.27	6.96	GL
21	CH_417	03_71G_008			China	Brahmaputra		29.5586	85.8807	5184	60	71.05	18.41	WB
22	CH_434	03_71K_011			China	Brahmaputra		29.4758	86.2308	4759	387	410.71	6.13	WB
23	CH_157	02_71L_002			China	Ganga	Arun Kosi	28.8581	86.5201	5254	76	91.13	19.91	WB
24	CH_123	02_71H_003			China	Ganga	Arun Kosi	28.6862	85.9542	4643	216	228.97	6.00	WB
25	CH_122	02_71H_002			China	Ganga	Arun Kosi	28.7236	85.8796	4646	2152	2365.10	9.90	WB
26	CH_580	03_77P_009			China	Brahmaputra		28.5463	91.5255	5083	94	111.39	18.50	WB
27	CH_806	03_82G_045			China	Brahmaputra		29.4054	93.7079	4505	70	77.31	10.44	WB
28	CH_442	03_71O_006			China	Brahmaputra		29.556	87.0275	4729	104	124.48	19.70	WB
29	CH_511	03_77K_009			China	Brahmaputra		29.467	90.1723	3933	69	78.31	13.49	WB
30	CH_446	03_71O_010			China	Brahmaputra		29.204	87.3914	4291	813	1443.39	77.54	WB
31	CH_448	03_71P_001			China	Brahmaputra		28.8324	87.56	5296	112	141.23	26.10	WB
32	CH_215	02_71P_027			China	Ganga	Arun Kosi	28.1945	87.6407	5352	49	59.08	20.58	GL
33	CH_258	02_77D_003			China	Ganga	Arun Kosi	28.3092	88.3253	4364	88	99.02	12.52	WB
34	CH_271	02_78A_005			China	Ganga	Arun Kosi	27.9281	88.0028	5345	89	115.39	29.66	GL
35	CH_483	03_77H_012			China	Brahmaputra		28.2404	89.6948	4693	76	90.58	19.19	GL
36	CH_484	03_77H_013			China	Brahmaputra		28.2089	89.7452	4949	48	58.65	22.19	GL
37	BH_4	03_77H_011			Bhutan	Brahmaputra		28.2302	89.8875	4921	143	165.51	15.74	GL

Table 2b - GL & WB that have shown DECREASE in water spread

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
38	JK_1	01_42H_001	J&K		India	Indus	Gilgit	36.8806	73.7013	4286	276	256.37	-7.11	WB
39	JK_47	01_43E_023	J&K		India	Indus	Gilgit	35.865	73.7452	4140	82	68.44	-16.54	WB
40	JK_85	01_43J_007	J&K		India	Indus	Jhelum	34.8292	74.0617	3680	95	30.32	-68.08	WB
41	JK_95	01_43J_017	J&K	Baramula (Kashmir North)	India	Indus	Jhelum	34.4321	74.9242	3571	164	148.37	-9.53	WB
42	JK_154	01_43N_027	J&K	Srinagar	India	Indus	Jhelum	34.3881	75.1185	3663	48	38.06	-20.71	WB
43	JK_147	01_43N_020	J&K		India	Indus	Jhelum	34.6973	75.1369	4103	63	53.28	-15.42	WB
44	JK_98	01_43J_020	J&K	Baramula (Kashmir North)	India	Indus	Jhelum	34.2499	74.6695	1579	191	171.01	-10.46	WB
45	JK_99	01_43J_021	J&K	Bagdam	India	Indus	Jhelum	34.1184	74.861	1585	1238	1095.52	-11.51	WB
46	JK_157	01_43N_030	J&K	Srinagar	India	Indus	Jhelum	34.1392	75.1474	3780	86	78.16	-9.12	WB
47	JK_111	01_43K_010	J&K	Rajauri	India	Indus	Jhelum	33.519	74.5837	3934	66	14.72	-77.70	WB
48	JK_67	01_43G_001	J&K		India	Indus	Jhelum	33.2131	73.7116	335	22154	20279.10	-8.46	WB
49	HP_9	01_53A_001	HP	Kangra	India	Indus	Beas	31.9894	76.0504	407	21867	8363.80	-61.75	WB
50	JK_191	01_52G_003	J&K	Ladakh (Leh)	India	Indus	Indus	33.3107	77.997	4531	1502	1293.77	-13.86	WB
51	JK_222	01_52K_014	J&K	Ladakh (Leh)	India	Indus	Indus	33.2519	78.0429	4532	405	323.94	-20.01	WB
52	JK_220	01_52K_012	J&K	Ladakh (Leh)	India	Indus	Indus	33.313	78.4781	4684	166	154.79	-6.75	WB
53	JK_219	01_52K_011	J&K	Ladakh (Leh)	India	Indus	Shyok	33.4274	78.4879	5284	186	167.48	-9.96	WB
54	JK_217	01_52K_009	J&K	Ladakh (Leh)	India	Indus	Shyok	33.4643	78.6109	4914	204	193.07	-5.36	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	**August 2017**		
55	CH_8	01_52O_005			China	Indus	Indus	33.3903	79.367	4353	780	713.84	-8.48	WB
56	JK_226	01_52L_002	J&K	Ladakh (Leh)	India	Indus	Indus	32.9819	78.5954	4985	442	385.31	-12.82	WB
57	JK_227	01_52L_003	J&K	Ladakh (Leh)	India	Indus	Indus	32.9208	78.6002	4982	648	593.38	-8.43	WB
58	HP_10	01_53A_002	HP	Bilaspur	India	Indus	Satluj	31.3855	76.535	506	13679	10955.60	-19.91	WB
59	JK_202	01_52J_006	J&K	Ladakh (Leh)	India	Indus	Shyok	34.1733	78.4378	5393	110	89.13	-18.97	WB
60	JK_205	01_52J_009	J&K	Ladakh (Leh)	India	Indus	Shyok	34.1506	78.5532	5562	57	38.38	-32.66	WB
61	CH_5	01_52O_002			China	Indus	Indus	33.9803	79.5432	5259	135	71.59	-46.97	WB
62	JK_196	01_52I_004	J&K		India	Indus	Shyok	35.3911	78.2188	5140	124	42.03	-66.10	WB
63	CH_28	01_61B_003			China	Indus	Indus	34.2349	80.5058	5071	224	54.10	-75.85	WB
64	CH_60	01_61F_003			China	Indus	Indus	34.2751	81.0521	5255	558	152.80	-72.62	WB
65	CH_59	01_61F_002			China	Indus	Indus	34.2987	81.2015	5274	55	12.08	-78.03	WB
66	CH_64	01_61G_003			China	Indus	Indus	33.6333	81.3874	4872	63	58.09	-7.79	WB
67	CH_62	01_61G_001			China	Indus	Indus	33.8202	81.6446	4968	85	34.53	-59.37	WB
68	CH_33	01_61C_005			China	Indus	Indus	33.7486	80.6416	4480	139	62.57	-54.98	WB
69	CH_39	01_61C_011			China	Indus	Indus	33.7204	80.7213	4490	408	374.19	-8.29	WB
70	CH_43	01_61C_015			China	Indus	Indus	33.4879	80.3162	4284	742	676.24	-8.86	WB
71	CH_44	01_61C_016			China	Indus	Indus	33.4329	80.4666	4287	344	277.54	-19.32	WB
72	CH_50	01_61C_022			China	Indus	Indus	33.0976	80.3928	4337	1501	1110.72	-26.00	WB
73	CH_49	01_61C_021			China	Indus	Indus	33.1046	80.2862	4345	1155	1006.75	-12.84	WB
74	CH_51	01_61C_023			China	Indus	Indus	33.0993	80.1774	4346	633	375.37	-40.70	WB
75	CH_53	01_61D_001			China	Indus	Indus	32.8015	80.4836	5590	70	17.02	-75.68	WB
76	CH_326	03_62N_009			China	Brahmaputra		30.5908	83.5187	5227	288	180.48	-37.34	WB
77	CH_338	03_62N_021			China	Brahmaputra		30.4308	83.9969	5429	197	166.19	-15.64	WB
78	CH_339	03_62N_022			China	Brahmaputra		30.2042	83.2422	4598	198	162.51	-17.92	WB
79	CH_373	03_62O_028			China	Brahmaputra		29.7947	83.5558	4574	932	280.05	-69.95	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL /WB
											2009 (Inventory)	**August 2017**		
80	CH_384	03_62O_039			China	Brahmaputra		29.5893	83.9888	4554	306	211.82	-30.78	WB
81	CH_398	03_71C_005			China	Brahmaputra		29.8455	84.6756	5536	57	52.95	-7.10	GL
82	CH_418	03_71G_009			China	Brahmaputra		29.5258	85.6437	5031	178	156.07	-12.32	WB
83	CH_429	03_71K_006			China	Brahmaputra		29.6251	86.2473	4846	2096	1944.56	-7.23	WB
84	CH_430	03_71K_007			China	Brahmaputra		29.5795	86.261	4749	80	61.98	-22.52	WB
85	CH_432	03_71K_009			China	Brahmaputra		29.5573	86.2663	4749	170	133.72	-21.34	WB
86	UK_2	02_53K_002	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	29.3194	78.9203	265	1597	546.19	-65.80	WB
87	CH_626	03_82A_007			China	Brahmaputra		31.0362	92.7869	4909	85	79.00	-7.05	WB
88	CH_632	03_82B_006			China	Brahmaputra		30.9338	92.7744	4835	124	110.84	-10.61	WB
89	CH_622	03_82A_003			China	Brahmaputra		31.1092	92.952	4894	99	83.56	-15.60	WB
90	CH_722	03_82E_004			China	Brahmaputra		31.0647	93.2924	5047	47	41.58	-11.54	WB
91	CH_564	03_77O_001			China	Brahmaputra		29.9188	91.0895	3873	154	102.79	-33.25	WB
92	CH_716	03_82D_010			China	Brahmaputra	Dangme Chu	28.1915	92.043	5036	76	17.07	-77.53	WB
93	CH_589	03_77P_018			China	Brahmaputra	Dangme Chu	28.1016	91.9429	4705	154	145.18	-5.73	WB
94	CH_590	03_77P_019			China	Brahmaputra	Dangme Chu	28.0588	91.9397	4631	220	38.72	-82.40	WB
95	CH_593	03_77P_023			China	Brahmaputra	Kuri Chu	28.0321	91.0017	4204	45	40.57	-9.84	WB
96	CH_640	03_82B_014			China	Brahmaputra		30.4936	92.6433	4817	157	111.35	-29.08	WB
97	CH_745	03_82F_020			China	Brahmaputra		30.2675	93.4563	4076	71	65.55	-7.67	GL
98	CH_823	03_82G_062			China	Brahmaputra		29.2403	93.276	4914	58	54.37	-6.26	WB
99	CH_1032	03_82O_029			China	Brahmaputra	Dihang	29.3049	95.639	3322	68	55.32	-18.64	WB
100	CH_1023	03_82O_016			China	Brahmaputra	Dihang	29.3721	95.8718	4344	91	29.07	-68.06	WB
101	CH_1039	03_82O_047			China	Brahmaputra	Dihang	29.1628	95.491	3544	44	38.36	-12.82	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
102	AP_49	03_82O_042	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.1768	95.6156	3063	44	41.28	-6.17	WB
103	AP_92	03_91C_046	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.2257	96.16	3313	61	46.26	-24.17	WB
104	AP_85	03_91C_038	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.269	96.1567	3991	113	58.89	-47.88	WB
105	CH_971	03_82L_009			China	Brahmaputra		28.8539	94.0002	3865	54	50.98	-5.60	GL
106	CH_835	03_82J_005			China	Brahmaputra		30.6263	94.445	4095	67	59.88	-10.63	GL
107	CH_1065	03_91C_014			China	Brahmaputra		29.599	96.1413	4073	51	27.70	-45.70	GL
108	BH_13	03_77L_033			Bhutan	Brahmaputra		28.2658	90.0688	5149	177	159.43	-9.93	GL
109	CH_529	03_77L_013			China	Brahmaputra		28.4489	90.2569	5188	318	77.47	-75.64	WB
110	CH_476	03_77H_001			China	Brahmaputra		28.8297	89.8518	4248	442	109.99	-75.12	WB
111	CH_527	03_77L_011			China	Brahmaputra		28.7597	90.847	4510	1209	1137.06	-5.95	WB
112	CH_524	03_77L_008			China	Brahmaputra		28.8255	90.6864	4446	85	76.60	-9.89	WB
113	CH_426	03_71K_003			China	Brahmaputra		29.7664	86.9226	4976	72	31.09	-56.83	WB
114	CH_438	03_71O_002			China	Brahmaputra		29.7047	87.0169	4903	48	31.98	-33.37	WB
115	CH_460	03_77C_006			China	Brahmaputra		29.5875	88.2317	4506	102	91.37	-10.43	WB
116	CH_256	02_77D_001			China	Ganga	Arun Kosi	28.4045	88.2286	4422	5831	1997.94	-65.74	WB
117	CH_252	02_72M_006			China	Ganga	Arun Kosi	27.9506	87.9088	5165	71	59.35	-16.41	GL
118	CH_269	02_78A_003			China	Ganga	Arun Kosi	27.9463	88.0752	5488	124	108.01	-12.90	GL
119	SK_3	03_77D_003	Sikkim	North Sikkim	India	Brahmaputra	Teesta	28.0132	88.7558	5094	96	26.12	-72.79	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
120	SK_4	03_77D_004	Sikkim	North Sikkim	India	Brahmaputra	Teesta	28.0071	88.7128	5236	106	69.09	-34.83	GL
121	CH_604	03_78E_006			China	Brahmaputra		27.9699	89.3782	4568	67	31.05	-53.65	WB
122	CH_482	03_77H_008			China	Brahmaputra		28.2272	89.6382	4568	1256	503.86	-59.88	WB
123	CH_1056	03_91C_005			China	Brahmaputra		29.8231	96.3507	4870	86	71.73	-16.59	GL

Table 2(c) - GL & WB that have shown NOCHANGE in water spread

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
124	JK_3	01_42H_003	J&K		India	Indus	Gilgit	36.6465	73.6473	3925	97	101.79	4.94	WB
125	HP_12	01_53E_001	HP	Mandi	India	Indus	Beas	31.673	77.0791	898	72	70.14	-2.58	WB
126	JK_212	01_52K_004	J&K		India	Indus	Shyok	33.5303	78.9105	4353	5741	5739.21	-0.03	WB
127	JK_189	01_52G_001	J&K	Ladakh (Leh)	India	Indus	Shyok	33.9992	77.9789	4991	45	43.48	-3.38	WB
128	JK_225	01_52L_001	J&K	Ladakh (Leh)	India	Indus	Satluj	32.8967	78.3135	4522	14110	14100.90	-0.06	WB
129	CH_4	01_52O_001			China	Indus	Shyok	33.75	79.24	5064	65825	66127.90	0.46	WB
130	CH_61	01_61F_004			China	Indus	Indus	34.0222	81.6133	4812	36392	38077.40	4.63	WB
131	CH_36	01_61C_008			China	Indus	Indus	33.7344	80.6771	4492	151	157.26	4.14	WB
132	CH_38	01_61C_010			China	Indus	Indus	33.7247	80.6903	4492	88	85.50	-2.85	WB
133	CH_29	01_61C_001			China	Indus	Indus	33.9535	80.9036	4525	11154	11382.60	2.05	WB
134	CH_40	01_61C_012			China	Indus	Indus	33.5459	80.1506	4280	290	276.11	-4.79	WB
135	CH_42	01_61C_014			China	Indus	Indus	33.4992	80.35	4277	286	296.42	3.64	WB
136	CH_46	01_61C_018			China	Indus	Indus	33.367	80.5531	4289	1779	1778.75	-0.01	WB
137	CH_54	01_61D_002			China	Indus	Indus	32.5367	80.2286	4306	1560	1525.17	-2.23	WB
138	CH_92	01_62F_001			China	Indus	Satluj	30.6888	81.232	4570	25486	24895.30	-2.32	WB
139	CH_94	01_62F_003			China	Indus	Satluj	30.6848	81.4701	4585	40552	40986.80	1.07	WB
140	CH_318	03_62N_001			China	Brahmaputra		30.8889	83.5802	5101	14300	14757.50	3.20	WB
141	CH_334	03_62N_017			China	Brahmaputra		30.4654	83.9845	5450	77	75.25	-2.27	WB
142	CH_410	03_71G_001			China	Brahmaputra		29.8928	85.2471	5162	720	717.07	-0.41	WB
143	CH_415	03_71G_006			China	Brahmaputra		29.6532	85.7377	5063	956	909.64	-4.85	WB
144	CH_416	03_71G_007			China	Brahmaputra		29.654	85.8088	5149	191	188.82	-1.14	WB
145	CH_621	03_82A_002			China	Brahmaputra		31.1201	92.8332	4902	319	309.23	-3.06	WB
146	CH_623	03_82A_004			China	Brahmaputra		31.1025	92.6988	5003	46	46.86	1.88	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	**August 2017**		
147	CH_628	03_82B_002			China	Brahmaputra		30.9759	92.9413	4904	405	401.11	-0.96	WB
148	CH_721	03_82E_003			China	Brahmaputra		31.1036	93.1435	5024	98	93.64	-4.45	WB
149	CH_634	03_82B_008			China	Brahmaputra		30.8961	92.9098	4943	254	243.56	-4.11	WB
150	CH_563	03_77N_004			China	Brahmaputra		30.009	91.8609	3869	1296	1234.38	-4.75	WB
151	CH_710	03_82D_004			China	Brahmaputra		28.8819	92.1515	4476	390	383.95	-1.55	WB
152	CH_729	03_82F_004			China	Brahmaputra		30.6212	93.1805	4499	692	669.04	-3.32	WB
153	CH_755	03_82F_030			China	Brahmaputra		30.0205	93.9681	3475	2675	2580.10	-3.55	WB
154	CH_847	03_82J_017			China	Brahmaputra		30.1259	94.09	3802	282	272.07	-3.52	WB
155	CH_1046	03_82O_054			China	Brahmaputra	Dibang	29.1283	95.4383	3284	51	52.45	2.85	WB
156	CH_821	03_82G_060			China	Brahmaputra		29.2872	93.7363	4562	59	58.19	-1.38	WB
157	CH_528	03_77L_012			China	Brahmaputra		28.5663	90.3964	5013	28771	28644.90	-0.44	WB
158	CH_520	03_77L_001			China	Brahmaputra		28.9557	90.711	4442	55435	53542.00	-3.41	WB
159	CH_521	03_77L_003			China	Brahmaputra		28.9493	90.517	4442	4065	3951.24	-2.80	WB
160	CH_425	03_71K_002			China	Brahmaputra		29.8012	86.9456	4969	2248	2199.25	-2.17	WB
161	CH_445	03_71O_009			China	Brahmaputra		29.3088	87.1895	4298	2123	2097.66	-1.19	WB
162	CH_251	02_72M_005			China	Ganga	Arun Kosi	27.9492	87.9311	5106	74	77.08	4.16	GL
163	CH_606	03_78E_010			China	Brahmaputra		27.9636	89.4127	4576	49	50.25	2.54	WB
164	CH_490	03_77H_020			China	Brahmaputra		28.1499	89.3497	4472	4972	4756.12	-4.34	WB
165	CH_6	01_52O_003			China	Indus	Indus	33.5621	79.963	4246	148	151.62	2.45	WB

Table 2d - GL & WB that have become DRY

S.NO	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
166	JK_188	01_52E_001	J&K		India	Indus	Shyok	35.418	77.6046	5098	51	DRY	DRY	GL

Table 2e - GL & WB that are CLOUD COVERED

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
167	JK_22	01_43A_001	J&K		India	Indus	Gilgit	35.995	72.6126	3622	203	Cloud	Cloud	WB
168	JK_23	01_43A_002	J&K		India	Indus	Gilgit	35.9451	72.5947	3761	91	Cloud	Cloud	WB
169	JK_30	01_43E_006	J&K		India	Indus	Gilgit	35.9453	73.3646	4162	71	Cloud	Cloud	WB
170	JK_82	01_43J_004	J&K		India	Indus	Jhelum	34.9209	74.5208	4045	65	Cloud	Cloud	WB
171	JK_128	01_43N_001	J&K		India	Indus	Shingo (Indus)	34.9912	75.2361	4138	127	Cloud	Cloud	WB
172	JK_159	01_43N_032	J&K	Anantnag (Kashmir South)	India	Indus	Jhelum	34.0937	75.4979	3575	49	Cloud	Cloud	WB
173	JK_115	01_43K_014	J&K	Anantnag (Kashmir South)	India	Indus	Jhelum	33.5131	74.7686	3486	112	Cloud	Cloud	WB
174	HP_3	01_52H_002	HP	Lahul and Spiti	India	Indus	Chenab	32.5247	77.2183	4069	62	Cloud	Cloud	GL
175	HP_6	01_52H_005	HP	Lahul and Spiti	India	Indus	Chenab	32.4816	77.6146	4276	45	Cloud	Cloud	WB
176	JK_224	01_52K_016	J&K	Ladakh (Leh)	India	Indus	Satluj	33.1062	78.3036	4671	507	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
177	JK_218	01_52K_010	J&K	Ladakh (Leh)	India	Indus	Shyok	33.4549	78.4984	5308	152	Cloud	Cloud	WB
178	CH_1	01_52L_008			China	Indus	Satluj	32.3264	78.7238	3861	50	Cloud	Cloud	WB
179	JK_197	01_52J_001	J&K	Ladakh (Leh)	India	Indus	Shyok	34.4577	78.1351	5295	97	Cloud	Cloud	GL
180	JK_198	01_52J_002	J&K	Ladakh (Leh)	India	Indus	Shyok	34.2331	78.4262	5350	67	Cloud	Cloud	WB
181	JK_201	01_52J_005	J&K	Ladakh (Leh)	India	Indus	Shyok	34.1861	78.5078	5424	44	Cloud	Cloud	WB
182	JK_195	01_52I_003	J&K		India	Indus	Shyok	35.4105	78.2844	5154	180	Cloud	Cloud	WB
183	CH_55	01_61D_003			China	Indus	Indus	32.4232	80.8653	4452	46	Cloud	Cloud	WB
184	CH_56	01_61D_004			China	Indus	Indus	32.1569	80.3033	4989	550	Cloud	Cloud	WB
185	CH_77	01_62E_002			China	Indus	Indus	31.6162	81.0168	5137	161	Cloud	Cloud	WB
186	CH_69	01_62A_003			China	Indus	Indus	31.5778	80.9895	5140	1355	Cloud	Cloud	WB
187	CH_78	01_62E_003			China	Indus	Indus	31.4584	81.0907	5101	136	Cloud	Cloud	WB
188	CH_79	01_62E_004			China	Indus	Indus	31.3568	81.1498	5157	233	Cloud	Cloud	WB
189	CH_81	01_62E_006			China	Indus	Indus	31.292	81.2447	5050	524	Cloud	Cloud	WB
190	CH_90	01_62E_015			China	Indus	Satluj	31.1823	81.1945	5413	51	Cloud	Cloud	WB
191	CH_80	01_62E_005			China	Indus	Indus	31.3133	81.5171	5174	189	Cloud	Cloud	WB
192	CH_85	01_62E_010			China	Indus	Indus	31.2741	81.5949	5228	156	Cloud	Cloud	WB
193	CH_88	01_62E_013			China	Indus	Indus	31.2415	81.6861	5341	166	Cloud	Cloud	WB
194	CH_93	01_62F_002			China	Indus	Satluj	30.8018	81.5652	4591	333	Cloud	Cloud	WB
195	CH_95	01_62F_004			China	Indus	Satluj	30.4308	81.4329	5484	196	Cloud	Cloud	WB
196	CH_73	01_62B_001			China	Indus	Satluj	30.823	80.743	4527	440	Cloud	Cloud	WB
197	CH_106	02_62B_001			China	Ganga	Karnal	30.618	80.6304	5214	47	Cloud	Cloud	WB
198	CH_102	01_62J_001			China	Indus	Satluj	30.6377	82.1351	4784	5571	Cloud	Cloud	WB
199	CH_283	03_62J_011			China	Brahmaputra		30.4685	82.0592	5180	401	Cloud	Cloud	WB
200	CH_101	01_62F_010			China	Indus	Satluj	30.3864	81.9299	5229	45	Cloud	Cloud	GL
201	CH_288	03_62J_016			China	Brahmaputra		30.3622	82.0548	5283	44	Cloud	Cloud	GL

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	**August 2017**		
202	CH_287	03_62J_015			China	Brahmaputra		30.3978	82.1923	5203	82	Cloud	Cloud	WB
203	CH_285	03_62J_013			China	Brahmaputra		30.4189	82.3022	4931	854	Cloud	Cloud	WB
204	CH_284	03_62J_012			China	Brahmaputra		30.4315	82.3617	4882	165	Cloud	Cloud	WB
205	CH_298	03_62J_026			China	Brahmaputra		30.256	82.2095	5057	103	Cloud	Cloud	GL
206	CH_303	03_62J_031			China	Brahmaputra		30.1039	82.2696	4876	166	Cloud	Cloud	GL
207	CH_304	03_62J_032			China	Brahmaputra		30.0785	82.3423	4849	77	Cloud	Cloud	GL
208	NP_19	02_62J_003	Nepal		Nepal	Ganga	Karnal	30.0678	82.1264	4829	49	Cloud	Cloud	WB
209	NP_12	02_62F_019	Nepal		Nepal	Ganga	Karnal	30.1296	81.7791	5015	58	Cloud	Cloud	WB
210	NP_28	02_62K_010	Nepal		Nepal	Ganga	Karnal	29.5306	82.0914	2970	1051	Cloud	Cloud	WB
211	NP_30	02_62K_012	Nepal		Nepal	Ganga	Bheri	29.1966	82.9485	3692	469	Cloud	Cloud	WB
212	CH_387	03_62O_042			China	Brahmaputra		29.4989	83.4279	4959	57	Cloud	Cloud	WB
213	CH_375	03_62O_030			China	Brahmaputra		29.7263	83.1046	5021	97	Cloud	Cloud	WB
214	CH_316	03_62K_012			China	Brahmaputra		29.7355	82.9739	5337	73	Cloud	Cloud	GL
215	CH_306	03_62K_002			China	Brahmaputra		29.9801	82.5881	4853	45	Cloud	Cloud	WB
216	CH_305	03_62K_001			China	Brahmaputra		29.9856	82.5346	4829	370	Cloud	Cloud	WB
217	CH_273	03_62J_001			China	Brahmaputra		30.8805	82.8592	5446	147	Cloud	Cloud	WB
218	CH_320	03_62N_003			China	Brahmaputra		30.7106	83.6086	5210	57	Cloud	Cloud	WB
219	CH_392	03_71B_002			China	Brahmaputra		30.4355	84.0592	5387	8185	Cloud	Cloud	WB
220	CH_347	03_62O_002			China	Brahmaputra		29.9607	83.2699	4585	52	Cloud	Cloud	WB
221	CH_369	03_62O_024			China	Brahmaputra		29.8574	83.2516	4635	721	Cloud	Cloud	WB
222	CH_372	03_62O_027			China	Brahmaputra		29.8131	83.6543	4574	47	Cloud	Cloud	WB
223	CH_388	03_62O_043			China	Brahmaputra		29.4704	83.7638	5281	86	Cloud	Cloud	WB
224	CH_403	03_71C_010			China	Brahmaputra		29.311	84.4304	4558	49	Cloud	Cloud	WB
225	CH_404	03_71C_011			China	Brahmaputra		29.2312	84.37	4679	119	Cloud	Cloud	WB
226	CH_419	03_71G_010			China	Brahmaputra		29.347	85.083	4483	304	Cloud	Cloud	WB
227	CH_423	03_71G_014			China	Brahmaputra		29.0838	85.1896	4605	140	Cloud	Cloud	WB
228	CH_420	03_71G_011			China	Brahmaputra		29.1221	85.3985	4618	1192	Cloud	Cloud	WB
229	CH_422	03_71G_013			China	Brahmaputra		29.1021	85.0971	4541	244	Cloud	Cloud	WB

S. NO	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
230	CH_156	02_71L_001			China	Ganga	Arun Kosi	28.8869	86.5145	5098	85	Cloud	Cloud	WB
231	CH_158	02_71L_003			China	Ganga	Arun Kosi	28.8322	86.5225	5319	258	Cloud	Cloud	WB
232	CH_128	02_71H_008			China	Ganga	Arun Kosi	28.6171	85.5265	5113	94	Cloud	Cloud	GL
233	CH_127	02_71H_007			China	Ganga	Arun Kosi	28.6238	85.5094	5127	125	Cloud	Cloud	GL
234	CH_137	02_71H_017			China	Ganga	Arun Kosi	28.4954	85.6359	5278	472	Cloud	Cloud	GL
235	CH_141	02_71H_021			China	Ganga	Trisuli	28.4685	85.5188	4445	48	Cloud	Cloud	GL
236	CH_135	02_71H_015			China	Ganga	Arun Kosi	28.533	85.6086	5352	506	Cloud	Cloud	GL
237	CH_132	02_71H_012			China	Ganga	Arun Kosi	28.5638	85.6041	5366	89	Cloud	Cloud	GL
238	CH_121	02_71H_001			China	Ganga	Arun Kosi	28.8923	85.5857	4602	26825	Cloud	Cloud	WB
239	NP_45	02_71D_004	Nepal		Nepal	Ganga	Trisuli	28.4888	84.4857	4181	74	Cloud	Cloud	GL
240	NP_36	02_62P_003	Nepal		Nepal	Ganga	Trisuli	28.6922	83.8525	4910	315	Cloud	Cloud	GL
241	NP_37	02_62P_004	Nepal		Nepal	Ganga	Trisuli	28.217	83.9455	798	406	Cloud	Cloud	WB
242	NP_48	02_71D_007	Nepal		Nepal	Ganga	Trisuli	28.1755	84.0994	705	300	Cloud	Cloud	WB
243	NP_49	02_71D_008	Nepal		Nepal	Ganga	Trisuli	28.1538	84.1121	624	98	Cloud	Cloud	WB
244	NP_57	02_72E_001	Nepal		Nepal	Ganga	Baghmati	27.6018	85.157	1545	142	Cloud	Cloud	WB
245	NP_41	02_63M_002	Nepal		Nepal	Ganga	Rapti	27.6211	83.1017	110	153	Cloud	Cloud	WB
246	UK_1	02_53K_001	Uthrakhand	Pauri Garhwal	India	Ganga	Ramganga	29.5695	78.763	347	6790	Cloud	Cloud	WB
247	UK_8	02_53O_005	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	29.1352	79.2888	239	1510	Cloud	Cloud	WB
248	UK_10	02_53P_002	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	28.9515	79.5869	213	734	Cloud	Cloud	WB
249	UK_11	02_53P_003	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	28.901	79.623	207	1078	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
250	UK_9	02_53P_001	Uthrakhand	Udham Singh Nagar	India	Ganga	Ganga	28.9583	79.8424	210	2054	Cloud	Cloud	WB
251	UK_4	02_53O_001	Uthrakhand	Naini Tal	India	Ganga	Ramganga	29.3859	79.4599	1942	46	Cloud	Cloud	WB
252	CH_635	03_82B_009			China	Brahmaputra		30.9061	92.8171	4960	156	Cloud	Cloud	WB
253	CH_631	03_82B_005			China	Brahmaputra		30.9346	92.8292	4886	195	Cloud	Cloud	WB
254	CH_630	03_82B_004			China	Brahmaputra		30.9489	92.8896	4892	97	Cloud	Cloud	WB
255	CH_725	03_82E_007			China	Brahmaputra		31.004	93.0878	5040	71	Cloud	Cloud	WB
256	CH_636	03_82B_010			China	Brahmaputra		30.8784	92.8806	4982	52	Cloud	Cloud	WB
257	CH_633	03_82B_007			China	Brahmaputra		30.8947	92.9507	4958	199	Cloud	Cloud	WB
258	CH_720	03_82E_002			China	Brahmaputra		31.1315	93.1768	5007	659	Cloud	Cloud	WB
259	CH_565	03_77O_002			China	Brahmaputra		29.8996	91.1667	3798	100	Cloud	Cloud	WB
260	CH_665	03_82C_010			China	Brahmaputra		29.7789	92.3881	4916	153	Cloud	Cloud	WB
261	CH_671	03_82C_016			China	Brahmaputra		29.6666	92.3935	4677	54	Cloud	Cloud	WB
262	CH_709	03_82D_003			China	Brahmaputra		28.8937	92.1287	4403	50	Cloud	Cloud	WB
263	CH_576	03_77P_005			China	Brahmaputra		28.7653	91.675	4616	110	Cloud	Cloud	WB
264	CH_577	03_77P_006			China	Brahmaputra		28.6629	91.6796	4616	5683	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
265	CH_584	03_77P_013			China	Brahmaputra		28.5301	91.5619	5153	53	Cloud	Cloud	WB
266	CH_583	03_77P_012			China	Brahmaputra		28.5287	91.6651	4973	66	Cloud	Cloud	WB
267	CH_587	03_77P_016			China	Brahmaputra	Dangme Chu	28.3302	91.9633	4747	251	Cloud	Cloud	WB
268	CH_588	03_77P_017			China	Brahmaputra	Dangme Chu	28.2972	91.9457	4756	2345	Cloud	Cloud	WB
269	CH_614	03_78M_003			China	Brahmaputra	Dangme Chu	27.9011	91.8969	4452	207	Cloud	Cloud	WB
270	CH_617	03_78M_016			China	Brahmaputra	Dangme Chu	27.8419	91.8929	4638	142	Cloud	Cloud	WB
271	BH_188	03_78M_010			Bhutan	Brahmaputra	Dangme Chu	27.8772	91.6338	4480	50	Cloud	Cloud	WB
272	BH_195	03_78M_020			Bhutan	Brahmaputra	Dangme Chu	27.8377	91.6051	4135	65	Cloud	Cloud	WB
273	BH_197	03_78M_022			Bhutan	Brahmaputra	Dangme Chu	27.8339	91.5536	4521	67	Cloud	Cloud	WB
274	BH_194	03_78M_019			Bhutan	Brahmaputra	Dangme Chu	27.8472	91.5833	4656	55	Cloud	Cloud	WB
275	CH_592	03_77P_021			China	Brahmaputra	Dangme Chu	28.0375	91.4518	4737	53	Cloud	Cloud	GL
276	CH_591	03_77P_020			China	Brahmaputra	Kuri Chu	28.0879	91.2572	4630	63	Cloud	Cloud	WB
277	CH_552	03_77L_043			China	Brahmaputra	Kuri Chu	28.0894	90.7885	5165	181	Cloud	Cloud	GL
278	CH_551	03_77L_042			China	Brahmaputra	Kuri Chu	28.099	90.7398	5008	50	Cloud	Cloud	GL
279	BH_34	03_77L_066			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	28.0226	90.7083	4868	148	Cloud	Cloud	GL

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
280	BH_36	03_77L_068			Bhutan	Brahmaputra	Kuri Chu	28.0035	90.9051	4754	86	Cloud	Cloud	WB
281	CH_543	03_77L_027			China	Brahmaputra	Kuri Chu	28.2738	90.7368	4510	163	Cloud	Cloud	WB
282	CH_547	03_77L_032			China	Brahmaputra	Kuri Chu	28.2424	90.7273	4654	88	Cloud	Cloud	GL
283	CH_545	03_77L_029			China	Brahmaputra	Kuri Chu	28.273	90.5901	5419	45	Cloud	Cloud	GL
284	CH_550	03_77L_041			China	Brahmaputra	Kuri Chu	28.1235	90.5667	5178	56	Cloud	Cloud	GL
285	CH_641	03_82B_015			China	Brahmaputra		30.349	92.7353	5112	75	Cloud	Cloud	WB
286	CH_646	03_82B_020			China	Brahmaputra		30.2164	92.5166	4981	49	Cloud	Cloud	WB
287	CH_647	03_82B_021			China	Brahmaputra		30.2128	92.5711	5037	48	Cloud	Cloud	WB
288	CH_654	03_82B_028			China	Brahmaputra		30.0495	92.4432	4993	48	Cloud	Cloud	WB
289	CH_499	03_77J_003			China	Brahmaputra		30.4793	90.9662	5035	89	Cloud	Cloud	WB
290	CH_733	03_82F_008			China	Brahmaputra		30.5349	93.0581	4817	83	Cloud	Cloud	WB
291	CH_732	03_82F_007			China	Brahmaputra		30.5205	93.4448	4780	115	Cloud	Cloud	GL
292	CH_735	03_82F_010			China	Brahmaputra		30.4703	93.5332	5014	44	Cloud	Cloud	GL
293	CH_739	03_82F_014			China	Brahmaputra		30.3478	93.5067	4537	49	Cloud	Cloud	GL
294	CH_741	03_82F_016			China	Brahmaputra		30.3188	93.3424	4612	49	Cloud	Cloud	WB
295	CH_747	03_82F_022			China	Brahmaputra		30.2418	93.6373	4181	103	Cloud	Cloud	GL
296	CH_848	03_82J_018			China	Brahmaputra		30.1152	94.1881	3905	99	Cloud	Cloud	GL
297	CH_849	03_82J_019			China	Brahmaputra		30.0971	94.2697	3896	45	Cloud	Cloud	GL
298	CH_850	03_82J_020			China	Brahmaputra		30.0503	94.2482	3830	439	Cloud	Cloud	WB
299	CH_853	03_82J_023			China	Brahmaputra		30.0461	94.1569	4294	105	Cloud	Cloud	WB
300	CH_863	03_82K_007			China	Brahmaputra		29.9588	94.2918	4282	130	Cloud	Cloud	WB
301	CH_865	03_82K_009			China	Brahmaputra		29.9469	94.3579	4148	116	Cloud	Cloud	WB
302	CH_855	03_82J_025			China	Brahmaputra		30.0049	94.3838	4020	59	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
303	CH_858	03_82K_002			China	Brahmaputra		29.9874	94.4354	3989	75	Cloud	Cloud	WB
304	CH_854	03_82J_024			China	Brahmaputra		30.0129	94.4716	4327	67	Cloud	Cloud	WB
305	CH_862	03_82K_006			China	Brahmaputra		29.9405	94.5884	4509	52	Cloud	Cloud	WB
306	CH_874	03_82K_018			China	Brahmaputra		29.8904	94.57	4149	165	Cloud	Cloud	WB
307	AP_77	03_83A_012	AP	Tawang	India	Brahmaputra	Dangme Chu	27.5185	92.034	4273	63	Cloud	Cloud	WB
308	CH_785	03_82G_024			China	Brahmaputra		29.5405	93.345	4631	95	Cloud	Cloud	WB
309	CH_809	03_82G_048			China	Brahmaputra		29.421	93.291	4643	55	Cloud	Cloud	WB
310	CH_770	03_82G_009			China	Brahmaputra		29.6295	93.5615	4563	51	Cloud	Cloud	WB
311	CH_778	03_82G_017			China	Brahmaputra		29.5423	93.8304	4419	53	Cloud	Cloud	WB
312	CH_780	03_82G_019			China	Brahmaputra		29.5025	93.9367	4444	59	Cloud	Cloud	WB
313	CH_930	03_82K_074			China	Brahmaputra		29.5261	94.0573	4533	88	Cloud	Cloud	WB
314	CH_924	03_82K_068			China	Brahmaputra		29.5447	94.0668	4299	52	Cloud	Cloud	WB
315	CH_931	03_82K_075			China	Brahmaputra		29.5176	94.1208	4501	118	Cloud	Cloud	WB
316	CH_933	03_82K_077			China	Brahmaputra		29.5045	94.1329	4577	100	Cloud	Cloud	WB
317	CH_936	03_82K_080			China	Brahmaputra		29.4727	94.2363	4509	47	Cloud	Cloud	WB
318	CH_901	03_82K_045			China	Brahmaputra		29.8167	94.133	4558	49	Cloud	Cloud	WB
319	CH_873	03_82K_017			China	Brahmaputra		29.9168	94.2796	4385	179	Cloud	Cloud	WB
320	CH_876	03_82K_020			China	Brahmaputra		29.8966	94.4615	4346	77	Cloud	Cloud	WB
321	CH_896	03_82K_040			China	Brahmaputra		29.8079	94.5005	4301	66	Cloud	Cloud	WB
322	CH_893	03_82K_037			China	Brahmaputra		29.8278	94.462	4133	55	Cloud	Cloud	WB
323	CH_895	03_82K_039			China	Brahmaputra		29.8127	94.4325	4083	224	Cloud	Cloud	WB

S. NO	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL / WB
											2009 (Inventory)	August 2017		
324	CH_892	03_82K_036			China	Brahmaputra		29.8296	94.632	4231	69	Cloud	Cloud	WB
325	CH_898	03_82K_042			China	Brahmaputra		29.7791	94.6008	4216	205	Cloud	Cloud	WB
326	CH_905	03_82K_049			China	Brahmaputra		29.7755	94.5724	4161	50	Cloud	Cloud	WB
327	CH_916	03_82K_060			China	Brahmaputra		29.5454	94.9649	4300	93	Cloud	Cloud	WB
328	CH_1037	03_82O_044			China	Brahmaputra	Dihang	29.1797	95.4852	3533	92	Cloud	Cloud	WB
329	AP_54	03_82O_061	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.0112	95.8849	3763	54	Cloud	Cloud	WB
330	AP_55	03_82O_062	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.0051	95.9054	3601	52	Cloud	Cloud	WB
331	AP_108	03_91D_009	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	28.9279	96.3388	4011	47	Cloud	Cloud	WB
332	AP_109	03_91D_010	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	28.919	96.383	3302	46	Cloud	Cloud	WB
333	AP_118	03_91D_022	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	28.8761	96.3941	3119	44	Cloud	Cloud	WB
334	AP_135	03_91D_041	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	28.7757	96.5315	3510	115	Cloud	Cloud	WB
335	CH_1136	03_91D_081			China	Brahmaputra	Luhit	28.5162	96.6984	3330	304	Cloud	Cloud	WB
336	CH_1135	03_91D_080			China	Brahmaputra	Luhit	28.5416	96.6176	4268	45	Cloud	Cloud	WB
337	AP_57	03_82O_064	AP		India	Brahmaputra	Dihang	29.0616	95.2625	3668	44	Cloud	Cloud	WB
338	AP_84	03_91C_034	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.3018	96.0822	4274	134	Cloud	Cloud	WB

S.NO	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
339	AP_91	03_91C_045	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.229	96.1915	3473	113	Cloud	Cloud	WB
340	AP_95	03_91C_049	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.1962	96.2028	4246	57	Cloud	Cloud	WB
341	AP_90	03_91C_044	AP	Upper Dibang Valley	India	Brahmaputra	Luhit	29.2231	96.2781	4207	63	Cloud	Cloud	WB
342	AP_89	03_91C_042	AP		India	Brahmaputra	Dibang	29.2439	96.2442	4459	50	Cloud	Cloud	WB
343	AP_87	03_91C_040	AP		India	Brahmaputra	Luhit	29.2553	96.2447	4406	94	Cloud	Cloud	WB
344	CH_796	03_82G_035			China	Brahmaputra		29.4765	93.6314	4369	81	Cloud	Cloud	WB
345	CH_784	03_82G_023			China	Brahmaputra		29.5125	93.6199	4362	84	Cloud	Cloud	WB
346	CH_811	03_82G_050			China	Brahmaputra		29.3826	93.6403	4717	44	Cloud	Cloud	WB
347	CH_812	03_82G_051			China	Brahmaputra		29.3697	93.6939	4725	49	Cloud	Cloud	WB
348	CH_816	03_82G_055			China	Brahmaputra		29.3322	93.7214	4610	62	Cloud	Cloud	WB
349	CH_826	03_82G_065			China	Brahmaputra		29.038	93.8357	4116	59	Cloud	Cloud	WB
350	CH_834	03_82J_004			China	Brahmaputra		30.6605	94.4855	3917	378	Cloud	Cloud	GL
351	CH_838	03_82J_008			China	Brahmaputra		30.4502	94.6041	3998	156	Cloud	Cloud	GL
352	CH_975	03_82N_004			China	Brahmaputra		30.6011	95.1831	4278	92	Cloud	Cloud	GL
353	CH_990	03_82N_019			China	Brahmaputra		30.4735	95.5751	4866	55	Cloud	Cloud	WB
354	CH_1001	03_82N_030			China	Brahmaputra		30.2508	95.6038	4442	132	Cloud	Cloud	GL
355	CH_1004	03_82N_033			China	Brahmaputra		30.2213	95.5834	4342	89	Cloud	Cloud	GL
356	CH_959	03_82K_103			China	Brahmaputra		29.2951	94.2017	3931	50	Cloud	Cloud	WB
357	AP_101	03_91C_069	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.051	96.1445	3199	78	Cloud	Cloud	WB
358	AP_100	03_91C_064	AP		India	Brahmaputra	Dibang	29.0794	96.1447	3945	89	Cloud	Cloud	WB
359	CH_108	03_91C_059			China	Brahmaputra	Dibang	29.0917	96.2109	4261	98	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL / WB
											2009 (Inventory)	August 2017		
360	CH_1102	03_91C_074			China	Brahmaputra	Dibang	29.03	96.223	4199	47	Cloud	Cloud	GL
361	CH_1106	03_91C_078			China	Brahmaputra	Dibang	29.0084	96.2179	3664	48	Cloud	Cloud	WB
362	CH_1098	03_91C_070			China	Brahmaputra	Dibang	29.0437	96.1935	4178	57	Cloud	Cloud	WB
363	CH_1085	03_91C_052			China	Brahmaputra	Luhit	29.1745	96.3256	4375	64	Cloud	Cloud	WB
364	CH_1075	03_91C_024			China	Brahmaputra		29.2981	96.8164	3952	239	Cloud	Cloud	GL
365	CH_1076	03_91C_025			China	Brahmaputra		29.2945	96.8344	4013	97	Cloud	Cloud	GL
366	CH_1079	03_91C_033			China	Brahmaputra		29.2297	96.8013	4263	153	Cloud	Cloud	GL
367	CH_1078	03_91C_029			China	Brahmaputra		29.2377	96.8237	4214	211	Cloud	Cloud	WB
368	CH_1170	03_91H_005			China	Brahmaputra	Luhit	28.9778	97.2141	4092	58	Cloud	Cloud	WB
369	CH_1175	03_91H_010			China	Brahmaputra	Luhit	28.9398	97.2614	4412	79	Cloud	Cloud	WB
370	CH_1182	03_91H_017			China	Brahmaputra	Luhit	28.877	97.3554	4569	46	Cloud	Cloud	WB
371	CH_1190	03_91H_025			China	Brahmaputra	Luhit	28.783	97.1519	3712	85	Cloud	Cloud	WB
372	CH_1194	03_91H_029			China	Brahmaputra	Luhit	28.7623	97.0567	3285	50	Cloud	Cloud	WB
373	CH_1176	03_91H_011			China	Brahmaputra	Luhit	28.9454	97.0981	4412	50	Cloud	Cloud	WB
374	CH_844	03_82J_014			China	Brahmaputra		30.1735	94.3457	3654	183	Cloud	Cloud	WB
375	BH_104	03_78I_023			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	27.9396	90.5348	5036	51	Cloud	Cloud	GL
376	BH_129	03_78I_048			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	27.8669	90.8162	4135	52	Cloud	Cloud	WB
377	BH_137	03_78I_056			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	27.8618	90.591	4770	76	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
378	BH_35	03_77L_067			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	28.0383	90.364	5216	78	Cloud	Cloud	GL
379	BH_40	03_77L_072			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	28.0155	90.3741	5185	91	Cloud	Cloud	GL
380	BH_132	03_78I_051			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	27.8906	90.2901	5059	103	Cloud	Cloud	GL
381	BH_99	03_78I_018			Bhutan	Brahmaputra	Puna Tsang Chu	27.9772	90.2323	5072	63	Cloud	Cloud	GL
382	BH_45	03_77L_077			Bhutan	Brahmaputra	Puna Tsang Chu	28.0151	90.2103	5127	51	Cloud	Cloud	WB
383	BH_19	03_77L_044			Bhutan	Brahmaputra	Puna Tsang Chu	28.1058	90.2471	4369	123	Cloud	Cloud	GL
384	BH_22	03_77L_051			Bhutan	Brahmaputra	Puna Tsang Chu	28.092	90.3	4513	143	Cloud	Cloud	GL
385	BH_15	03_77L_037			Bhutan	Brahmaputra		28.2377	90.1043	5126	542	Cloud	Cloud	GL
386	BH_14	03_77L_035			Bhutan	Brahmaputra		28.2497	90.1871	5455	58	Cloud	Cloud	GL
387	BH_12	03_77L_030			Bhutan	Brahmaputra		28.2787	90.2258	5301	79	Cloud	Cloud	GL
388	CH_533	03_77L_017			China	Brahmaputra		28.3857	90.3192	5337	74	Cloud	Cloud	WB
389	CH_530	03_77L_014			China	Brahmaputra		28.4387	90.1736	5283	48	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
390	CH_523	03_77L_007			China	Brahmaputra		28.8242	90.8334	4508	1478	Cloud	Cloud	WB
391	CH_525	03_77L_009			China	Brahmaputra		28.7892	90.8941	4511	522	Cloud	Cloud	WB
392	CH_526	03_77L_010			China	Brahmaputra		28.8113	90.4929	4459	47	Cloud	Cloud	WB
393	CH_522	03_77L_006			China	Brahmaputra		28.8945	90.4054	4529	44	Cloud	Cloud	WB
394	CH_519	03_77K_017			China	Brahmaputra		29.011	90.4473	4445	3853	Cloud	Cloud	WB
395	CH_517	03_77K_015			China	Brahmaputra		29.1176	90.3359	4451	108	Cloud	Cloud	WB
396	CH_453	03_77B_002			China	Brahmaputra		30.1477	88.6267	5011	227	Cloud	Cloud	WB
397	CH_452	03_77B_001			China	Brahmaputra		30.1682	88.6197	5029	52	Cloud	Cloud	WB
398	CH_149	02_71H_029			China	Ganga	Sun Kosi	28.3206	85.8392	5067	474	Cloud	Cloud	GL
399	CH_148	02_71H_028			China	Ganga	Sun Kosi	28.3303	85.8687	5167	200	Cloud	Cloud	WB
400	CH_147	02_71H_027			China	Ganga	Sun Kosi	28.3612	85.8701	5212	434	Cloud	Cloud	GL
401	CH_155	02_71H_035			China	Ganga	Sun Kosi	28.1825	85.9229	4355	45	Cloud	Cloud	WB
402	CH_166	02_71L_011			China	Ganga	Sun Kosi	28.3354	86.1917	5422	58	Cloud	Cloud	GL
403	CH_168	02_71L_013			China	Ganga	Sun Kosi	28.3034	86.1576	5307	64	Cloud	Cloud	GL
404	CH_165	02_71L_010			China	Ganga	Sun Kosi	28.3486	86.225	5348	47	Cloud	Cloud	GL
405	CH_183	02_71L_028			China	Ganga	Sun Kosi	28.1358	86.5293	4984	77	Cloud	Cloud	GL
406	CH_178	02_71L_023			China	Ganga	Arun Kosi	28.1974	86.5817	5094	116	Cloud	Cloud	GL
407	CH_181	02_71L_026			China	Ganga	Sun Kosi	28.1857	86.5317	5025	59	Cloud	Cloud	GL
408	CH_187	02_71L_032			China	Ganga	Sun Kosi	28.0445	86.5137	5241	55	Cloud	Cloud	GL
409	CH_188	02_71L_034			China	Ganga	Sun Kosi	28.0336	86.4962	5057	46	Cloud	Cloud	GL

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	**August 2017**		
410	NP_59	02_72I_003	Nepal		Nepal	Ganga	Sun Kosi	27.951	86.6897	4726	45	Cloud	Cloud	GL
411	NP_58	02_72I_002	Nepal		Nepal	Ganga	Sun Kosi	27.9752	86.6812	4834	67	Cloud	Cloud	GL
412	NP_62	02_72I_007	Nepal		Nepal	Ganga	Sun Kosi	27.9237	86.7866	4516	56	Cloud	Cloud	GL
413	NP_67	02_72I_014	Nepal		Nepal	Ganga	Sun Kosi	27.8614	86.4764	4550	137	Cloud	Cloud	GL
414	CH_244	02_72I_004			China	Ganga	Sun Kosi	27.9461	86.4465	5046	121	Cloud	Cloud	GL
415	NP_78	02_72I_025	Nepal		Nepal	Ganga	Sun Kosi	27.779	86.6136	4831	106	Cloud	Cloud	GL
416	NP_80	02_72I_027	Nepal		Nepal	Ganga	Sun Kosi	27.7548	86.958	4940	82	Cloud	Cloud	GL
417	NP_76	02_72I_023	Nepal		Nepal	Ganga	Sun Kosi	27.7831	86.9569	5204	81	Cloud	Cloud	GL
418	NP_64	02_72I_011	Nepal		Nepal	Ganga	Sun Kosi	27.8995	86.9211	5003	100	Cloud	Cloud	GL
419	NP_92	02_72M_016	Nepal		Nepal	Ganga	Arun Kosi	27.7985	87.0926	4538	161	Cloud	Cloud	GL
420	CH_223	02_71P_035			China	Ganga	Arun Kosi	28.152	87.1575	5141	107	Cloud	Cloud	WB
421	CH_242	02_71P_054			China	Ganga	Arun Kosi	28.21	87.1	4852	102	Cloud	Cloud	GL
422	CH_216	02_71P_028			China	Ganga	Arun Kosi	28.206	87.0521	4980	54	Cloud	Cloud	GL
423	CH_235	02_71P_047			China	Ganga	Arun Kosi	28.0693	87.0483	5589	71	Cloud	Cloud	GL
424	CH_210	02_71P_022			China	Ganga	Arun Kosi	28.2294	87.591	5410	80	Cloud	Cloud	GL
425	CH_213	02_71P_025			China	Ganga	Arun Kosi	28.2142	87.4683	4781	123	Cloud	Cloud	WB
426	CH_217	02_71P_029			China	Ganga	Arun Kosi	28.1784	87.5615	5011	80	Cloud	Cloud	GL
427	CH_231	02_71P_043			China	Ganga	Arun Kosi	28.0935	87.6375	5178	66	Cloud	Cloud	GL
428	CH_228	02_71P_040			China	Ganga	Arun Kosi	28.1139	87.6553	4954	135	Cloud	Cloud	WB
429	CH_204	02_71P_016			China	Ganga	Arun Kosi	28.4991	87.4522	4177	137	Cloud	Cloud	WB
430	CH_203	02_71P_015			China	Ganga	Arun Kosi	28.5766	87.5441	4152	1012	Cloud	Cloud	WB
431	CH_259	02_77D_004			China	Ganga	Arun Kosi	28.2939	88.121	4383	1273	Cloud	Cloud	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	**August 2017**		
432	CH_206	02_71P_018			China	Ganga	Arun Kosi	28.3577	87.8852	4204	51	Cloud	Cloud	WB
433	CH_207	02_71P_019			China	Ganga	Arun Kosi	28.3524	87.8751	4199	48	Cloud	Cloud	GL
434	CH_264	02_77D_009			China	Ganga	Arun Kosi	28.0103	88.2582	5256	58	Cloud	Cloud	GL
435	CH_263	02_77D_008			China	Ganga	Arun Kosi	28.0184	88.2873	5268	44	Cloud	Cloud	GL
436	CH_262	02_77D_007			China	Ganga	Arun Kosi	28.0233	88.3545	5195	54	Cloud	Cloud	GL
437	CH_253	02_72M_007			China	Ganga	Arun Kosi	27.9264	87.7699	4913	90	Cloud	Cloud	GL
438	NP_86	02_72M_009	Nepal		Nepal	Ganga	Tamur Kosi	27.8703	87.8676	4910	64	Cloud	Cloud	GL
439	SK_20	03_78A_014	Sikkim	North Sikkim	India	Brahmaputra	Teesta	27.9119	88.1986	5199	94	Cloud	Cloud	GL
440	SK_19	03_78A_013	Sikkim	North Sikkim	India	Brahmaputra	Teesta	27.9188	88.161	5441	63	Cloud	Cloud	GL
441	CH_270	02_78A_004			China	Ganga	Arun Kosi	27.9328	88.0668	5562	84	Cloud	Cloud	GL
442	SK_26	03_78A_021	Sikkim	North Sikkim	India	Brahmaputra	Teesta	27.8245	88.2492	5427	56	Cloud	Cloud	GL
443	SK_16	03_78A_009	Sikkim	North Sikkim	India	Brahmaputra	Teesta	27.9477	88.3313	5034	54	Cloud	Cloud	GL
444	SK_2	03_77D_002	Sikkim	North Sikkim	India	Brahmaputra	Teesta	28.0261	88.71	5148	105	Cloud	Cloud	GL
445	SK_5	03_77D_005	Sikkim	North Sikkim	India	Brahmaputra	Teesta	28.0091	88.6979	5209	79	Cloud	Cloud	GL
446	SK_9	03_78A_001	Sikkim	North Sikkim	India	Brahmaputra	Teesta	27.9917	88.8155	5303	156	Cloud	Cloud	GL
447	SK_11	03_78A_003	Sikkim	North Sikkim	India	Brahmaputra	Teesta	27.9753	88.6164	4960	58	Cloud	Cloud	GL
448	SK_8	03_77D_008	Sikkim	North Sikkim	India	Brahmaputra	Teesta	28.0073	88.4949	5023	46	Cloud	Cloud	GL
449	CH_261	02_77D_006			China	Ganga	Arun Kosi	28.056	88.4265	4886	80	Cloud	Cloud	GL
450	CH_612	03_78E_023			China	Brahmaputra		27.8549	89.2666	5192	58	Cloud	Cloud	GL

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	**August 2017**		
451	CH_613	03_78E_026			China	Brahmaputra	Amo Chu	27.8087	89.227	5137	60	Cloud	Cloud	GL
452	CH_609	03_78E_017			China	Brahmaputra		27.8766	89.2961	5236	65	Cloud	Cloud	GL
453	CH_611	03_78E_019			China	Brahmaputra		27.8779	89.312	5001	60	Cloud	Cloud	GL
454	CH_598	03_78A_018			China	Brahmaputra	Amo Chu	27.8554	88.9448	4874	67	Cloud	Cloud	WB
455	CH_607	03_78E_012			China	Brahmaputra		27.9424	89.3879	4584	279	Cloud	Cloud	WB
456	CH_605	03_78E_009			China	Brahmaputra		27.9603	89.3964	4576	175	Cloud	Cloud	WB
457	CH_495	03_77H_030			China	Brahmaputra		28.0256	89.4271	4791	66	Cloud	Cloud	WB
458	CH_479	03_77H_004			China	Brahmaputra		28.3271	89.4288	4426	201	Cloud	Cloud	WB
459	CH_481	03_77H_007			China	Brahmaputra		28.2738	89.3457	4425	924	Cloud	Cloud	WB
460	CH_478	03_77H_003			China	Brahmaputra		28.4005	89.0614	4712	208	Cloud	Cloud	WB
461	CH_488	03_77H_018			China	Brahmaputra		28.1807	89.5344	4694	80	Cloud	Cloud	WB
462	CH_492	03_77H_023			China	Brahmaputra		28.1374	89.5348	5292	47	Cloud	Cloud	WB
463	BH_60	03_78E_007			Bhutan	Brahmaputra	Puna Tsang Chu	27.9414	89.93	5002	61	Cloud	Cloud	GL
464	BH_57	03_78E_002			Bhutan	Brahmaputra	Puna Tsang Chu	27.9725	89.9299	5076	58	Cloud	Cloud	GL
465	BH_166	03_78I_085			Bhutan	Brahmaputra	Puna Tsang Chu	27.7996	90.2306	4758	70	Cloud	Cloud	WB
466	BH_73	03_78E_029			Bhutan	Brahmaputra	Puna Tsang Chu	27.6438	89.4611	4220	45	Cloud	Cloud	WB
467	BH_72	03_78E_028			Bhutan	Brahmaputra	Puna Tsang Chu	27.6392	89.7401	2130	47	Cloud	Cloud	WB

S.NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	**August 2017**		
468	CH_159	02_71L_004			China	Ganga	Arun Kosi	28.3947	86.3792	5481	86	Cloud	Cloud	GL
469	CH_161	02_71L_006			China	Ganga	Arun Kosi	28.3741	86.3046	5346	379	Cloud	Cloud	GL
470	AP_204	03_92A_006	AP	Lohit	India	Brahmaputra	Luhit	27.6973	96.452	1167	83	Cloud	Cloud	WB
471	AP_203	03_92A_005	AP	Lohit	India	Brahmaputra	Luhit	27.6899	96.8606	3371	50	Cloud	Cloud	WB
472	AP_67	03_82P_010	AP	Lower Dibang Valley	India	Brahmaputra	Dibang	28.1481	95.9433	1655	99	Cloud	Cloud	WB
473	AP_163	03_91D_107	AP	Lohit	India	Brahmaputra	Luhit	28.2024	96.8977	3751	67	Cloud	Cloud	WB
474	AP_185	03_91H_067	AP	Lohit	India	Brahmaputra	Luhit	28.0957	97.289	3762	56	Cloud	Cloud	WB
475	AP_206	03_92E_001	AP	Lohit	India	Brahmaputra	Luhit	27.9898	97.3691	4185	45	Cloud	Cloud	WB
476	CH_1205	03_91H_040			China	Brahmaputra	Luhit	28.4123	97.4646	4300	51	Cloud	Cloud	WB
477	CH_575	03_77P_004			China	Brahmaputra		28.81	91.1452	4450	211	Cloud	Cloud	WB

Table 3 – List of GL & WB with extreme change in water spread area

Table 3(a). List of List of GL&WB that have shown INCREASE in water spread area (>20%)

S.NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	August 2017		
1	HP_1	01_52D_001	HP	Chamba	India	Indus	Ravi	32.6147	76.0316	1141	688	866.85	26.00	WB
2	HP_5	01_52H_004	HP	Lahul and Spiti	India	Indus	Chenab	32.4964	77.5516	4150	46	118.63	157.88	GL
3	CH_385	03_62O_040			China	Brahmaputra		29.5824	83.3556	4888	107	131.57	22.96	WB
4	CH_377	03_62O_032			China	Brahmaputra		29.6893	83.1901	5007	49	64.24	31.10	WB
5	CH_446	03_71O_010			China	Brahmaputra		29.204	87.3914	4291	813	1443.39	77.54	WB
6	CH_448	03_71P_001			China	Brahmaputra		28.8324	87.56	5296	112	141.23	26.10	WB
7	CH_215	02_71P_027			China	Ganga	Arun Kosi	28.1945	87.6407	5352	49	59.08	20.58	GL
8	CH_271	02_78A_005			China	Ganga	Arun Kosi	27.9281	88.0028	5345	89	115.39	29.66	GL
9	CH_484	03_77H_013			China	Brahmaputra		28.2089	89.7452	4949	48	58.65	22.19	GL

Table 3(b). List of List of GL&WB that have shown DECREASE in water spread area (>20%)

S.NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
1	JK_85	01_43J_007	J&K		India	Indus	Jhelum	34.8292	74.0617	3680	95	30.32	-68.08	WB
2	JK_154	01_43N_027	J&K	Srinagar	India	Indus	Jhelum	34.3881	75.1185	3663	48	38.06	-20.71	WB
3	JK_111	01_43K_010	J&K	Rajauri	India	Indus	Jhelum	33.519	74.5837	3934	66	14.72	-77.70	WB
4	HP_9	01_53A_001	HP	Kangra	India	Indus	Beas	31.9894	76.0504	407	21867	8363.80	-61.75	WB
5	JK_222	01_52K_014	J&K	Ladakh (Leh)	India	Indus	Indus	33.2519	78.0429	4532	405	323.94	-20.01	WB
6	JK_205	01_52J_009	J&K	Ladakh (Leh)	India	Indus	Shyok	34.1506	78.5532	5562	57	38.38	-32.66	WB
7	CH_5	01_52O_002			China	Indus	Indus	33.9803	79.5432	5259	135	71.59	-46.97	WB
8	JK_196	01_52I_004	J&K		India	Indus	Shyok	35.3911	78.2188	5140	124	42.03	-66.10	WB
9	CH_28	01_61B_003			China	Indus	Indus	34.2349	80.5058	5071	224	54.10	-75.85	WB
10	CH_60	01_61F_003			China	Indus	Indus	34.2751	81.0521	5255	558	152.80	-72.62	WB
11	CH_59	01_61F_002			China	Indus	Indus	34.2987	81.2015	5274	55	12.08	-78.03	WB
12	CH_62	01_61G_001			China	Indus	Indus	33.8202	81.6446	4968	85	34.53	-59.37	WB
13	CH_33	01_61C_005			China	Indus	Indus	33.7486	80.6416	4480	139	62.57	-54.98	WB
14	CH_50	01_61C_022			China	Indus	Indus	33.0976	80.3928	4337	1501	1110.72	-26.00	WB
15	CH_51	01_61C_023			China	Indus	Indus	33.0993	80.1774	4346	633	375.37	-40.70	WB
16	CH_53	01_61D_001			China	Indus	Indus	32.8015	80.4836	5590	70	17.02	-75.68	WB
17	CH_326	03_62N_009			China	Brahmaputra		30.5908	83.5187	5227	288	180.48	-37.34	WB
18	CH_373	03_62O_028			China	Brahmaputra		29.7947	83.5558	4574	932	280.05	-69.95	WB
19	CH_384	03_62O_039			China	Brahmaputra		29.5893	83.9888	4554	306	211.82	-30.78	WB
20	CH_430	03_71K_007			China	Brahmaputra		29.5795	86.261	4749	80	61.98	-22.52	WB

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
21	CH_432	03_71K_009			China	Brahmaputra		29.5573	86.2663	4749	170	133.72	-21.34	WB
22	UK_2	02_53K_002	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	29.3194	78.9203	265	1597	546.19	-65.80	WB
23	CH_564	03_77O_001			China	Brahmaputra		29.9188	91.0895	3873	154	102.79	-33.25	WB
24	CH_716	03_82D_010			China	Brahmaputra	Dangme Chu	28.1915	92.043	5036	76	17.07	-77.53	WB
25	CH_590	03_77P_019			China	Brahmaputra	Dangme Chu	28.0588	91.9397	4631	220	38.72	-82.40	WB
26	CH_640	03_82B_014			China	Brahmaputra		30.4936	92.6433	4817	157	111.35	-29.08	WB
27	CH_1023	03_82O_016			China	Brahmaputra	Dihang	29.3721	95.8718	4344	91	29.07	-68.06	WB
28	AP_92	03_91C_046	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.2257	96.16	3313	61	46.26	-24.17	WB
29	AP_85	03_91C_038	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	29.269	96.1567	3991	113	58.89	-47.88	WB
30	CH_1065	03_91C_014			China	Brahmaputra		29.599	96.1413	4073	51	27.70	-45.70	GL
31	CH_529	03_77L_013			China	Brahmaputra		28.4489	90.2569	5188	318	77.47	-75.64	WB
32	CH_476	03_77H_001			China	Brahmaputra		28.8297	89.8518	4248	442	109.99	-75.12	WB
33	CH_426	03_71K_003			China	Brahmaputra		29.7664	86.9226	4976	72	31.09	-56.83	WB
34	CH_438	03_71O_002			China	Brahmaputra		29.7047	87.0169	4903	48	31.98	-33.37	WB
35	CH_256	02_77D_001			China	Ganga	Arun Kosi	28.4045	88.2286	4422	5831	1997.94	-65.74	WB
36	SK_3	03_77D_003	Sikkim	North Sikkim	India	Brahmaputra	Teesta	28.0132	88.7558	5094	96	26.12	-72.79	WB
37	SK_4	03_77D_004	Sikkim	North Sikkim	India	Brahmaputra	Teesta	28.0071	88.7128	5236	106	69.09	-34.83	GL

S. NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/ WB
											2009 (Inventory)	August 2017		
38	CH_604	03_78E_006			China	Brahmaputra		27.9699	89.3782	4568	67	31.05	-53.65	WB
39	CH_482	03_77H_008			China	Brahmaputra		28.2272	89.6382	4568	1256	503.86	-59.88	WB

Table 3(c). List of DRIED-UP GL & WB

S.NO.	UID	Lake_ID	State	District	Country	Basin	River	LAT	LONG	Elevation	Water spread area in Ha		% diff	GL/WB
											2009 (Inventory)	June 2017		
1	JK_188	01_52E_001	J&K		India	Indus	Shyok	35.418	77.6046	5098	51	DRY	DRY	GL

Figure 2 (a) Glacial Lakes & Water Bodies in Arunachal Pradesh

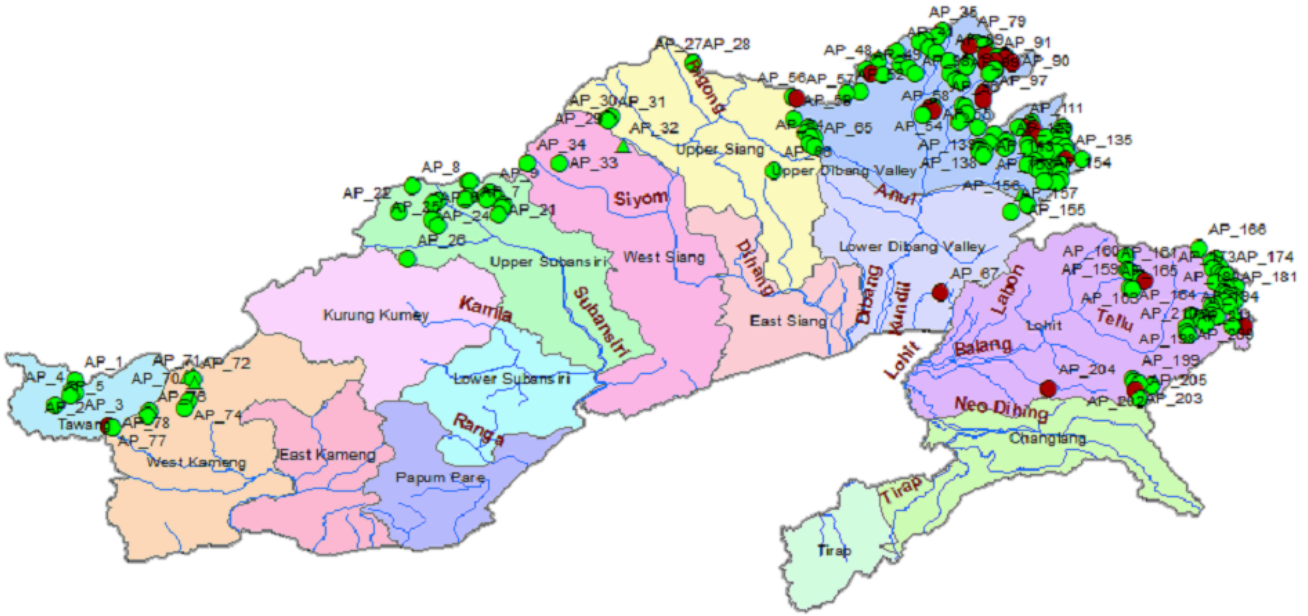
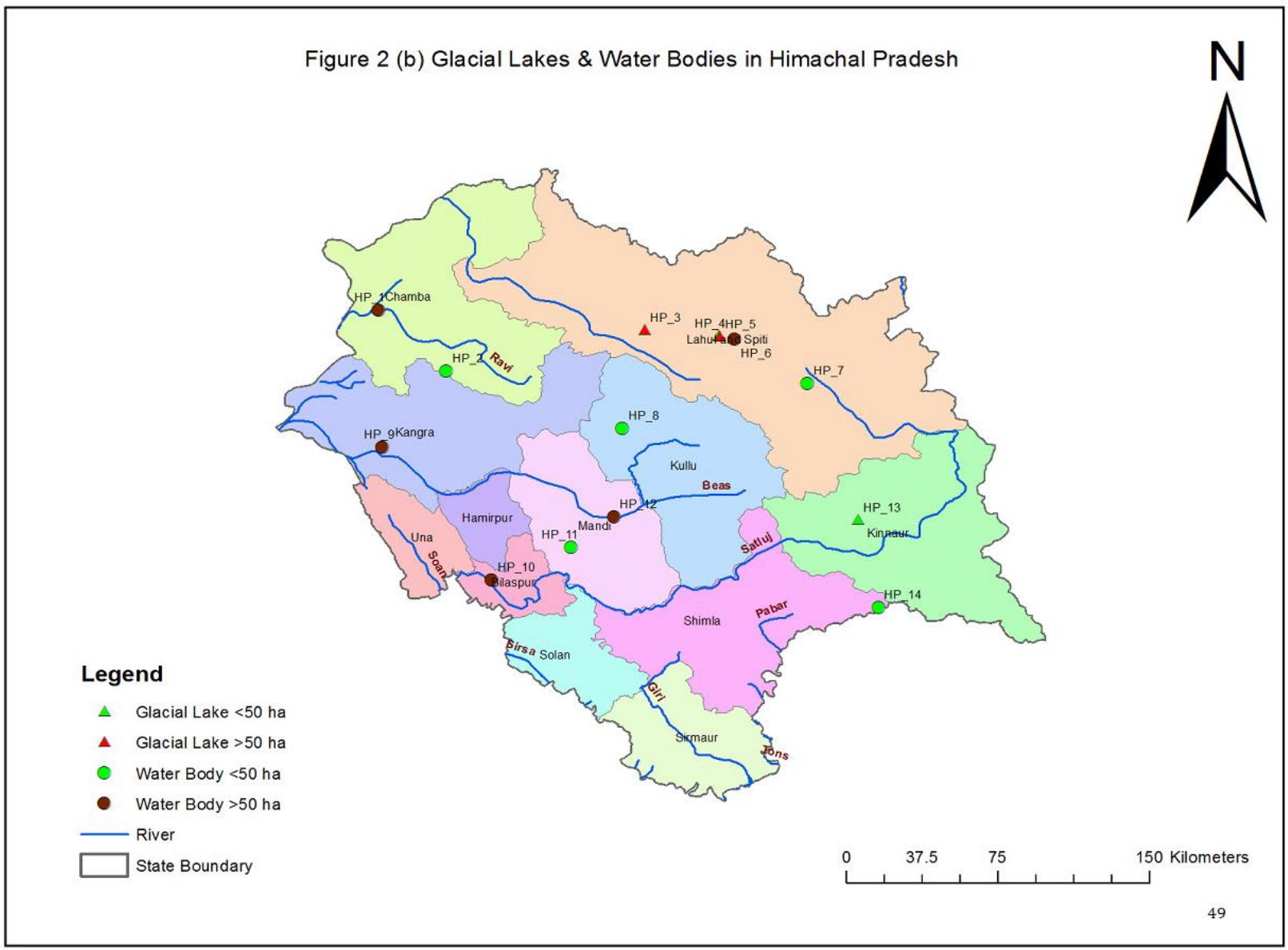


Figure 2 (b) Glacial Lakes & Water Bodies in Himachal Pradesh



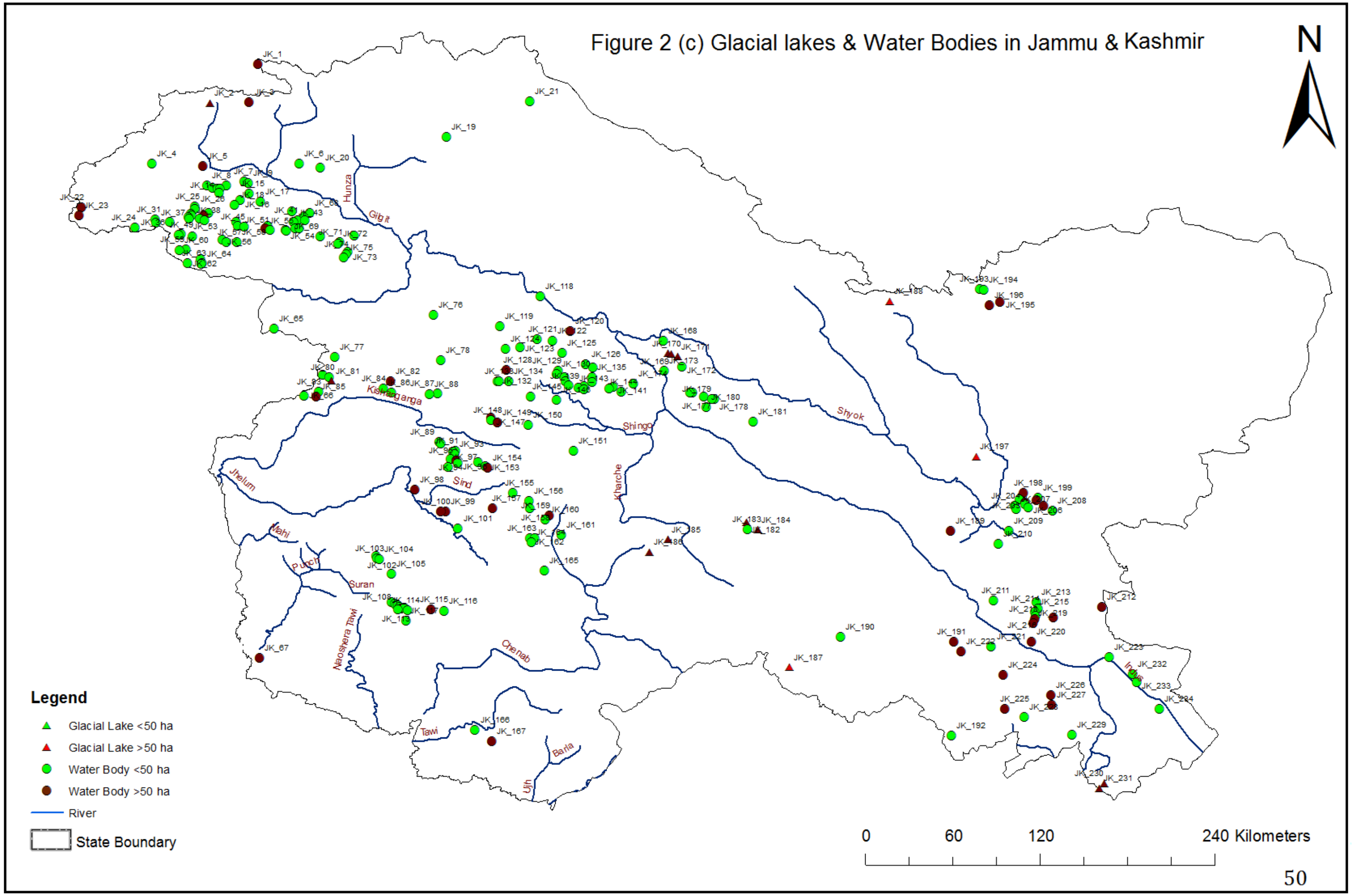
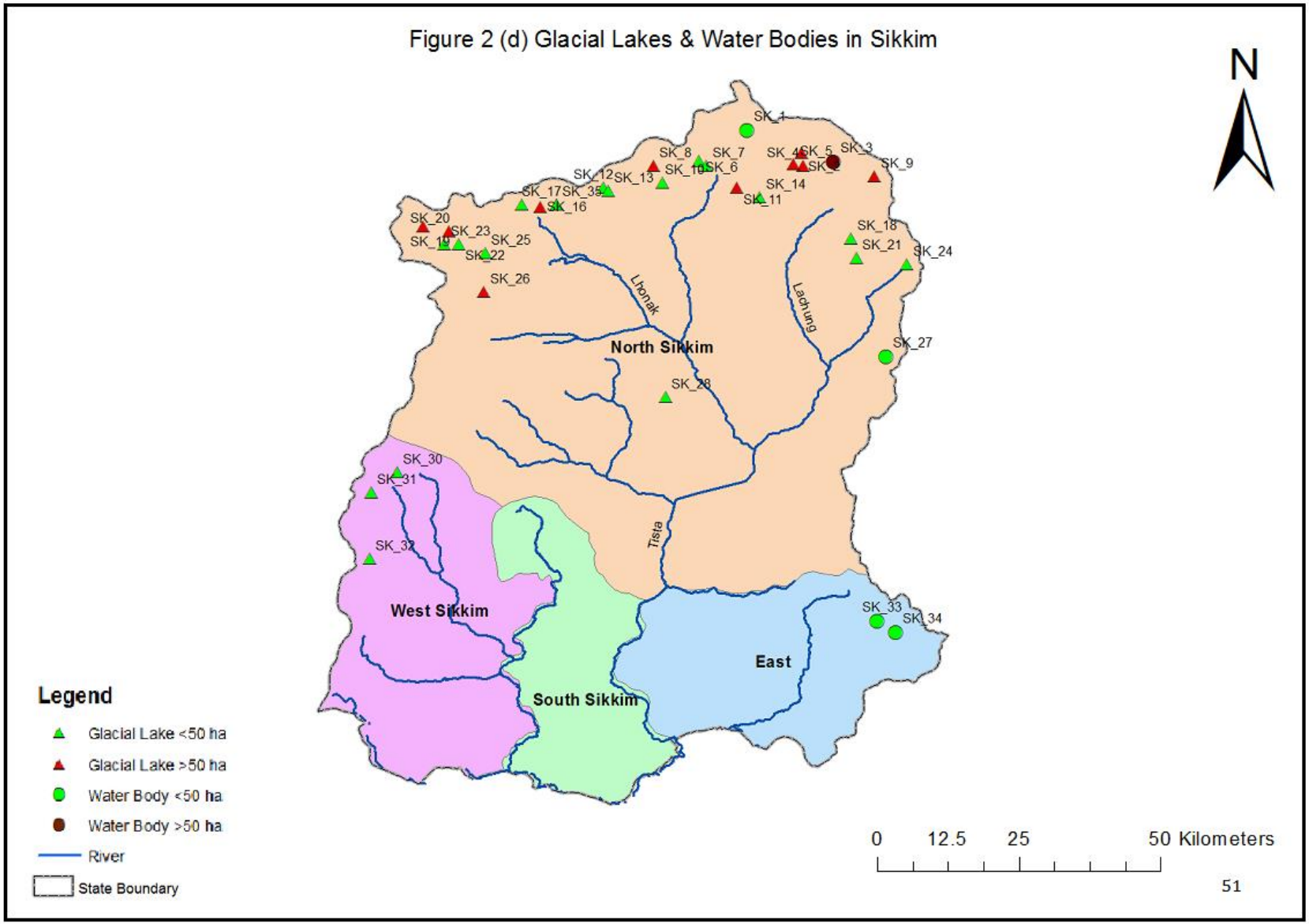


Figure 2 (c) Glacial lakes & Water Bodies in Jammu & Kashmir

Figure 2 (d) Glacial Lakes & Water Bodies in Sikkim



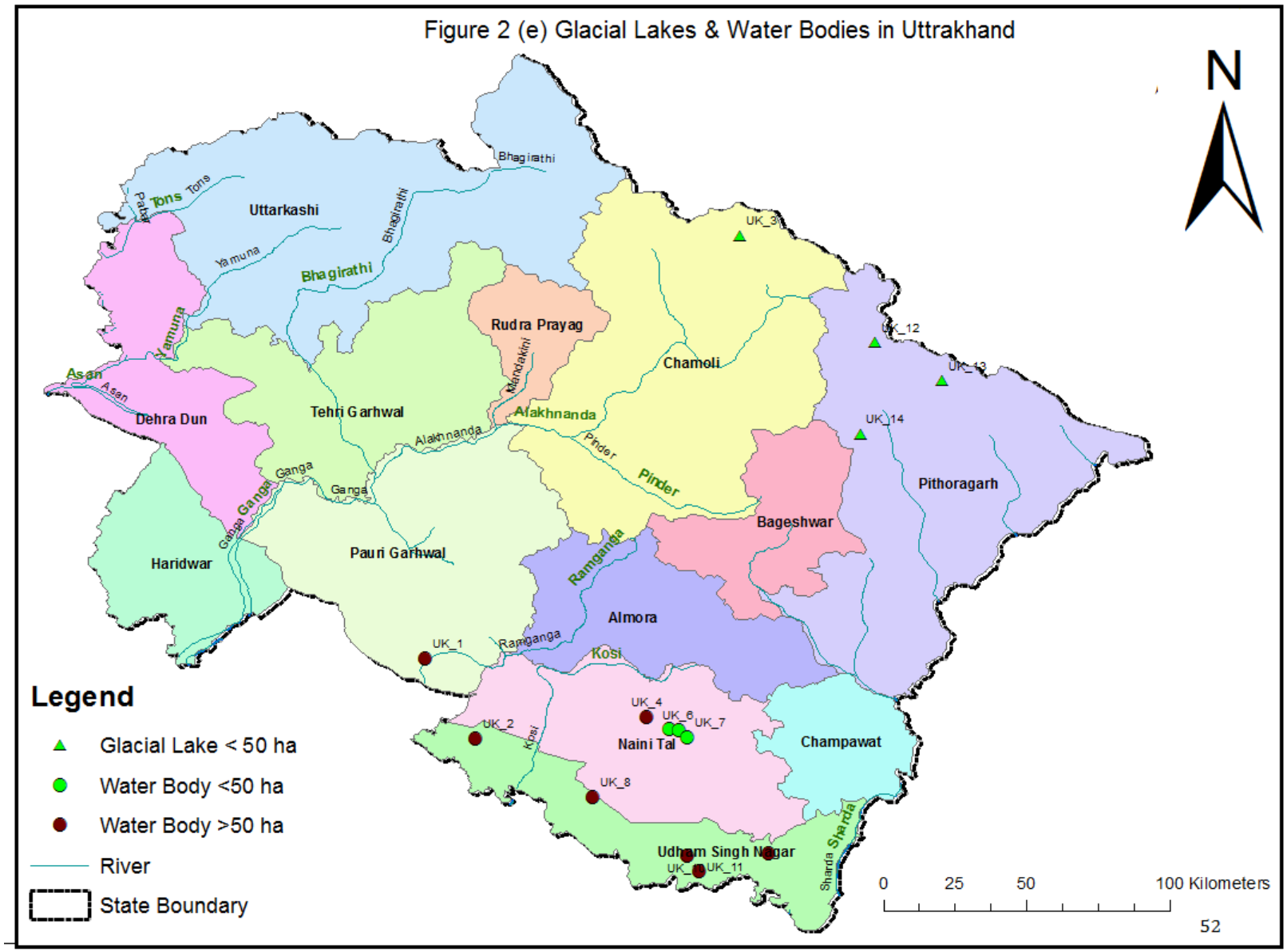


Figure 2 (e) Glacial Lakes & Water Bodies in Uttrakhand
N
Uttarkashi
Chamoli
Rudra Prayag
Tehri Garhwal
Dehra Dun
Haridwar
Pauri Garhwal
Almora
Bageshwar
Pithoragarh
Champawat
Naini Tal
Udham Singh Nagar
Bhagirathi
Yamuna
Tons
Asan
Mandakini
Alakhnanda
Pinder
Ganga
Ramganga
Kosi
Sharda
UK_1
UK_2
UK_3
UK_4
UK_6
UK_7
UK_8
UK_11
UK_12
UK_13
UK_14
Legend
Glacial Lake < 50 ha
Water Body <50 ha
Water Body >50 ha
River
State Boundary
0
25
50
100 Kilometers
52

References

NRSC, June 2011. *Final Report of "Inventory and Monitoring of Glacial Lakes / Water Bodies in the Himalayan Region of Indian River Basins"*, Technical Report Published by National Remote Sensing Centre, Hyderabad.

NRSC, April 2012. *Report on "Monitoring of Glacial Lakes/Water Bodies in the Himalayan Region of Indian River Basins during 2011"*, Technical Report Published by National Remote Sensing Centre, Hyderabad.

NRSC, March 2013. *Report on "Monitoring of Glacial Lakes/Water Bodies in the Himalayan Region of Indian River Basins during 2012"*, Technical Report Published by National Remote Sensing Centre, Hyderabad.

NRSC, December 2013. *Report on "Monitoring of Glacial Lakes/Water Bodies in the Himalayan Region of Indian River Basins during 2013"*, Technical Report Published by National Remote Sensing Centre, Hyderabad.

NRSC, December 2014. *Report on "Monitoring of Glacial Lakes/Water Bodies in the Himalayan Region of Indian River Basins during 2014"*, Technical Report Published by National Remote Sensing Centre, Hyderabad.

NRSC, December 2015. *Report on "Monitoring of Glacial Lakes/Water Bodies in the Himalayan Region of Indian River Basins during 2015"*, Technical Report Published by National Remote Sensing Centre, Hyderabad.

CWC, February 2017. *Report on "Monitoring of Glacial Lakes/Water Bodies in the Himalayan Region of Indian River Basins for 2016"*, Technical Report Published by Climate Change & IAD Directorate, CWC, New Delhi.