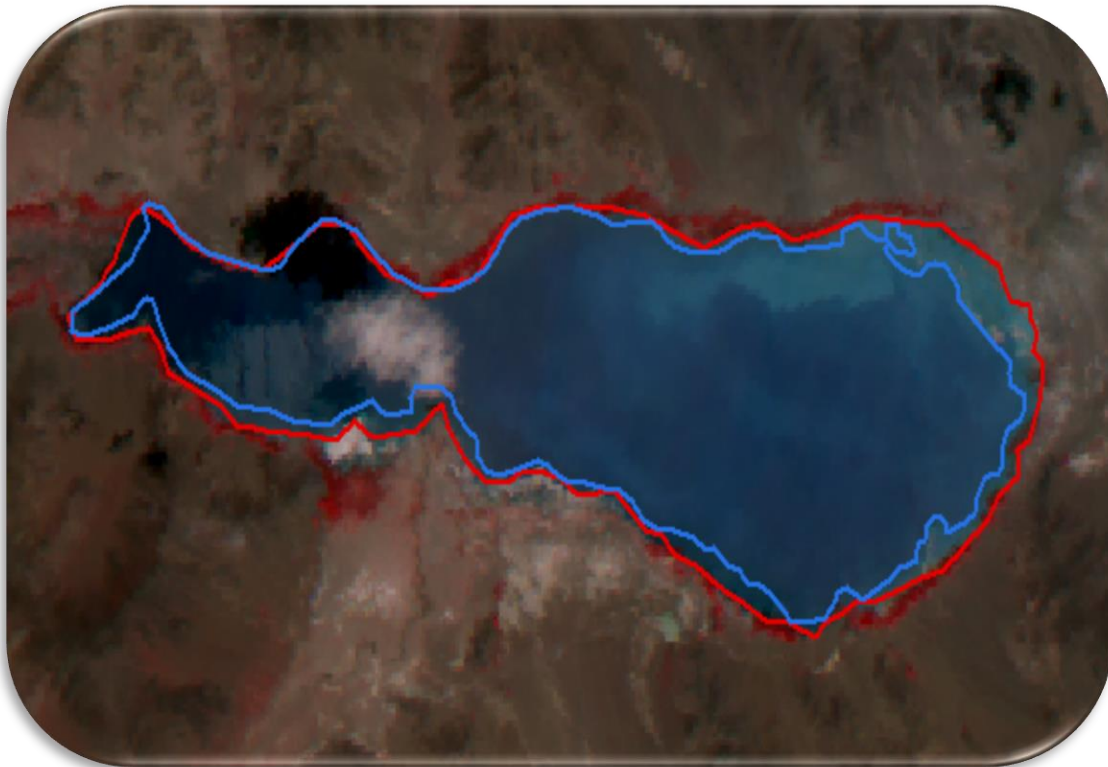




**Monitoring of Glacial Lakes &
Water Bodies in the Himalayan
Region of Indian River Basins for
the Year 2020 (June to October)**



**Morphology & Climate Change Directorate
Central Water Commission
Department of Water Resources, River Development &
Ganga Rejuvenation
Ministry of Jal Shakti, New Delhi**



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Document Control Sheet

1.	Security Classification	Restricted		
2.	Distribution	This document is for use by Central Water Commission, Ministry of Jal Shakti (Department of Water Resources, River Development & Ganga Rejuvenation), Govt. of India.		
3.	Report / Document Type	Technical report		
4.	Document Control Number	CWC/M&CC/2020/TR-6		
5.	Title	Monitoring of Glacial Lakes & Water Bodies in the Himalayan Region of Indian River Basins for the Year 2020		
6.	Author(s)	Rekhraj Meena & Saurabh		
7.	Affiliation of authors	Morphology and Climate Change Directorate, CWC, New Delhi		
8.	Project Team	Rekhraj Meena, Ajay Kumar Sinha & Saurabh		
9.	Scrutiny mechanism	Compiled by Rekhraj meena & Saurabh	Reviewed by Ajay Kumar Sinha	Approved / Controlled by Reading Shimray, CE (P&D Org.)
10.	Originating unit	P&D organization, CWC, New Delhi		
11.	Date of Publication	22/12/2020		
12.	Abstract (with Keywords) : This document presents the details on monitoring of glacial lakes and water bodies in the Indian Himalayan region during the month from June to October 2020 using satellite remote sensing technique including the data used and methodology followed in this study. Keywords: Glacial Lake, Water Bodies, Himalayas, Remote Sensing, GLOF, AWiFS			

S.NO.	Contents	Page No.
	List of Tables	iv
	List of Figures	v
	Abbreviations	vi
	Executive Summary	vii
1.	Introduction	1
1.1.	Background	1
1.2	Remote Sensing Technology	1
1.3	Objectives	2
2.	Study Area & Materials	3
2.1	Study Area	3
2.2	Materials	3
2.2.1	Satellite Data	3
3.	Methodology	6
3.1	Ortho-rectification of Satellite Data	6
3.2	Monitoring of Glacial Lakes & Water Bodies	6
4.	Results	8
5.	Conclusions	10
6.	References	54

List of Tables			
S.NO.	Table No.	Particulars	Page No.
1.	Table 1	List of satellite data used	3
2.	Table 2	List of Glacial Lakes & Water bodies monitored during the year 2020	9
3.	Table 3(a)	List of GL & WB that have shown INCREASE in water spread area (>40%)	11
4.	Table 3 (b)	Comparison of Water Spread Ares for Lakes showing INCREASE in water spread area (>20%) from 2016-2020 with Inventory Area	13
5.	Table 3 (c)	Comparison of Water Spread Ares for Lakes showing DECREASE in water spread area (>20%) from 2016-2020 with Inventory Area	17
6.	Table 4	Comparison of all GLs & WBs with extreme change in water spread area during 2020 with inventory area 2009	18
7.	Table 4 (a)	List of GL & WB that have shown INCREASE in water spread area	18
8.	Table 4 (b)	List of GL & WB that have shown DECREASE in water spread area	30
9.	Table 4 (c)	List of GL & WB that have shown NO CHANGE in water spread area	34
10.	Table 4 (d)	GL & WB that are CLOUD COVERED	39
11.	Table 5 (a)	List of GL & WB that have shown INCREASE in water spread area during 2020 with inventory area 2009 (>20%)	43
12.	Table 5 (b)	List of GL & WB that have shown DECREASE in water spread area during 2020 with inventory area 2009 (>20%)	48

List of Figures			
S.NO.	Table No.	Particulars	Page No.
1.	Figure 1	Index map of study area	5
2.	Figure 2	Glacial Lakes/ Water Bodies Monitored during the year 2020	9
3.	Figure 3 (a)	Glacial Lakes & Water Bodies in Arunachal Pradesh	49
4.	Figure 3 (b)	Glacial Lakes & Water Bodies in Himachal Pradesh	50
5.	Figure 3 (c)	Glacial Lakes & Water Bodies in Jammu & Kashmir including Ladakh	51
6.	Figure 3 (d)	Glacial Lakes & Water Bodies in Sikkim	52
7.	Figure 3 (e)	Glacial Lakes & Water Bodies in Uttarakhand	53

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 June to October 2020 and Water spread areas for glacial lakes & water bodies compared with inventory year of 2009.

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 2020.

Satellite images of AWiFS sensor received from NRSC, Hyderabad were used as input for this report. Water spread areas for glacial lakes & water bodies during June to October 2020 were computed and compared with inventory area of 2009. The data monitored during June to October 2020 is summarised below in tabular form:-

Month	Monitored	Cloud
Jun-2020	218	259
Jul-2020	173	304
Aug-2020	267	210
Sep-2020	222	255
Oct-2020	372	105

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, 2020 to October, 2020
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 2011-2020. 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 for the month from June, 2020 to October, 2020.

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 June to October 2020 is given in Table 1.

<u>Table 1. List of satellite data used</u>			
June-2020 Satellite data			
S. No.	Path	Row	Date
1	113	51	16- June -2020
2	107	51	10- June -2020
3	102	50	09- June -2020
4	102	49	09- June -2020
5	96	48	27- June -2020
6	93	46	01- June -2020

July-2020 Satellite data			
S. No.	Path	Row	Date
1	111	51	24- July -2020
2	107	51	04- July -2020
3	102	49	03- July -2020
4	97	48	26- July -2020
5	93	46	30- July -2020
August-2020 Satellite data			
S. No.	Path	Row	Date
1	112	51	22- August -2020
2	108	51	26- August -2020
3	104	51	30- August -2020
4	98	49	24- August -2020
5	98	48	24- August -2020
6	91	46	13- August -2020
September-2020 Satellite data			
S. No.	Path	Row	Date
1	114	51	01- September -2020
2	108	51	19- September -2020
3	103	49	18- September -2020
4	99	49	22- September -2020
5	93	46	16- September -2020
October-2020 Satellite data			
S. No.	Path	Row	Date
1	112	51	09- October -2020
2	109	51	18- October -2020
3	103	51	12- October -2020
4	97	48	16- October -2020
5	93	46	10- October -2020

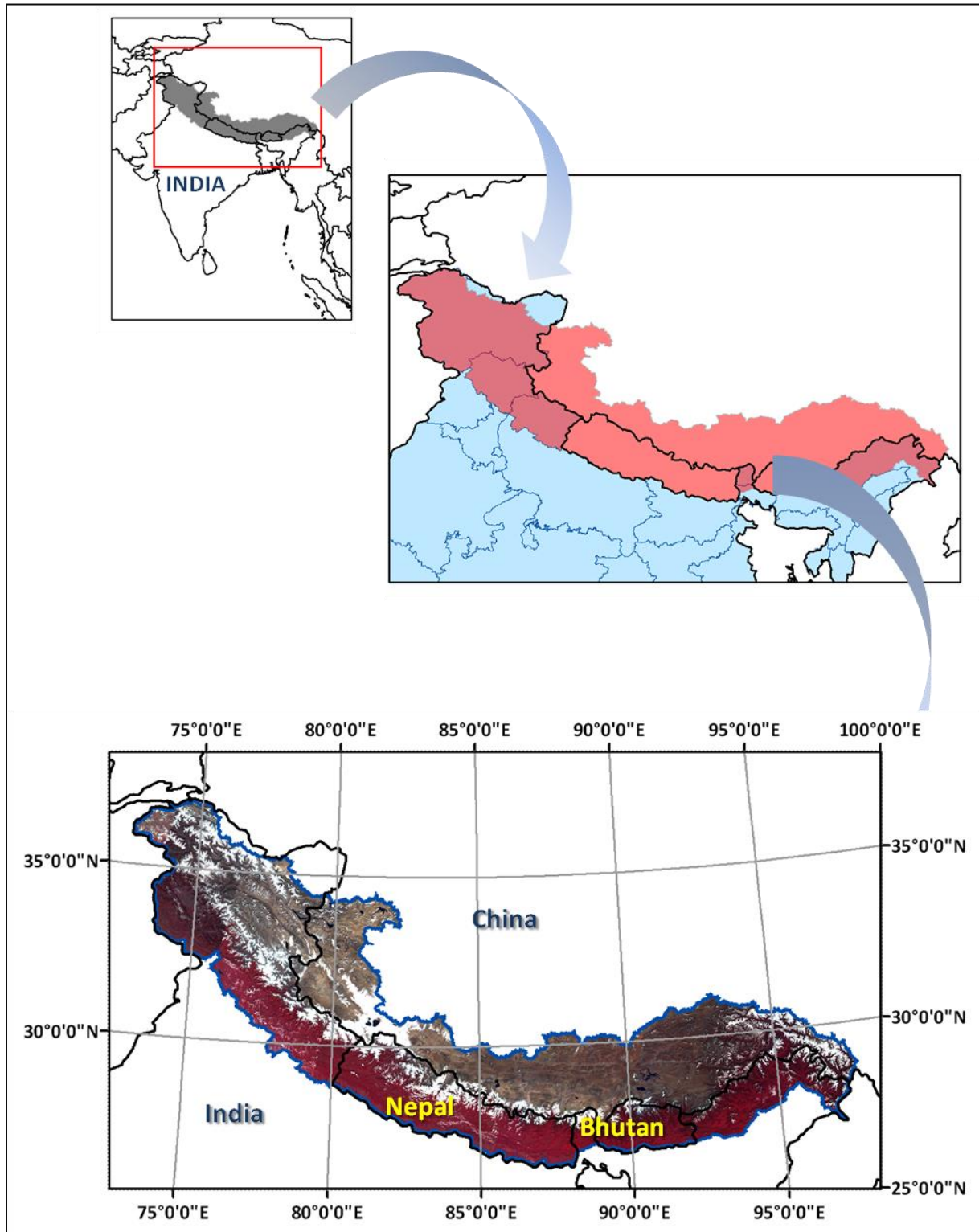


Figure 1. Index map of study area

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 plan metrically 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 June to October 2020 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

June 2020

The analysis of water spread area of glacial lakes & water bodies monitored in June 2020 was done for only 218 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 26 glacial lakes & water bodies have shown decrease in water spread area, 147 have shown increase and 45 have not shown any significant change ($\pm 5\%$).
- 12 out of 26 have decreased by more than 20% and 64 out of 147 water bodies have shown increase in area by more than 20%.

July 2020

The analysis of water spread area of glacial lakes & water bodies monitored in July 2020 was done for only 173 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 28 glacial lakes & water bodies have shown decrease in water spread area, 104 have shown increase and 41 have not shown any significant change ($\pm 5\%$).
- 09 out of 28 have decreased by more than 20% and 33 out of 104 water bodies have shown increase in area by more than 20%.

August 2020

The analysis of water spread area of glacial lakes & water bodies monitored in August 2020 was done for only 267 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 70 glacial lakes & water bodies have shown decrease in water spread area, 118 have shown increase and 79 have not shown any significant change ($\pm 5\%$).
- 27 out of 70 have decreased by more than 20% and 49 out of 118 water bodies have shown increase in area by more than 20%.

September 2020

The analysis of water spread area of glacial lakes & water bodies monitored in September 2020 was done for only 222 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 79 glacial lakes & water bodies have shown decrease in water spread area, 69 have shown increase and 74 have not shown any significant change ($\pm 5\%$).

- 33 out of 79 have decreased by more than 20% and 27 out of 69 water bodies have shown increase in area by more than 20%.

October 2020

The analysis of water spread area of glacial lakes & water bodies monitored in October 2020 was done for only 372 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 115 glacial lakes & water bodies have shown decrease in water spread area, 136 have shown increase and 121 have not shown any significant change ($\pm 5\%$).
- 35 out of 115 have decreased by more than 20% and 52 out of 136 water bodies have shown increase in area by more than 20%.

Table 2 List of glacial lakes & water bodies monitored during the year 2020

Month	Monitored	Increased			Decreased			No Change
		> 20%	< 20%	Total	> 20%	< 20%	Total	
Jun-2020	218	64	83	147	12	14	26	45
Jul-2020	173	33	71	104	09	19	28	41
Aug-2020	267	49	69	118	27	43	70	79
Sep-2020	222	27	42	69	33	46	79	74
Oct-2020	372	52	84	136	35	80	115	121

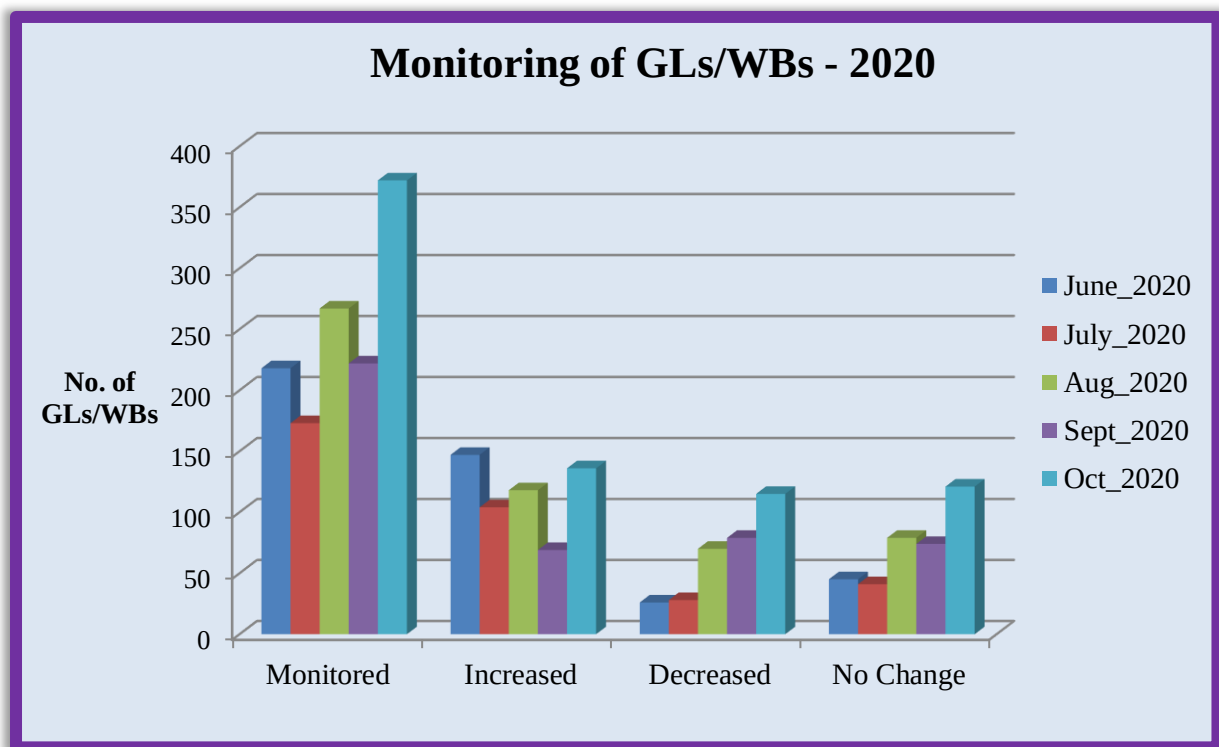


Figure 2: Glacial Lakes/Water Bodies Monitored during the year 2020

5. Conclusions

5.1 Conclusions

- i. GL & WB having UID's CH_6, CH_33, CH_36, CH_38, CH_39, CH_55, CH_59, HP_3, HP_5, JK_85, JK_159, JK_187 may affect Jammu & Kashmir including Ladakh, CH_1, CH_101, HP_3, HP_5, HP_12 may affect Himachal Pradesh, HP_12 may affect Punjab, CH_132, CH_159, CH_165, CH_188, CH_206, CH_244, NP_45, NP_64 may affect Bihar, SK_5, SK_20, SK_26 may affect Sikkim and West Bengal, CH_369, CH_404, CH_423, CH_426, CH_446, CH_551, CH_590, CH_593, CH_834, CH_849, CH_858, CH_1076, CH_1079 may affect Arunachal Pradesh & CH_369, CH_404, CH_423, CH_426, CH_446, CH_551, CH_590, CH_593, CH_834, CH_849, CH_858, CH_1076, CH_1079, SK_5, SK_20, SK_26 may affect Assam respectively as these GLs/WBs have shown increase in water spread area by 40%. These Glacial Lakes/Water Bodies are shown in **Table 3(a)** and **requires vigorous monitoring in order to avoid any future disaster.**
- ii. Water spread area of glacial lakes & water bodies showing Increase in water spread area (>20%) are shown in **Table 3(b)**. Last four year trends of this glacial lakes & water bodies have been also shown for comparison. **These Glacial lakes & water bodies requires continuous monitoring in order to avoid any future disaster.**
- iii. Water spread area of glacial lakes & water bodies showing Decrease in water spread area (>20%) are shown in **Table 3(c)**. Last four year trends of this glacial lakes & water bodies have been also shown for comparison.

Table 3 (a): List of GL & WB that have shown INCREASE in water spread area (> 40%)

S. No.	UID	Lake_ID	%Diff in Water Spread Area					State	Country	Basin	River	State/UT which may likely to affect
			2020	2019	2018	2017	2016					
1.	CH_33	01_61C_005	273.38	238.13	176.63	-54.99	150.39		China	Indus	Indus	J&K/Ladakh
2.	HP_5	01_52H_004	260.87	252.17	243.48	157.89	202.17	HP	India	Indus	Chenab	HP, J&K/Ladakh
3.	CH_206	02_71P_018	203.92	74.51	-3.92	-11.25	-17.49		China	Ganga	ArunKosi	Bihar
4.	CH_1	01_52L_008	148.00	140.00	147.54	85.84	99.42		China	Indus	Satluj	HP
5.	HP_12	01_53E_001	140.28	98.61	90.54	81.65	79.54	HP	India	Indus	Beas	HP, Punjab
6.	CH_551	03_77L_042	96.00	104.00	62	Cloud	49.52		China	Brahmaputra	Kuri Chu	AP, Assam
7.	CH_423	03_71G_014	86.43	95.71	78.57	22.21	-18.73		China	Brahmaputra		AP, Assam
8.	CH_593	03_77P_023	82.22	82.22	Cloud	-9.84	44.18		China	Brahmaputra	Kuri Chu	AP, Assam
9.	CH_849	03_82J_019	82.22	82.22	80.19	Cloud	Cloud		China	Brahmaputra		AP, Assam
10.	CH_244	02_72I_004	73.55	97.52	75.21	71.93	86.55		China	Ganga	Sun Kosi	Bihar
11.	CH_404	03_71C_011	72.27	52.10	18.49	11.33	2.56		China	Brahmaputra		AP, Assam
12.	JK_85	01_43J_007	71.58	38.95	1.05	0.35	32.65	J&K/Ladakh	India	Indus	Jhelum	J&K/Ladakh
13.	HP_3	01_52H_002	70.97	72.58	74.58	44.58	29.27	HP	India	Indus	Chenab	HP, J&K/Ladakh
14.	CH_188	02_71L_034	69.57	89.13	73.91	29.98	34.22		China	Ganga	Sun Kosi	Bihar
15.	NP_64	02_72I_011	69.00	92.00	75	44.68	56.65	Nepal	Nepal	Ganga	Sun Kosi	Bihar
16.	CH_101	01_62F_010	68.89	64.44	85.66	49.72	Cloud		China	Indus	Satluj	HP
17.	JK_159	01_43N_032	65.31	34.69	34.69	30.08	21.71	J&K/Ladakh	India	Indus	Jhelum	J&K/Ladakh
18.	CH_55	01_61D_003	63.04	65.22	63.41	66.98	26.46		China	Indus	Indus	J&K/Ladakh
19.	SK_20	03_78A_014	59.57	65.96	65.96	5.2	Cloud	Sikkim	India	Brahmaputra	Teesta	Sikkim, West Bengal & Assam
20.	CH_132	02_71H_012	59.55	56.18	56.18	42.15	Cloud		China	Ganga	Arun Kosi	Bihar
21.	CH_38	01_61C_010	59.09	61.36	35.23	27.78	656.22		China	Indus	Indus	J&K/Ladakh
22.	CH_426	03_71K_003	58.33	72.22	23.61	-6.54	-11.11		China	Brahmaputra		AP, Assam
23.	CH_39	01_61C_011	53.43	45.59	33.33	27.3	Cloud		China	Indus	Indus	J&K/Ladakh
24.	NP_45	02_71D_004	51.35	45.95	45.95	22.96	Cloud	Nepal	Nepal	Ganga	Trisuli	Bihar
25.	CH_59	01_61F_002	50.91	21.82	-5.7	8.8	20		China	Indus	Indus	J&K/Ladakh
26.	CH_590	03_77P_019	50.91	64.09	4.19	4.19	-2.86		China	Brahmaputra	Dangme Chu	AP, Assam
27.	CH_6	01_52O_003	50.68	71.62	40.54	48.13	54.95		China	Indus	Indus	J&K/Ladakh
28.	JK_187	01_52C_003	48.89	73.33	73.33	27.36	35.56	J&K/Ladakh	India	Indus	Indus	J&K/Ladakh

S. No.	UID	Lake_ID	%Diff in Water Spread Area					State	Country	Basin	River	State/UT which may likely to affect
			2020	2019	2018	2017	2016					
29.	CH_834	03_82J_004	48.68	57.41	48.05	45.7	Cloud		China	Brahmaputra		AP, Assam
30.	CH_1079	03_91C_033	47.06	6.54	16.76	-0.52	11.33		China	Brahmaputra		AP, Assam
31.	CH_1076	03_91C_025	45.36	54.64	32.99	7.46	7.35		China	Brahmaputra		AP, Assam
32.	CH_858	03_82K_002	45.33	10.67	Cloud	Cloud	-5.71		China	Brahmaputra		AP, Assam
33.	SK_26	03_78A_021	44.64	37.50	-39.29	-87.99	-81.87	Sikkim	India	Brahmaputra	Teesta	Sikkim, West Bengal & Assam
34.	CH_36	01_61C_008	44.37	44.37	18.54	15.32	19.38		China	Indus	Indus	J&K/Ladakh
35.	CH_446	03_71O_010	43.67	45.51	7.75	77.54	1.99		China	Brahmaputra		AP, Assam
36.	CH_165	02_71L_010	42.55	38.30	38.3	9.92	21.89		China	Ganga	Sun Kosi	Bihar
37.	CH_369	03_62O_024	42.16	43.83	19.97	9.45	3.23		China	Brahmaputra		AP, Assam
38.	CH_159	02_71L_004	40.70	54.65	35.26	38.86	Cloud		China	Ganga	ArunKosi	Bihar
39.	SK_5	03_77D_005	40.51	49.37	41.77	-23.83	Cloud	Sikkim	India	Brahmaputra	Teesta	Sikkim, West Bengal & Assam

Table 3 (b) – Comparison of Water Spread Area for lakes showing INCREASE in water spread area (>20%) from 2016 – 2020 with inventory area

S. No.	UID	Lake_ID	Water spread area in Ha	%Diff in Water Spread Area				
			2009 (Inventory)	2020	2019	2018	2017	2016
1.	CH_33	01_61C_005	139	273.38	238.13	176.63	-54.99	150.39
2.	HP_5	01_52H_004	46	260.87	252.17	243.48	157.89	202.17
3.	CH_206	02_71P_018	51	203.92	74.51	-3.92	-11.25	-17.49
4.	CH_1	01_52L_008	50	148.00	140.00	147.54	85.84	99.42
5.	HP_12	01_53E_001	72	140.28	98.61	90.54	81.65	79.54
6.	CH_551	03_77L_042	50	96.00	104.00	62	Cloud	49.52
7.	CH_423	03_71G_014	140	86.43	95.71	78.57	22.21	-18.73
8.	CH_593	03_77P_023	45	82.22	82.22	Cloud	-9.84	44.18
9.	CH_849	03_82J_019	45	82.22	82.22	80.19	Cloud	Cloud
10.	CH_244	02_72I_004	121	73.55	97.52	75.21	71.93	86.55
11.	CH_404	03_71C_011	119	72.27	52.10	18.49	11.33	2.56
12.	JK_85	01_43J_007	95	71.58	38.95	1.05	0.35	32.65
13.	HP_3	01_52H_002	62	70.97	72.58	74.58	44.58	29.27
14.	CH_188	02_71L_034	46	69.57	89.13	73.91	29.98	34.22
15.	NP_64	02_72I_011	100	69.00	92.00	75	44.68	56.65
16.	CH_101	01_62F_010	45	68.89	64.44	85.66	49.72	Cloud
17.	JK_159	01_43N_032	49	65.31	34.69	34.69	30.08	21.71
18.	CH_55	01_61D_003	46	63.04	65.22	63.41	66.98	26.46
19.	SK_20	03_78A_014	94	59.57	65.96	65.96	5.2	Cloud
20.	CH_132	02_71H_012	89	59.55	56.18	56.18	42.15	Cloud
21.	CH_38	01_61C_010	88	59.09	61.36	35.23	27.78	656.22
22.	CH_426	03_71K_003	72	58.33	72.22	23.61	-6.54	-11.11
23.	CH_39	01_61C_011	408	53.43	45.59	33.33	27.3	Cloud
24.	NP_45	02_71D_004	74	51.35	45.95	45.95	22.96	Cloud
25.	CH_59	01_61F_002	55	50.91	21.82	-5.7	8.8	20
26.	CH_590	03_77P_019	220	50.91	64.09	4.19	4.19	-2.86
27.	CH_6	01_52O_003	148	50.68	71.62	40.54	48.13	54.95
28.	JK_187	01_52C_003	45	48.89	73.33	73.33	27.36	35.56
29.	CH_834	03_82J_004	378	48.68	57.41	48.05	45.7	Cloud
30.	CH_1079	03_91C_033	153	47.06	6.54	16.76	-0.52	11.33

S. No.	UID	Lake_ID	Water spread area in Ha	%Diff in Water Spread Area				
			2009 (Inventory)	2020	2019	2018	2017	2016
31.	CH_1076	03_91C_025	97	45.36	54.64	32.99	7.46	7.35
32.	CH_858	03_82K_002	75	45.33	10.67	Cloud	Cloud	-5.71
33.	SK_26	03_78A_021	56	44.64	37.50	-39.29	-87.99	-81.87
34.	CH_36	01_61C_008	151	44.37	44.37	18.54	15.32	19.38
35.	CH_446	03_71O_010	813	43.67	45.51	7.75	77.54	1.99
36.	CH_165	02_71L_010	47	42.55	38.30	38.3	9.92	21.89
37.	CH_369	03_62O_024	721	42.16	43.83	19.97	9.45	3.23
38.	CH_159	02_71L_004	86	40.70	54.65	35.26	38.86	Cloud
39.	SK_5	03_77D_005	79	40.51	49.37	41.77	-23.83	Cloud
40.	CH_524	03_77L_008	85	40.00	22.35	1.18	-9.89	5.67
41.	CH_53	01_61D_001	70	38.57	34.29	30.14	28.93	-75.69
42.	CH_347	03_62O_002	52	38.46	26.92	5.77	-22.27	-12.52
43.	CH_316	03_62K_012	73	38.36	32.88	24.66	12.35	18.77
44.	CH_552	03_77L_043	181	38.12	41.99	37.02	-21.84	Cloud
45.	SK_19	03_78A_013	63	38.10	66.67	57.07	28.29	60.98
46.	CH_235	02_71P_047	71	36.62	53.52	35.21	20.65	Cloud
47.	CH_288	03_62J_016	44	36.36	54.55	43.18	9.75	11.91
48.	CH_183	02_71L_028	77	36.36	64.94	18.18	25.26	49.44
49.	CH_43	01_61C_015	742	36.25	21.29	17.85	5.77	-5.62
50.	CH_545	03_77L_029	45	35.56	48.89	24.44	45.51	10.84
51.	CH_438	03_71O_002	48	35.42	47.92	16.67	-27.71	119.21
52.	CH_838	03_82J_008	156	34.62	40.38	40.4	Cloud	Cloud
53.	CH_298	03_62J_026	103	33.98	37.86	36.89	24.7	22.14
54.	JK_115	01_43K_014	112	33.93	41.96	41.07	23.57	14.65
55.	CH_420	03_71G_011	1192	33.64	37.58	33.05	7.27	-6.14
56.	CH_303	03_62J_031	166	33.13	50.00	46.99	36.51	22.75
57.	CH_375	03_62O_030	97	32.99	32.99	23.71	27.54	-6.71
58.	CH_128	02_71H_008	94	32.98	37.23	31.91	14.98	4.87
59.	CH_432	03_71K_009	170	32.94	90.00	46.47	35.3	26.19
60.	NP_92	02_72M_016	161	32.92	31.06	27.33	14.94	-74.55
61.	CH_621	03_82A_002	319	32.92	64.89	21.94	8.37	14.86
62.	NP_67	02_72I_014	137	32.12	44.53	21.9	20.37	Cloud
63.	CH_40	01_61C_012	290	31.38	27.59	23.13	13.89	0.04

S. No.	UID	Lake_ID	Water spread area in Ha	%Diff in Water Spread Area				
			2009 (Inventory)	2020	2019	2018	2017	2016
64.	CH_313	03_62K_009	250	31.20	34.40	29.2	22.25	26.17
65.	CH_422	03_71G_013	244	31.15	47.54	37.3	19.99	Cloud
66.	JK_23	01_43A_002	91	30.77	26.37	26.37	9.56	17.08
67.	CH_377	03_62O_032	49	30.61	32.65	20.41	31.1	-4.57
68.	CH_1075	03_91C_024	239	30.13	32.22	40.68	31.5	10.31
69.	CH_217	02_71P_029	80	30.00	91.25	16.25	21.21	Cloud
70.	HP_1	01_52D_001	688	29.94	32.12	32.25	29.05	26.13
71.	CH_271	02_78A_005	89	29.21	46.07	39.14	29.66	153.70
72.	CH_396	03_71C_003	47	27.66	27.66	27.66	6.96	6.96
73.	CH_526	03_77L_010	47	27.66	23.40	4.26	-38.06	-11.89
74.	JK_67	01_43G_001	22154	27.34	20.80	20.8	21.2	-1.34
75.	CH_924	03_82K_068	52	26.92	15.38	0.24	-2.83	-16.69
76.	CH_448	03_71P_001	112	26.79	36.61	19.73	26.1	27.05
77.	JK_100	01_43J_022	60	26.67	26.67	3.33	6.7	0.89
78.	JK_195	01_52I_003	180	26.67	30.00	29.44	24.12	23.42
79.	CH_304	03_62J_032	77	25.97	28.57	40.59	21.32	21.95
80.	CH_46	01_61C_018	1779	25.80	25.41	15.06	13.3	0.97
81.	CH_30	01_61C_002	685	25.40	25.84	21.84	18.52	30.17
82.	JK_147	01_43N_020	63	25.40	17.46	-1.22	-9.71	10.56
83.	CH_547	03_77L_032	88	25.00	31.82	-18.66	Cloud	12.77
84.	JK_205	01_52J_009	57	24.56	42.11	25.32	-6.53	Cloud
85.	CH_387	03_62O_042	57	24.56	24.56	3.51	-5.32	7.04
86.	SK_4	03_77D_004	106	24.53	43.40	31.13	22.23	22.23
87.	CH_385	03_62O_040	107	24.30	21.50	21.25	22.96	29.36
88.	CH_78	01_62E_003	136	23.53	30.15	22.79	14.17	5.47
89.	NP_49	02_71D_008	98	23.47	15.31	12.24	-4.73	15.12
90.	JK_5	01_42H_005	52	23.08	32.69	23.08	25.11	-11.63
91.	JK_167	01_43P_002	52	23.08	23.08	25.67	19.69	7.96
92.	CH_178	02_71L_023	116	22.41	26.72	29.31	6.09	17.02
93.	CH_204	02_71P_016	137	21.90	27.01	15.13	17.37	-100
94.	CH_90	01_62E_015	51	21.57	5.88	8.95	-5.97	-19.84
95.	CH_936	03_82K_080	47	21.28	2.13	1.55	0.31	0.32
96.	BH_22	03_77L_051	143	20.98	42.66	24.48	-5.12	Cloud

S. No.	UID	Lake_ID	Water spread area in Ha	%Diff in Water Spread Area				
			2009 (Inventory)	2020	2019	2018	2017	2016
97.	BH_36	03_77L_068	86	20.93	15.12	0.42	Cloud	-2.55
98.	CH_564	03_77O_001	154	20.78	25.97	27.13	18.96	16.72
99.	CH_63	01_61G_002	1134	20.37	20.19	17.11	11.67	10.85
100.	CH_580	03_77P_009	94	20.21	25.53	22.33	18.5	11.2
101.	CH_269	02_78A_003	124	20.16	37.90	33.87	22.35	-12.9

Table 3 (c) – Comparison of Water Spread Area for lakes showing DECREASE in water spread area (>20%) from 2016 – 2020 with inventory area

S. No.	UID	Lake_ID	Water spread area in Ha	%Diff in Water Spread Area				
			2009 (Inventory)	2020	2019	2018	2017	2016
1.	UK_2	02_53K_002	1597	-20.66	-3.82	-8.27	-16.62	-54.38
2.	CH_770	03_82G_009	51	-21.57	13.73	6.89	-9.80	84.43
3.	CH_576	03_77P_005	110	-21.82	9.09	7.55	-4.78	27.94
4.	CH_716	03_82D_010	76	-22.37	-7.89	0.35	-77.53	39.47
5.	CH_609	03_78E_017	65	-23.08	Cloud	-4.62	-14.63	2.17
6.	CH_809	03_82G_048	55	-23.64	-3.64	-4.38	-27.64	-27.04
7.	AP_163	03_91D_107	67	-23.88	-1.49	Cloud	-11.93	0
8.	AP_85	03_91C_038	113	-27.43	Cloud	1.03	-17.89	3.98
9.	CH_73	01_62B_001	440	-27.73	-2.73	-2.60	-26.14	-18.94
10.	CH_258	02_77D_003	88	-31.82	21.59	7.95	12.52	Cloud
11.	CH_419	03_71G_010	304	-33.55	18.75	16.52	2.74	-18.66
12.	CH_479	03_77H_004	201	-35.82	0.00	7.75	-3.57	-37.31
13.	CH_256	02_77D_001	5831	-36.32	-18.28	-18.28	-38.10	-75.97
14.	UK_8	02_53O_005	1510	-36.82	26.09	26.09	21.17	-6.21
15.	UK_10	02_53P_002	734	-50.68	-39.10	-38.56	-40.59	-36.48
16.	JK_196	01_52I_004	124	-53.23	-29.84	-6.82	-16.63	-25.49
17.	CH_259	02_77D_004	1273	-63.00	-38.10	-1.96	-41.75	-41.75
18.	NP_41	02_63M_002	153	-65.36	-1.31	-0.12	-33.76	-33.76
19.	JK_188	01_52E_001	51	-74.51	-80.39	Dry	Dry	-11.35
20.	CH_478	03_77H_003	208	-83.65	40.87	-6.73	-85.01	-85.01

Table 4 - Comparison of all GL & WB with change in water spread area during 2020 with Inventory area 2009

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
1.	CH_33	01_61C_005			China	Indus	Indus	139	503	516	519	499	498	519.00	273.38
2.	HP_5	01_52H_004	HP	Lahul and Spiti	India	Indus	Chenab	46	166	Cloud	160	Cloud	140	166.00	260.87
3.	CH_206	02_71P_018			China	Ganga	Arun Kosi	51	Cloud	Cloud	90	108	155	155.00	203.92
4.	CH_1	01_52L_008			China	Indus	Satluj	50	124	Cloud	Cloud	Cloud	124	124.00	148.00
5.	HP_12	01_53E_001	HP	Mandi	India	Indus	Beas	72	173	Cloud	114	Cloud	90	173.00	140.28
6.	CH_551	03_77L_042			China	Brahmaputra	Kuri Chu	50	98	Cloud	76	Cloud	70	98.00	96.00
7.	CH_423	03_71G_014			China	Brahmaputra		140	Cloud	Cloud	261	259	258	261.00	86.43
8.	CH_593	03_77P_023			China	Brahmaputra	Kuri Chu	45	Cloud	82	Cloud	Cloud	66	82.00	82.22
9.	CH_849	03_82J_019			China	Brahmaputra		45	Cloud	Cloud	82	77	Cloud	82.00	82.22
10.	CH_244	02_72I_004			China	Ganga	Sun Kosi	121	210	Cloud	193	Cloud	176	210.00	73.55
11.	CH_404	03_71C_011			China	Brahmaputra		119	205	Cloud	173	176	169	205.00	72.27
12.	JK_85	01_43J_007	J&K/ Ladakh		India	Indus	Jhelum	95	Cloud	Cloud	Cloud	Cloud	163	163.00	71.58
13.	HP_3	01_52H_002	HP	Lahul and Spiti	India	Indus	Chenab	62	106	Cloud	105	88	99	106.00	70.97
14.	CH_188	02_71L_034			China	Ganga	Sun Kosi	46	78	Cloud	68	Cloud	74	78.00	69.57
15.	NP_64	02_72I_011	Nepal		Nepal	Ganga	Sun Kosi	100	169	163	150	148	156	169.00	69.00
16.	CH_101	01_62F_010			China	Indus	Satluj	45	74	76	Cloud	66	62	76.00	68.89
17.	JK_159	01_43N_032	J&K/ Ladakh	Anantnag (Kashmir South)	India	Indus	Jhelum	49	81	58	59	58	60	81.00	65.31
18.	CH_55	01_61D_003			China	Indus	Indus	46	75	53	43	22	25	75.00	63.04

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
19.	SK_20	03_78A_014	Sikkim	North Sikkim	India	Brahmaputra	Teesta	94	Cloud	Cloud	148	Cloud	150	150.00	59.57
20.	CH_132	02_71H_012			China	Ganga	Arun Kosi	89	Cloud	142	134	Cloud	130	142.00	59.55
21.	CH_38	01_61C_010			China	Indus	Indus	88	135	140	140	121	125	140.00	59.09
22.	CH_426	03_71K_003			China	Brahmaputra		72	114	Cloud	98	94	104	114.00	58.33
23.	CH_39	01_61C_011			China	Indus	Indus	408	618	626	608	608	602	626.00	53.43
24.	NP_45	02_71D_004	Nepal		Nepal	Ganga	Trisuli	74	112	Cloud	97	Cloud	95	112.00	51.35
25.	CH_59	01_61F_002			China	Indus	Indus	55	83	53	Cloud	58	54	83.00	50.91
26.	CH_590	03_77P_019			China	Brahmaputra	Dangme Chu	220	Cloud	Cloud	Cloud	Cloud	332	332.00	50.91
27.	CH_6	01_52O_003			China	Indus	Indus	148	223	221	185	189	204	223.00	50.68
28.	JK_187	01_52C_003	J&K/ Ladakh	Kargil	India	Indus	Indus	45	67	Cloud	61	Cloud	58	67.00	48.89
29.	CH_834	03_82J_004			China	Brahmaputra		378	Cloud	Cloud	562	552	558	562.00	48.68
30.	CH_1079	03_91C_033			China	Brahmaputra		153	Cloud	225	Cloud	188	Cloud	225.00	47.06
31.	CH_1076	03_91C_025			China	Brahmaputra		97	Cloud	141	Cloud	106	112	141.00	45.36
32.	CH_858	03_82K_002			China	Brahmaputra		75	Cloud	109	Cloud	Cloud	Cloud	109.00	45.33
33.	SK_26	03_78A_021	Sikkim	North Sikkim	India	Brahmaputra	Teesta	56	Cloud	Cloud	68	Cloud	81	81.00	44.64
34.	CH_36	01_61C_008			China	Indus	Indus	151	211	218	214	200	208	218.00	44.37
35.	CH_446	03_71O_010			China	Brahmaputra		813	1168	1143	1095	1103	1030	1168.00	43.67
36.	CH_165	02_71L_010			China	Ganga	Sun Kosi	47	67	Cloud	56	Cloud	53	67.00	42.55
37.	CH_369	03_62O_024			China	Brahmaputra		721	1022	1025	997	997	976	1025.00	42.16
38.	CH_159	02_71L_004			China	Ganga	Arun Kosi	86	119	Cloud	118	Cloud	121	121.00	40.70
39.	SK_5	03_77D_005	Sikkim	North Sikkim	India	Brahmaputra	Teesta	79	111	Cloud	Cloud	104	99	111.00	40.51
40.	CH_524	03_77L_008			China	Brahmaputra		85	114	119	Cloud	76	81	119.00	40.00
41.	CH_53	01_61D_001			China	Indus	Indus	70	97	Cloud	Cloud	72	64	97.00	38.57

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
42.	CH_347	03_62O_002			China	Brahmaputra		52	72	62	53	Cloud	47	72.00	38.46
43.	CH_316	03_62K_012			China	Brahmaputra		73	101	Cloud	92	Cloud	88	101.00	38.36
44.	CH_552	03_77L_043			China	Brahmaputra	Kuri Chu	181	250	Cloud	232	Cloud	237	250.00	38.12
45.	SK_19	03_78A_013	Sikkim	North Sikkim	India	Brahmaputra	Teesta	63	Cloud	Cloud	71	69	87	87.00	38.10
46.	CH_235	02_71P_047			China	Ganga	Arun Kosi	71	97	Cloud	90	Cloud	88	97.00	36.62
47.	CH_288	03_62J_016			China	Brahmaputra		44	Cloud	60	Cloud	52	51	60.00	36.36
48.	CH_183	02_71L_028			China	Ganga	Sun Kosi	77	Cloud	Cloud	105	Cloud	104	105.00	36.36
49.	CH_43	01_61C_015			China	Indus	Indus	742	1011	948	906	841	851	1011.00	36.25
50.	CH_545	03_77L_029			China	Brahmaputra	Kuri Chu	45	61	Cloud	Cloud	41	52	61.00	35.56
51.	CH_438	03_71O_002			China	Brahmaputra		48	63	59	65	53	61	65.00	35.42
52.	CH_838	03_82J_008			China	Brahmaputra		156	Cloud	Cloud	210	197	Cloud	210.00	34.62
53.	CH_298	03_62J_026			China	Brahmaputra		103	136	138	Cloud	123	129	138.00	33.98
54.	JK_115	01_43K_014	J&K/ Ladakh	Anantnag (Kashmir South)	India	Indus	Jhelum	112	130	Cloud	Cloud	150	138	150.00	33.93
55.	CH_420	03_71G_011			China	Brahmaputra		1192	Cloud	1583	1593	1580	1581	1593.00	33.64
56.	CH_303	03_62J_031			China	Brahmaputra		166	215	221	Cloud	208	211	221.00	33.13
57.	CH_375	03_62O_030			China	Brahmaputra		97	129	Cloud	101	Cloud	97	129.00	32.99
58.	CH_128	02_71H_008			China	Ganga	Arun Kosi	94	125	113	108	Cloud	108	125.00	32.98
59.	CH_432	03_71K_009			China	Brahmaputra		170	Cloud	Cloud	226	Cloud	214	226.00	32.94
60.	NP_92	02_72M_016	Nepal		Nepal	Ganga	Arun Kosi	161	Cloud	Cloud	214	Cloud	213	214.00	32.92
61.	CH_621	03_82A_002			China	Brahmaputra		319	424	Cloud	367	Cloud	377	424.00	32.92
62.	NP_67	02_72I_014	Nepal		Nepal	Ganga	Sun Kosi	137	180	Cloud	181	175	167	181.00	32.12
63.	CH_40	01_61C_012			China	Indus	Indus	290	381	Cloud	349	320	326	381.00	31.38
64.	CH_313	03_62K_009			China	Brahmaputra		250	Cloud	328	323	301	311	328.00	31.20

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
65.	CH_422	03_71G_013			China	Brahmaputra		244	Cloud	Cloud	320	217	161	320.00	31.15
66.	JK_23	01_43A_002	J&K/ Ladakh		India	Indus	Gilgit	91	Cloud	119	111	86	Cloud	119.00	30.77
67.	CH_377	03_62O_032			China	Brahmaputra		49	64	53	55	51	52	64.00	30.61
68.	CH_1075	03_91C_024			China	Brahmaputra		239	Cloud	311	Cloud	279	290	311.00	30.13
69.	CH_217	02_71P_029			China	Ganga	Arun Kosi	80	Cloud	Cloud	102	Cloud	104	104.00	30.00
70.	HP_1	01_52D_001	HP	Chamba	India	Indus	Ravi	688	894	818	809	795	794	894.00	29.94
71.	CH_271	02_78A_005			China	Ganga	Arun Kosi	89	Cloud	Cloud	Cloud	Cloud	115	115.00	29.21
72.	CH_396	03_71C_003			China	Brahmaputra		47	60	47	49	45	48	60.00	27.66
73.	CH_526	03_77L_010			China	Brahmaputra		47	47	60	43	Cloud	34	60.00	27.66
74.	JK_67	01_43G_001	J&K/ Ladakh		India	Indus	Jhelum	22154	Cloud	Cloud	Cloud	28210	26121	28210.00	27.34
75.	CH_924	03_82K_068			China	Brahmaputra		52	66	Cloud	Cloud	Cloud	Cloud	66.00	26.92
76.	CH_448	03_71P_001			China	Brahmaputra		112	142	Cloud	137	124	126	142.00	26.79
77.	JK_100	01_43J_022	J&K/ Ladakh	Baramula (Kashmir North)	India	Indus	Jhelum	60	76	68	56	62	62	76.00	26.67
78.	JK_195	01_52I_003	J&K/ Ladakh		India	Indus	Shyok	180	228	221	206	211	201	228.00	26.67
79.	CH_304	03_62J_032			China	Brahmaputra		77	Cloud	97	Cloud	85	88	97.00	25.97
80.	CH_46	01_61C_018			China	Indus	Indus	1779	2238	Cloud	2084	2038	2086	2238.00	25.80
81.	CH_30	01_61C_002			China	Indus	Indus	685	859	855	854	841	834	859.00	25.40
82.	JK_147	01_43N_020	J&K/ Ladakh		India	Indus	Jhelum	63	69	79	Cloud	63	59	79.00	25.40
83.	CH_547	03_77L_032			China	Brahmaputra	Kuri Chu	88	Cloud	Cloud	110	Cloud	107	110.00	25.00
84.	JK_205	01_52J_009	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	57	Cloud	Cloud	71	52	52	71.00	24.56
85.	CH_387	03_62O_042			China	Brahmaputra		57	71	Cloud	62	59	55	71.00	24.56

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
86.	SK_4	03_77D_004	Sikkim	North Sikkim	India	Brahmaputra	Teesta	106	Cloud	Cloud	107	109	132	132.00	24.53
87.	CH_385	03_62O_040			China	Brahmaputra		107	133	130	122	115	107	133.00	24.30
88.	CH_78	01_62E_003			China	Indus	Indus	136	168	150	Cloud	Cloud	146	168.00	23.53
89.	NP_49	02_71D_008	Nepal		Nepal	Ganga	Trisuli	98	121	Cloud	Cloud	Cloud	107	121.00	23.47
90.	JK_5	01_42H_005	J&K/ Ladakh		India	Indus	Gilgit	52	62	62	64	42	Cloud	64.00	23.08
91.	JK_167	01_43P_002	J&K/ Ladakh	Jammu	India	Indus	Ravi	52	64	Cloud	59	Cloud	54	64.00	23.08
92.	CH_178	02_71L_023			China	Ganga	Arun Kosi	116	140	142	127	127	126	142.00	22.41
93.	CH_204	02_71P_016			China	Ganga	Arun Kosi	137	167	164	84	82	69	167.00	21.90
94.	CH_90	01_62E_015			China	Indus	Satluj	51	62	53	Cloud	Cloud	48	62.00	21.57
95.	CH_936	03_82K_080			China	Brahmaputra		47	Cloud	Cloud	57	Cloud	57	57.00	21.28
96.	BH_22	03_77L_051			Bhutan	Brahmaputra	Puna Tsang Chu	143	173	Cloud	164	Cloud	Cloud	173.00	20.98
97.	BH_36	03_77L_068			Bhutan	Brahmaputra	Kuri Chu	86	104	Cloud	72	Cloud	85	104.00	20.93
98.	CH_564	03_77O_001			China	Brahmaputra		154	186	Cloud	183	Cloud	169	186.00	20.78
99.	CH_63	01_61G_002			China	Indus	Indus	1134	1362	1365	1357	1339	1331	1365.00	20.37
100.	CH_580	03_77P_009			China	Brahmaputra		94	113	Cloud	101	99	101	113.00	20.21
101.	CH_269	02_78A_003			China	Ganga	Arun Kosi	124	Cloud	Cloud	146	149	146	149.00	20.16
102.	CH_525	03_77L_009			China	Brahmaputra		522	626	607	562	Cloud	556	626.00	19.92
103.	NP_78	02_72I_025	Nepal		Nepal	Ganga	Sun Kosi	106	Cloud	Cloud	107	Cloud	127	127.00	19.81
104.	CH_550	03_77L_041			China	Brahmaputra	Kuri Chu	56	Cloud	Cloud	Cloud	Cloud	67	67.00	19.64
105.	JK_3	01_42H_003	J&K/ Ladakh		India	Indus	Gilgit	97	Cloud	115	116	Cloud	Cloud	116.00	19.59
106.	CH_623	03_82A_004			China	Brahmaputra		46	55	53	44	45	47	55.00	19.57
107.	CH_631	03_82B_005			China	Brahmaputra		195	188	233	215	Cloud	219	233.00	19.49

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
108.	CH_44	01_61C_016			China	Indus	Indus	344	411	388	Cloud	361	361	411.00	19.48
109.	BH_99	03_78I_018			Bhutan	Brahmaputra	Puna Tsang Chu	63	Cloud	Cloud	75	Cloud	Cloud	75.00	19.05
110.	CH_720	03_82E_002			China	Brahmaputra		659	783	Cloud	699	Cloud	674	783.00	18.82
111.	SK_3	03_77D_003	Sikkim	North Sikkim	India	Brahmaputra	Teesta	96	114	Cloud	Cloud	96	103	114.00	18.75
112.	CH_383	03_62O_038			China	Brahmaputra		124	147	Cloud	132	129	130	147.00	18.55
113.	CH_483	03_77H_012			China	Brahmaputra		76	80	90	Cloud	63	69	90.00	18.42
114.	CH_42	01_61C_014			China	Indus	Indus	286	338	332	329	303	319	338.00	18.18
115.	CH_122	02_71H_002			China	Ganga	Arun Kosi	2152	2543	2541	2518	2518	2513	2543.00	18.17
116.	CH_66	01_61H_001			China	Indus	Indus	282	333	320	311	279	306	333.00	18.09
117.	CH_52	01_61C_024			China	Indus	Indus	4486	5295	5280	Cloud	5268	5267	5295.00	18.03
118.	SK_9	03_78A_001	Sikkim	North Sikkim	India	Brahmaputra	Teesta	156	Cloud	Cloud	175	Cloud	184	184.00	17.95
119.	CH_203	02_71P_015			China	Ganga	Arun Kosi	1012	1192	1140	1164	1164	1014	1192.00	17.79
120.	HP_6	01_52H_005	HP	Lahul and Spiti	India	Indus	Chenab	45	53	Cloud	51	36	42	53.00	17.78
121.	CH_306	03_62K_002			China	Brahmaputra		45	53	51	44	Cloud	48	53.00	17.78
122.	BH_12	03_77L_030			Bhutan	Brahmaputra		79	93	84	Cloud	77	86	93.00	17.72
123.	CH_430	03_71K_007			China	Brahmaputra		80	94	Cloud	94	58	76	94.00	17.50
124.	CH_635	03_82B_009			China	Brahmaputra		156	183	Cloud	Cloud	Cloud	171	183.00	17.31
125.	JK_47	01_43E_023	J&K/ Ladakh		India	Indus	Gilgit	82	Cloud	96	Cloud	Cloud	87	96.00	17.07
126.	CH_80	01_62E_005			China	Indus	Indus	189	221	212	Cloud	126	181	221.00	16.93
127.	JK_120	01_43M_003	J&K/ Ladakh		India	Indus	Shigar (Indus)	208	Cloud	242	243	235	213	243.00	16.83
128.	CH_654	03_82B_028			China	Brahmaputra		48	Cloud	Cloud	56	Cloud	52	56.00	16.67

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
129.	CH_231	02_71P_043			China	Ganga	Arun Kosi	66	Cloud	Cloud	70	Cloud	77	77.00	16.67
130.	CH_543	03_77L_027			China	Brahmaputra	Kuri Chu	163	Cloud	Cloud	190	Cloud	180	190.00	16.56
131.	CH_442	03_71O_006			China	Brahmaputra		104	121	Cloud	108	Cloud	110	121.00	16.35
132.	CH_261	02_77D_006			China	Ganga	Arun Kosi	80	93	93	90	84	89	93.00	16.25
133.	CH_529	03_77L_013			China	Brahmaputra		318	Cloud	369	Cloud	327	343	369.00	16.04
134.	CH_628	03_82B_002			China	Brahmaputra		405	468	Cloud	459	Cloud	452	468.00	15.56
135.	CH_270	02_78A_004			China	Ganga	Arun Kosi	84	Cloud	Cloud	86	97	84	97.00	15.48
136.	CH_640	03_82B_014			China	Brahmaputra		157	181	Cloud	154	Cloud	149	181.00	15.29
137.	JK_149	01_43N_022	J&K/ Ladakh		India	Indus	Jhelum	72	Cloud	83	Cloud	75	71	83.00	15.28
138.	CH_50	01_61C_022			China	Indus	Indus	1501	1728	1657	1678	1642	1670	1728.00	15.12
139.	CH_216	02_71P_028			China	Ganga	Arun Kosi	54	Cloud	Cloud	62	54	57	62.00	14.81
140.	BH_13	03_77L_033			Bhutan	Brahmaputra		177	198	Cloud	Cloud	194	203	203.00	14.69
141.	CH_647	03_82B_021			China	Brahmaputra		48	Cloud	Cloud	55	Cloud	55	55.00	14.58
142.	CH_876	03_82K_020			China	Brahmaputra		77	Cloud	Cloud	88	Cloud	Cloud	88.00	14.29
143.	CH_49	01_61C_021			China	Indus	Indus	1155	1319	Cloud	1279	1221	1233	1319.00	14.20
144.	CH_62	01_61G_001			China	Indus	Indus	85	97	77	69	47	55	97.00	14.12
145.	BH_35	03_77L_067			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	78	Cloud	89	Cloud	Cloud	81	89.00	14.10
146.	CH_517	03_77K_015			China	Brahmaputra		108	Cloud	123	106	Cloud	105	123.00	13.89
147.	JK_82	01_43J_004	J&K/ Ladakh		India	Indus	Jhelum	65	Cloud	74	Cloud	Cloud	60	74.00	13.85
148.	NP_12	02_62F_019	Nepal		Nepal	Ganga	Karnal	58	Cloud	Cloud	Cloud	Cloud	66	66.00	13.79
149.	JK_202	01_52J_006	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	110	120	125	107	100	100	125.00	13.64

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
150.	BH_132	03_78I_051			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	103	Cloud	Cloud	117	Cloud	111	117.00	13.59
151.	CH_326	03_62N_009			China	Brahmaputra		288	327	318	314	301	301	327.00	13.54
152.	BH_4	03_77H_011			Bhutan	Brahmaputra		143	Cloud	162	Cloud	Cloud	147	162.00	13.29
153.	CH_584	03_77P_013			China	Brahmaputra		53	60	Cloud	Cloud	Cloud	39	60.00	13.21
154.	CH_334	03_62N_017			China	Brahmaputra		77	87	79	81	80	81	87.00	12.99
155.	CH_156	02_71L_001			China	Ganga	Arun Kosi	85	96	95	86	88	82	96.00	12.94
156.	CH_626	03_82A_007			China	Brahmaputra		85	Cloud	92	92	Cloud	96	96.00	12.94
157.	BH_34	03_77L_066			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	148	Cloud	Cloud	Cloud	Cloud	167	167.00	12.84
158.	JK_30	01_43E_006	J&K/ Ladakh		India	Indus	Gilgit	71	Cloud	80	Cloud	Cloud	64	80.00	12.68
159.	CH_873	03_82K_017			China	Brahmaputra		179	Cloud	201	Cloud	Cloud	Cloud	201.00	12.29
160.	CH_533	03_77L_017			China	Brahmaputra		74	Cloud	78	Cloud	73	83	83.00	12.16
161.	JK_220	01_52K_012	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Indus	166	186	Cloud	Cloud	147	168	186.00	12.05
162.	CH_123	02_71H_003			China	Ganga	Arun Kosi	216	242	Cloud	221	Cloud	219	242.00	12.04
163.	BH_137	03_78I_056			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	76	Cloud	Cloud	Cloud	Cloud	85	85.00	11.84
164.	JK_22	01_43A_001	J&K/ Ladakh		India	Indus	Gilgit	203	221	227	223	Cloud	Cloud	227.00	11.82
165.	JK_128	01_43N_001	J&K/ Ladakh		India	Indus	Shingo (Indus)	127	142	119	130	115	128	142.00	11.81
166.	CH_285	03_62J_013			China	Brahmaputra		854	940	Cloud	954	940	897	954.00	11.71
167.	CH_137	02_71H_017			China	Ganga	Arun Kosi	472	527	469	485	489	483	527.00	11.65

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
168.	JK_197	01_52J_001	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	97	Cloud	108	105	96	92	108.00	11.34
169.	CH_339	03_62N_022			China	Brahmaputra		198	220	204	195	185	195	220.00	11.11
170.	NP_36	02_62P_003	Nepal		Nepal	Ganga	Trisuli	315	Cloud	Cloud	350	340	345	350.00	11.11
171.	SK_16	03_78A_009	Sikkim	North Sikkim	India	Brahmaputra	Teesta	54	Cloud	Cloud	60	Cloud	59	60.00	11.11
172.	BH_15	03_77L_037			Bhutan	Brahmaputra		542	598	602	Cloud	580	581	602.00	11.07
173.	BH_40	03_77L_072			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	91	Cloud	Cloud	Cloud	Cloud	101	101.00	10.99
174.	JK_222	01_52K_014	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Indus	405	448	432	433	410	424	448.00	10.62
175.	JK_111	01_43K_010	J&K/ Ladakh	Rajauri	India	Indus	Jhelum	66	Cloud	Cloud	Cloud	71	73	73.00	10.61
176.	CH_147	02_71H_027			China	Ganga	Sun Kosi	434	480	Cloud	463	Cloud	463	480.00	10.60
177.	CH_305	03_62K_001			China	Brahmaputra		370	Cloud	Cloud	409	Cloud	386	409.00	10.54
178.	CH_141	02_71H_021			China	Ganga	Trisuli	48	53	Cloud	45	Cloud	42	53.00	10.42
179.	CH_530	03_77L_014			China	Brahmaputra		48	53	51	Cloud	44	48	53.00	10.42
180.	CH_484	03_77H_013			China	Brahmaputra		48	Cloud	53	Cloud	Cloud	42	53.00	10.42
181.	CH_605	03_78E_009			China	Brahmaputra		175	Cloud	193	173	127	176	193.00	10.29
182.	CH_215	02_71P_027			China	Ganga	Arun Kosi	49	54	Cloud	41	Cloud	52	54.00	10.20
183.	CH_158	02_71L_003			China	Ganga	Arun Kosi	258	284	283	276	266	268	284.00	10.08
184.	CH_417	03_71G_008			China	Brahmaputra		60	Cloud	66	57	Cloud	50	66.00	10.00
185.	CH_79	01_62E_004			China	Indus	Indus	233	256	246	Cloud	255	235	256.00	9.87
186.	CH_384	03_62O_039			China	Brahmaputra		306	336	322	308	295	302	336.00	9.80
187.	JK_95	01_43J_017	J&K/ Ladakh	Baramula (Kashmir North)	India	Indus	Jhelum	164	180	152	Cloud	Cloud	159	180.00	9.76

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
188.	CH_95	01_62F_004			China	Indus	Satluj	196	215	Cloud	Cloud	189	186	215.00	9.69
189.	CH_321	03_62N_004			China	Brahmaputra		878	962	953	939	932	925	962.00	9.57
190.	CH_135	02_71H_015			China	Ganga	Arun Kosi	506	Cloud	554	536	540	536	554.00	9.49
191.	CH_8	01_52O_005			China	Indus	Indus	780	842	835	853	808	833	853.00	9.36
192.	CH_386	03_62O_041			China	Brahmaputra		206	225	Cloud	193	209	202	225.00	9.22
193.	CH_157	02_71L_002			China	Ganga	Arun Kosi	76	83	81	76	Cloud	80	83.00	9.21
194.	JK_201	01_52J_005	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	44	Cloud	47	48	40	42	48.00	9.09
195.	JK_198	01_52J_002	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	67	73	67	Cloud	56	54	73.00	8.96
196.	JK_189	01_52G_001	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	45	49	47	43	44	40	49.00	8.89
197.	CH_61	01_61F_004			China	Indus	Indus	36392	39558	39574	39574	39574	39574	39574.00	8.74
198.	SK_11	03_78A_003	Sikkim	North Sikkim	India	Brahmaputra	Teesta	58	Cloud	Cloud	Cloud	Cloud	63	63.00	8.62
199.	CH_425	03_71K_002			China	Brahmaputra		2248	2421	2441	2274	2274	2249	2441.00	8.59
200.	CH_85	01_62E_010			China	Indus	Indus	156	169	148	Cloud	138	147	169.00	8.33
201.	JK_224	01_52K_016	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Satluj	507	549	Cloud	529	494	508	549.00	8.28
202.	CH_149	02_71H_029			China	Ganga	Sun Kosi	474	Cloud	Cloud	504	Cloud	513	513.00	8.23
203.	CH_614	03_78M_003			China	Brahmaputra	Dangme Chu	207	Cloud	224	Cloud	Cloud	213	224.00	8.21
204.	CH_844	03_82J_014			China	Brahmaputra		183	Cloud	Cloud	Cloud	198	Cloud	198.00	8.20
205.	CH_273	03_62J_001			China	Brahmaputra		147	159	147	145	134	141	159.00	8.16
206.	NP_30	02_62K_012	Nepal		Nepal	Ganga	Bheri	469	507	Cloud	481	479	477	507.00	8.10
207.	CH_77	01_62E_002			China	Indus	Indus	161	174	161	Cloud	Cloud	156	174.00	8.07
208.	CH_284	03_62J_012			China	Brahmaputra		165	178	173	Cloud	161	154	178.00	7.88
209.	CH_88	01_62E_013			China	Indus	Indus	166	179	164	Cloud	145	156	179.00	7.83

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
210.	BH_129	03_78I_048			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	52	Cloud	Cloud	Cloud	Cloud	56	56.00	7.69
211.	CH_835	03_82J_005			China	Brahmaputra		67	Cloud	Cloud	69	69	72	72.00	7.46
212.	CH_5	01_52O_002			China	Indus	Indus	135	145	Cloud	Cloud	114	105	145.00	7.41
213.	CH_161	02_71L_006			China	Ganga	Arun Kosi	379	407	401	389	389	381	407.00	7.39
214.	CH_338	03_62N_021			China	Brahmaputra		197	211	207	201	199	194	211.00	7.11
215.	CH_445	03_71O_009			China	Brahmaputra		2123	2266	2272	2272	2272	2258	2272.00	7.02
216.	CH_388	03_62O_043			China	Brahmaputra		86	92	79	74	74	70	92.00	6.98
217.	CH_3	01_52N_001			China	Indus	Indus	11564	12365	12152	12321	12321	12321	12365.00	6.93
218.	BH_14	03_77L_035			Bhutan	Brahmaputra		58	62	Cloud	Cloud	56	62	62.00	6.90
219.	CH_522	03_77L_006			China	Brahmaputra		44	Cloud	47	30	Cloud	18	47.00	6.82
220.	CH_263	02_77D_008			China	Ganga	Arun Kosi	44	Cloud	Cloud	45	Cloud	47	47.00	6.82
221.	CH_181	02_71L_026			China	Ganga	Sun Kosi	59	Cloud	Cloud	63	Cloud	61	63.00	6.78
222.	CH_410	03_71G_001			China	Brahmaputra		720	768	764	760	755	752	768.00	6.67
223.	CH_253	02_72M_007			China	Ganga	Arun Kosi	90	Cloud	Cloud	95	96	94	96.00	6.67
224.	CH_102	01_62J_001			China	Indus	Satluj	5571	5915	5933	5884	5904	5921	5933.00	6.50
225.	CH_488	03_77H_018			China	Brahmaputra		80	Cloud	Cloud	85	83	85	85.00	6.25
226.	CH_4	01_52O_001			China	Indus	Shyok	65825	69872	69841	69552	69488	69552	69872.00	6.15
227.	CH_415	03_71G_006			China	Brahmaputra		956	Cloud	1010	971	971	954	1010.00	5.65
228.	NP_57	02_72E_001	Nepal		Nepal	Ganga	Baghmati	142	145	Cloud	Cloud	Cloud	150	150.00	5.63
229.	CH_745	03_82F_020			China	Brahmaputra		71	Cloud	Cloud	65	74	75	75.00	5.63
230.	CH_971	03_82L_009			China	Brahmaputra		54	Cloud	Cloud	57	Cloud	Cloud	57.00	5.56
231.	JK_217	01_52K_009	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	204	215	213	Cloud	182	188	215.00	5.39
232.	JK_219	01_52K_011	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	186	196	182	Cloud	161	180	196.00	5.38

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
233.	NP_62	02_72I_007	Nepal		Nepal	Ganga	Sun Kosi	56	49	Cloud	57	Cloud	59	59.00	5.36
234.	CH_398	03_71C_005			China	Brahmaputra		57	60	52	51	53	52	60.00	5.26
235.	CH_318	03_62N_001			China	Brahmaputra		14300	15051	15003	14998	14896	14993	15051.00	5.25
236.	CH_51	01_61C_023			China	Indus	Indus	633	666	Cloud	651	634	622	666.00	5.21
237.	CH_729	03_82F_004			China	Brahmaputra		692	Cloud	728	715	685	703	728.00	5.20
238.	NP_37	02_62P_004	Nepal		Nepal	Ganga	Trisuli	406	427	Cloud	Cloud	Cloud	399	427.00	5.17
239.	CH_166	02_71L_011			China	Ganga	Sun Kosi	58	60	61	51	Cloud	54	61.00	5.17
240.	CH_630	03_82B_004			China	Brahmaputra		97	92	102	99	100	102	102.00	5.15
241.	CH_634	03_82B_008			China	Brahmaputra		254	265	Cloud	Cloud	Cloud	267	267.00	5.12

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
1.	CH_855	03_82J_025			China	Brahmaputra		59	Cloud	Cloud	Cloud	56	Cloud	56.00	-5.08
2.	AP_87	03_91C_040	AP		India	Brahmaputra	Luhit	94	Cloud	Cloud	Cloud	Cloud	89	89.00	-5.32
3.	CH_490	03_77H_020			China	Brahmaputra		4972	Cloud	4421	4505	Cloud	4698	4698.00	-5.51
4.	CH_499	03_77J_003			China	Brahmaputra		89	Cloud	Cloud	84	Cloud	84	84.00	-5.62
5.	NP_58	02_72I_002	Nepal		Nepal	Ganga	Sun Kosi	67	46	52	51	Cloud	63	63.00	-5.97
6.	CH_495	03_77H_030			China	Brahmaputra		66	Cloud	Cloud	Cloud	51	62	62.00	-6.06
7.	CH_155	02_71H_035			China	Ganga	Sun Kosi	45	Cloud	Cloud	42	Cloud	36	42.00	-6.67
8.	NP_59	02_72I_003	Nepal		Nepal	Ganga	Sun Kosi	45	42	Cloud	38	38	41	42.00	-6.67
9.	CH_523	03_77L_007			China	Brahmaputra		1478	1379	1344	1346	Cloud	1339	1379.00	-6.70
10.	AP_49	03_82O_042	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	44	Cloud	Cloud	Cloud	41	Cloud	41.00	-6.82
11.	CH_612	03_78E_023			China	Brahmaputra		58	Cloud	Cloud	49	Cloud	54	54.00	-6.90
12.	CH_320	03_62N_003			China	Brahmaputra		57	53	47	34	33	33	53.00	-7.02
13.	CH_187	02_71L_032			China	Ganga	Sun Kosi	55	Cloud	Cloud	50	Cloud	51	51.00	-7.27
14.	CH_636	03_82B_010			China	Brahmaputra		52	Cloud	Cloud	Cloud	Cloud	48	48.00	-7.69
15.	BH_188	03_78M_010			Bhutan	Brahmaputra	Dangme Chu	50	Cloud	Cloud	34	Cloud	46	46.00	-8.00
16.	CH_1194	03_91H_029			China	Brahmaputra	Luhit	50	Cloud	Cloud	Cloud	46	Cloud	46.00	-8.00
17.	CH_739	03_82F_014			China	Brahmaputra		49	Cloud	Cloud	39	Cloud	45	45.00	-8.16
18.	CH_812	03_82G_051			China	Brahmaputra		49	Cloud	Cloud	Cloud	Cloud	45	45.00	-8.16
19.	CH_28	01_61B_003			China	Indus	Indus	224	Cloud	Cloud	205	185	185	205.00	-8.48
20.	JK_227	01_52L_003	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Indus	648	589	Cloud	Cloud	545	526	589.00	-9.10
21.	BH_60	03_78E_007			Bhutan	Brahmaputra	Puna Tsang Chu	61	Cloud	Cloud	55	Cloud	Cloud	55.00	-9.84

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
22.	CH_565	03_77O_002			China	Brahmaputra		100	Cloud	Cloud	75	Cloud	90	90.00	-10.00
23.	JK_98	01_43J_020	J&K/ Ladakh	Baramula (Kashmir North)	India	Indus	Jhelum	191	Cloud	168	171	156	158	171.00	-10.47
24.	UK_4	02_53O_001	Uthrakhand	Naini Tal	India	Ganga	Ramganga	46	Cloud	Cloud	Cloud	Cloud	41	41.00	-10.87
25.	CH_481	03_77H_007			China	Brahmaputra		924	Cloud	351	455	Cloud	821	821.00	-11.15
26.	UK_1	02_53K_001	Uthrakhand	Pauri Garhwal	India	Ganga	Ramganga	6790	Cloud	Cloud	Cloud	5995	6029	6029.00	-11.21
27.	CH_778	03_82G_017			China	Brahmaputra		53	Cloud	Cloud	Cloud	Cloud	47	47.00	-11.32
28.	CH_811	03_82G_050			China	Brahmaputra		44	Cloud	Cloud	Cloud	39	Cloud	39.00	-11.36
29.	CH_1190	03_91H_025			China	Brahmaputra	Luhit	85	Cloud	Cloud	Cloud	75	Cloud	75.00	-11.76
30.	CH_460	03_77C_006			China	Brahmaputra		102	90	Cloud	89	68	90	90.00	-11.76
31.	JK_99	01_43J_021	J&K/ Ladakh	Bagdam	India	Indus	Jhelum	1238	1092	902	854	818	838	1092.00	-11.79
32.	CH_709	03_82D_003			China	Brahmaputra		50	Cloud	Cloud	40	44	42	44.00	-12.00
33.	UK_11	02_53P_003	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	1078	829	946	Cloud	897	860	946.00	-12.24
34.	CH_577	03_77P_006			China	Brahmaputra		5683	Cloud	4986	4790	Cloud	4234	4986.00	-12.26
35.	CH_207	02_71P_019			China	Ganga	Arun Kosi	48	Cloud	Cloud	42	26	31	42.00	-12.50
36.	UK_9	02_53P_001	Uthrakhand	Udham Singh Nagar	India	Ganga	Ganga	2054	Cloud	1697	Cloud	1724	1796	1796.00	-12.56
37.	HP_10	01_53A_002	HP	Bilaspur	India	Indus	Satluj	13679	10522	Cloud	Cloud	Cloud	11865	11865.00	-13.26
38.	CH_1065	03_91C_014			China	Brahmaputra		51	Cloud	Cloud	Cloud	36	44	44.00	-13.73
39.	CH_606	03_78E_010			China	Brahmaputra		49	Cloud	Cloud	40	35	42	42.00	-14.29
40.	NP_80	02_72I_027	Nepal		Nepal	Ganga	Sun Kosi	82	Cloud	Cloud	Cloud	Cloud	70	70.00	-14.63
41.	CH_1032	03_82O_029			China	Brahmaputra	Dihang	68	Cloud	Cloud	Cloud	58	Cloud	58.00	-14.71

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
42.	CH_476	03_77H_001			China	Brahmaputra		442	Cloud	371	Cloud	Cloud	377	377.00	-14.71
43.	AP_92	03_91C_046	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	61	Cloud	Cloud	Cloud	Cloud	52	52.00	-14.75
44.	CH_589	03_77P_018			China	Brahmaputra	Dangme Chu	154	131	Cloud	Cloud	Cloud	123	131.00	-14.94
45.	CH_223	02_71P_035			China	Ganga	Arun Kosi	107	Cloud	Cloud	Cloud	Cloud	91	91.00	-14.95
46.	AP_204	03_92A_006	AP	Lohit	India	Brahmaputra	Luhit	83	Cloud	Cloud	Cloud	Cloud	70	70.00	-15.66
47.	CH_990	03_82N_019			China	Brahmaputra		55	Cloud	Cloud	Cloud	46	Cloud	46.00	-16.36
48.	BH_73	03_78E_029			Bhutan	Brahmaputra	Puna Tsang Chu	45	Cloud	Cloud	37	Cloud	Cloud	37.00	-17.78
49.	CH_372	03_62O_027			China	Brahmaputra		47	38	20	34	Cloud	32	38.00	-19.15
50.	UK_2	02_53K_002	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	1597	652	603	Cloud	Cloud	1267	1267.00	-20.66
51.	CH_770	03_82G_009			China	Brahmaputra		51	Cloud	Cloud	38	40	Cloud	40.00	-21.57
52.	CH_576	03_77P_005			China	Brahmaputra		110	Cloud	Cloud	Cloud	Cloud	86	86.00	-21.82
53.	CH_716	03_82D_010			China	Brahmaputra	Dangme Chu	76	59	Cloud	Cloud	45	49	59.00	-22.37
54.	CH_609	03_78E_017			China	Brahmaputra		65	Cloud	Cloud	50	Cloud	43	50.00	-23.08
55.	CH_809	03_82G_048			China	Brahmaputra		55	Cloud	Cloud	Cloud	Cloud	42	42.00	-23.64
56.	AP_163	03_91D_107	AP	Lohit	India	Brahmaputra	Luhit	67	Cloud	Cloud	Cloud	51	Cloud	51.00	-23.88
57.	AP_85	03_91C_038	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	113	Cloud	Cloud	Cloud	82	Cloud	82.00	-27.43
58.	CH_73	01_62B_001			China	Indus	Satluj	440	318	271	Cloud	148	206	318.00	-27.73
59.	CH_258	02_77D_003			China	Ganga	Arun Kosi	88	Cloud	Cloud	60	42	48	60.00	-31.82
60.	CH_419	03_71G_010			China	Brahmaputra		304	Cloud	Cloud	202	179	194	202.00	-33.55
61.	CH_479	03_77H_004			China	Brahmaputra		201	Cloud	Cloud	118	110	129	129.00	-35.82

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
62.	CH_256	02_77D_001			China	Ganga	Arun Kosi	5831	Cloud	Cloud	3663	3664	3713	3713.00	-36.32
63.	UK_8	02_53O_005	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	1510	802	Cloud	934	954	851	954.00	-36.82
64.	UK_10	02_53P_002	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	734	101	Cloud	Cloud	362	332	362.00	-50.68
65.	JK_196	01_52I_004	J&K/ Ladakh		India	Indus	Shyok	124	Cloud	58	56	44	40	58.00	-53.23
66.	CH_259	02_77D_004			China	Ganga	Arun Kosi	1273	Cloud	Cloud	471	449	374	471.00	-63.00
67.	NP_41	02_63M_002	Nepal		Nepal	Ganga	Rapti	153	Cloud	Cloud	53	Cloud	43	53.00	-65.36
68.	JK_188	01_52E_001	J&K/ Ladakh		India	Indus	Shyok	51	10	12	13	4	Cloud	13.00	-74.51
69.	CH_478	03_77H_003			China	Brahmaputra		208	Cloud	Cloud	34	Cloud	Cloud	34.00	-83.65

Table 4(c) – List of GL & WB that have shown NO CHANGE in Water Spread Area

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
1.	CH_617	03_78M_016			China	Brahmaputra	Dangme Chu	142	Cloud	Cloud	Cloud	Cloud	149	149.00	4.93
2.	CH_287	03_62J_015			China	Brahmaputra		82	86	85	52	82	85	86.00	4.88
3.	CH_747	03_82F_022			China	Brahmaputra		103	Cloud	Cloud	105	108	Cloud	108.00	4.85
4.	AP_77	03_83A_012	AP	Tawang	India	Brahmaputra	Dangme Chu	63	Cloud	Cloud	Cloud	Cloud	66	66.00	4.76
5.	CH_482	03_77H_008			China	Brahmaputra		1256	Cloud	1315	Cloud	Cloud	1171	1315.00	4.70
6.	NP_86	02_72M_009	Nepal		Nepal	Ganga	Tamur Kosi	64	Cloud	Cloud	46	Cloud	67	67.00	4.69
7.	CH_56	01_61D_004			China	Indus	Indus	550	575	Cloud	Cloud	549	545	575.00	4.55
8.	CH_583	03_77P_012			China	Brahmaputra		66	69	Cloud	56	Cloud	51	69.00	4.55
9.	CH_633	03_82B_007			China	Brahmaputra		199	208	Cloud	Cloud	Cloud	206	208.00	4.52
10.	CH_434	03_71K_011			China	Brahmaputra		387	404	Cloud	352	Cloud	313	404.00	4.39
11.	CH_806	03_82G_045			China	Brahmaputra		70	Cloud	Cloud	73	Cloud	73	73.00	4.29
12.	CH_1078	03_91C_029			China	Brahmaputra		211	Cloud	220	Cloud	199	218	220.00	4.27
13.	CH_29	01_61C_001			China	Indus	Indus	11154	11621	11625	11624	11624	11624	11625.00	4.22
14.	CH_721	03_82E_003			China	Brahmaputra		98	92	101	93	78	102	102.00	4.08
15.	CH_622	03_82A_003			China	Brahmaputra		99	103	Cloud	75	Cloud	95	103.00	4.04
16.	NP_48	02_71D_007	Nepal		Nepal	Ganga	Trisuli	300	312	Cloud	287	Cloud	285	312.00	4.00
17.	CH_641	03_82B_015			China	Brahmaputra		75	Cloud	Cloud	Cloud	Cloud	78	78.00	4.00
18.	CH_60	01_61F_003			China	Indus	Indus	558	Cloud	Cloud	580	557	553	580.00	3.94
19.	BH_104	03_78I_023			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	51	Cloud	Cloud	Cloud	Cloud	53	53.00	3.92
20.	CH_592	03_77P_021			China	Brahmaputra	Dangme Chu	53	Cloud	Cloud	54	52	55	55.00	3.77
21.	CH_262	02_77D_007			China	Ganga	Arun Kosi	54	Cloud	Cloud	Cloud	Cloud	56	56.00	3.70
22.	CH_575	03_77P_004			China	Brahmaputra		211	218	192	190	Cloud	184	218.00	3.32

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
23.	BH_195	03_78M_020			Bhutan	Brahmaputra	Dangme Chu	65	Cloud	Cloud	67	Cloud	63	67.00	3.08
24.	CH_755	03_82F_030			China	Brahmaputra		2675	Cloud	Cloud	2750	2734	2739	2750.00	2.80
25.	CH_528	03_77L_012			China	Brahmaputra		28771	29201	29524	29504	29414	29384	29524.00	2.62
26.	CH_796	03_82G_035			China	Brahmaputra		81	Cloud	Cloud	Cloud	Cloud	83	83.00	2.47
27.	CH_733	03_82F_008			China	Brahmaputra		83	Cloud	Cloud	Cloud	Cloud	85	85.00	2.41
28.	JK_212	01_52K_004	J&K/ Ladakh		India	Indus	Shyok	5741	5872	5857	5851	5820	5851	5872.00	2.28
29.	CH_228	02_71P_040			China	Ganga	Arun Kosi	135	Cloud	Cloud	133	129	138	138.00	2.22
30.	CH_69	01_62A_003			China	Indus	Indus	1355	1358	1384	Cloud	Cloud	1347	1384.00	2.14
31.	BH_72	03_78E_028			Bhutan	Brahmaputra	Puna Tsang Chu	47	Cloud	Cloud	48	Cloud	Cloud	48.00	2.13
32.	CH_403	03_71C_010			China	Brahmaputra		49	50	Cloud	38	35	34	50.00	2.04
33.	CH_646	03_82B_020			China	Brahmaputra		49	Cloud	Cloud	Cloud	Cloud	50	50.00	2.04
34.	CH_933	03_82K_077			China	Brahmaputra		100	Cloud	Cloud	99	Cloud	102	102.00	2.00
35.	JK_218	01_52K_010	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Shyok	152	155	Cloud	Cloud	129	139	155.00	1.97
36.	CH_1136	03_91D_081			China	Brahmaputra	Luhit	304	Cloud	Cloud	Cloud	310	Cloud	310.00	1.97
37.	CH_94	01_62F_003			China	Indus	Satluj	40552	41189	41346	41346	41271	41290	41346.00	1.96
38.	BH_194	03_78M_019			Bhutan	Brahmaputra	Dangme Chu	55	Cloud	Cloud	Cloud	Cloud	56	56.00	1.82
39.	JK_1	01_42H_001	J&K/ Ladakh		India	Indus	Gilgit	276	Cloud	279	281	Cloud	Cloud	281.00	1.81
40.	CH_213	02_71P_025			China	Ganga	Arun Kosi	123	Cloud	Cloud	118	Cloud	125	125.00	1.63
41.	CH_416	03_71G_007			China	Brahmaputra		191	Cloud	Cloud	194	Cloud	180	194.00	1.57
42.	CH_81	01_62E_006			China	Indus	Indus	524	530	532	Cloud	Cloud	515	532.00	1.53
43.	CH_283	03_62J_011			China	Brahmaputra		401	407	381	Cloud	362	376	407.00	1.50
44.	CH_725	03_82E_007			China	Brahmaputra		71	56	Cloud	60	Cloud	72	72.00	1.41

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
45.	CH_521	03_77L_003			China	Brahmaputra		4065	4031	4122	Cloud	Cloud	4100	4122.00	1.40
46.	CH_850	03_82J_020			China	Brahmaputra		439	Cloud	Cloud	Cloud	445	440	445.00	1.37
47.	JK_226	01_52L_002	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Indus	442	448	431	Cloud	426	414	448.00	1.36
48.	NP_28	02_62K_010	Nepal		Nepal	Ganga	Karnal	1051	1065	Cloud	1042	Cloud	1038	1065.00	1.33
49.	CH_429	03_71K_006			China	Brahmaputra		2096	2117	2120	2053	Cloud	2022	2120.00	1.15
50.	JK_225	01_52L_001	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Satluj	14110	14265	Cloud	14205	14073	14205	14265.00	1.10
51.	CH_847	03_82J_017			China	Brahmaputra		282	Cloud	Cloud	285	273	Cloud	285.00	1.06
52.	CH_853	03_82J_023			China	Brahmaputra		105	Cloud	Cloud	Cloud	Cloud	106	106.00	0.95
53.	SK_2	03_77D_002	Sikkim	North Sikkim	India	Brahmaputra	Teesta	105	Cloud	Cloud	104	106	99	106.00	0.95
54.	CH_121	02_71H_001			China	Ganga	Arun Kosi	26825	27057	27048	27067	27067	27067	27067.00	0.90
55.	CH_732	03_82F_007			China	Brahmaputra		115	Cloud	Cloud	112	Cloud	116	116.00	0.87
56.	CH_931	03_82K_075			China	Brahmaputra		118	Cloud	Cloud	118	119	Cloud	119.00	0.85
57.	CH_520	03_77L_001			China	Brahmaputra		55435	55173	55870	55802	55802	55664	55870.00	0.78
58.	CH_392	03_71B_002			China	Brahmaputra		8185	8240	8168	8129	8134	8125	8240.00	0.67
59.	HP_9	01_53A_001	HP	Kangra	India	Indus	Beas	21867	19460	18540	Cloud	Cloud	21905	21905.00	0.17
60.	CH_563	03_77N_004			China	Brahmaputra		1296	Cloud	Cloud	1298	Cloud	1247	1298.00	0.15
61.	JK_154	01_43N_027	J&K/ Ladakh	Srinagar	India	Indus	Jhelum	48	45	Cloud	48	Cloud	47	48.00	0.00
62.	NP_19	02_62J_003	Nepal		Nepal	Ganga	Karnal	49	Cloud	Cloud	Cloud	Cloud	49	49.00	0.00
63.	CH_127	02_71H_007			China	Ganga	Arun Kosi	125	Cloud	125	119	108	118	125.00	0.00
64.	CH_823	03_82G_062			China	Brahmaputra		58	Cloud	Cloud	Cloud	Cloud	58	58.00	0.00
65.	CH_916	03_82K_060			China	Brahmaputra		93	Cloud	Cloud	Cloud	93	Cloud	93.00	0.00
66.	CH_168	02_71L_013			China	Ganga	Sun Kosi	64	64	Cloud	55	Cloud	55	64.00	0.00
67.	CH_264	02_77D_009			China	Ganga	Arun Kosi	58	Cloud	Cloud	58	39	58	58.00	0.00

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
68.	CH_251	02_72M_005			China	Ganga	Arun Kosi	74	Cloud	Cloud	74	58	70	74.00	0.00
69.	CH_611	03_78E_019			China	Brahmaputra		60	Cloud	Cloud	60	Cloud	57	60.00	0.00
70.	CH_604	03_78E_006			China	Brahmaputra		67	Cloud	67	Cloud	Cloud	62	67.00	0.00
71.	CH_492	03_77H_023			China	Brahmaputra		47	Cloud	Cloud	Cloud	Cloud	47	47.00	0.00
72.	CH_92	01_62F_001			China	Indus	Satluj	25486	25450	25421	25421	25385	25343	25450.00	-0.14
73.	CH_632	03_82B_006			China	Brahmaputra		124	Cloud	Cloud	123	Cloud	122	123.00	-0.81
74.	CH_848	03_82J_018			China	Brahmaputra		99	Cloud	Cloud	93	98	Cloud	98.00	-1.01
75.	CH_710	03_82D_004			China	Brahmaputra		390	Cloud	386	378	Cloud	366	386.00	-1.03
76.	CH_607	03_78E_012			China	Brahmaputra		279	Cloud	Cloud	254	Cloud	276	276.00	-1.08
77.	CH_874	03_82K_018			China	Brahmaputra		165	Cloud	Cloud	Cloud	163	Cloud	163.00	-1.21
78.	CH_665	03_82C_010			China	Brahmaputra		153	Cloud	Cloud	Cloud	Cloud	151	151.00	-1.31
79.	CH_252	02_72M_006			China	Ganga	Arun Kosi	71	70	Cloud	57	52	66	70.00	-1.41
80.	BH_197	03_78M_022			Bhutan	Brahmaputra	Dangme Chu	67	Cloud	Cloud	Cloud	Cloud	66	66.00	-1.49
81.	CH_671	03_82C_016			China	Brahmaputra		54	Cloud	Cloud	53	Cloud	48	53.00	-1.85
82.	JK_191	01_52G_003	J&K/ Ladakh	Ladakh (Leh)	India	Indus	Indus	1502	1474	Cloud	1465	1462	1430	1474.00	-1.86
83.	CH_862	03_82K_006			China	Brahmaputra		52	Cloud	Cloud	51	51	Cloud	51.00	-1.92
84.	CH_452	03_77B_001			China	Brahmaputra		52	51	Cloud	47	Cloud	41	51.00	-1.92
85.	CH_93	01_62F_002			China	Indus	Satluj	333	326	296	Cloud	281	287	326.00	-2.10
86.	CH_722	03_82E_004			China	Brahmaputra		47	28	Cloud	43	Cloud	46	46.00	-2.13
87.	SK_8	03_77D_008	Sikkim	North Sikkim	India	Brahmaputra	Teesta	46	Cloud	Cloud	37	Cloud	45	45.00	-2.17
88.	CH_519	03_77K_017			China	Brahmaputra		3853	3732	3767	Cloud	Cloud	3732	3767.00	-2.23
89.	CH_527	03_77L_011			China	Brahmaputra		1209	1163	1141	1182	Cloud	1178	1182.00	-2.23
90.	CH_587	03_77P_016			China	Brahmaputra	Dangme Chu	251	245	Cloud	233	191	204	245.00	-2.39
91.	CH_373	03_62O_028			China	Brahmaputra		932	907	Cloud	475	Cloud	473	907.00	-2.68
92.	CH_54	01_61D_002			China	Indus	Indus	1560	1518	1389	Cloud	1375	1353	1518.00	-2.69

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
93.	CH_588	03_77P_017			China	Brahmaputra	Dangme Chu	2345	2272	Cloud	2274	2273	2246	2274.00	-3.03
94.	CH_453	03_77B_002			China	Brahmaputra		227	218	220	214	Cloud	201	220.00	-3.08
95.	JK_157	01_43N_030	J&K/ Ladakh	Srinagar	India	Indus	Jhelum	86	56	Cloud	Cloud	72	83	83.00	-3.49
96.	CH_148	02_71H_028			China	Ganga	Sun Kosi	200	Cloud	Cloud	191	Cloud	192	192.00	-4.00
97.	CH_106	02_62B_001			China	Ganga	Karnal	47	45	Cloud	Cloud	40	33	45.00	-4.26
98.	CH_511	03_77K_009			China	Brahmaputra		69	Cloud	66	Cloud	Cloud	62	66.00	-4.35
99.	CH_418	03_71G_009			China	Brahmaputra		178	170	170	155	Cloud	149	170.00	-4.49
100.	CH_64	01_61G_003			China	Indus	Indus	63	56	47	Cloud	60	Cloud	60.00	-4.76
101.	CH_591	03_77P_020			China	Brahmaputra	Kuri Chu	63	Cloud	Cloud	Cloud	Cloud	60	60.00	-4.76
102.	CH_242	02_71P_054			China	Ganga	Arun Kosi	102	Cloud	Cloud	97	Cloud	91	97.00	-4.90
103.	CH_210	02_71P_022			China	Ganga	Arun Kosi	80	Cloud	Cloud	Cloud	Cloud	76	76.00	-5.00

Table 4(d) - GL & WB that are CLOUD COVERED

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
1.	CH_735	03_82F_010			China	Brahmaputra		44	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
2.	CH_741	03_82F_016			China	Brahmaputra		49	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
3.	CH_863	03_82K_007			China	Brahmaputra		130	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
4.	CH_865	03_82K_009			China	Brahmaputra		116	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
5.	CH_854	03_82J_024			China	Brahmaputra		67	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
6.	CH_785	03_82G_024			China	Brahmaputra		95	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
7.	CH_780	03_82G_019			China	Brahmaputra		59	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
8.	CH_930	03_82K_074			China	Brahmaputra		88	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
9.	CH_901	03_82K_045			China	Brahmaputra		49	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
10.	CH_896	03_82K_040			China	Brahmaputra		66	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
11.	CH_893	03_82K_037			China	Brahmaputra		55	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
12.	CH_895	03_82K_039			China	Brahmaputra		224	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
13.	CH_892	03_82K_036			China	Brahmaputra		69	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
14.	CH_898	03_82K_042			China	Brahmaputra		205	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
15.	CH_905	03_82K_049			China	Brahmaputra		50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
16.	CH_1023	03_82O_016			China	Brahmaputra	Dihang	91	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
17.	CH_1037	03_82O_044			China	Brahmaputra	Dihang	92	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
18.	CH_1039	03_82O_047			China	Brahmaputra	Dihang	44	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
19.	CH_1046	03_82O_054			China	Brahmaputra	Dibang	51	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
20.	AP_54	03_82O_061	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	54	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
21.	AP_55	03_82O_062	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	52	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
22.	AP_108	03_91D_009	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	47	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
23.	AP_109	03_91D_010	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	46	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
24.	AP_118	03_91D_022	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	44	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
25.	AP_135	03_91D_041	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	115	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
26.	CH_1135	03_91D_080			China	Brahmaputra	Luhit	45	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
27.	AP_57	03_82O_064	AP		India	Brahmaputra	Dihang	44	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
28.	AP_84	03_91C_034	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	134	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
29.	AP_91	03_91C_045	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	113	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
30.	AP_95	03_91C_049	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	57	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
31.	AP_90	03_91C_044	AP	Upper Dibang Valley	India	Brahmaputra	Luhit	63	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
32.	AP_89	03_91C_042	AP		India	Brahmaputra	Dibang	50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
33.	CH_784	03_82G_023			China	Brahmaputra		84	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
34.	CH_816	03_82G_055			China	Brahmaputra		62	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
35.	CH_821	03_82G_060			China	Brahmaputra		59	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
36.	CH_826	03_82G_065			China	Brahmaputra		59	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
37.	CH_975	03_82N_004			China	Brahmaputra		92	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
38.	CH_1001	03_82N_030			China	Brahmaputra		132	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
39.	CH_1004	03_82N_033			China	Brahmaputra		89	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
40.	CH_959	03_82K_103			China	Brahmaputra		50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
41.	AP_101	03_91C_069	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	78	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
42.	AP_100	03_91C_064	AP		India	Brahmaputra	Dibang	89	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
43.	CH_1089	03_91C_059			China	Brahmaputra	Dibang	98	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
44.	CH_1102	03_91C_074			China	Brahmaputra	Dibang	47	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
45.	CH_1106	03_91C_078			China	Brahmaputra	Dibang	48	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
46.	CH_1098	03_91C_070			China	Brahmaputra	Dibang	57	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
47.	CH_1085	03_91C_052			China	Brahmaputra	Luhit	64	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
48.	CH_1170	03_91H_005			China	Brahmaputra	Luhit	58	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
49.	CH_1175	03_91H_010			China	Brahmaputra	Luhit	79	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
50.	CH_1182	03_91H_017			China	Brahmaputra	Luhit	46	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
51.	CH_1176	03_91H_011			China	Brahmaputra	Luhit	50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
52.	BH_45	03_77L_077			Bhutan	Brahmaputra	Puna Tsang Chu	51	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
53.	BH_19	03_77L_044			Bhutan	Brahmaputra	Puna Tsang Chu	123	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
54.	NP_76	02_72I_023	Nepal		Nepal	Ganga	Sun Kosi	81	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
55.	CH_613	03_78E_026			China	Brahmaputra	Amo Chu	60	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
56.	CH_598	03_78A_018			China	Brahmaputra	Amo Chu	67	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
57.	BH_57	03_78E_002			Bhutan	Brahmaputra	Puna Tsang Chu	58	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
58.	BH_166	03_78I_085			Bhutan	Brahmaputra	Puna Tsang Chu	70	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
59.	AP_203	03_92A_005	AP	Lohit	India	Brahmaputra	Luhit	50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
60.	AP_67	03_82P_010	AP	Lower Dibang Valley	India	Brahmaputra	Dibang	99	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
61.	AP_185	03_91H_067	AP	Lohit	India	Brahmaputra	Luhit	56	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
62.	AP_206	03_92E_001	AP	Lohit	India	Brahmaputra	Luhit	45	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
63.	CH_1205	03_91H_040			China	Brahmaputra	Luhit	51	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
64.	CH_1056	03_91C_005			China	Brahmaputra		86	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud

Table 5(a) - List of GL & WB that have shown INCREASE in water spread area during 2020 with Inventory area 2009 (>20%)

S. No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
1.	CH_33	01_61C_005	139	503	516	519	499	498	519.00	273.38
2.	HP_5	01_52H_004	46	166	Cloud	160	Cloud	140	166.00	260.87
3.	CH_206	02_71P_018	51	Cloud	Cloud	90	108	155	155.00	203.92
4.	CH_1	01_52L_008	50	124	Cloud	Cloud	Cloud	124	124.00	148.00
5.	HP_12	01_53E_001	72	173	Cloud	114	Cloud	90	173.00	140.28
6.	CH_551	03_77L_042	50	98	Cloud	76	Cloud	70	98.00	96.00
7.	CH_423	03_71G_014	140	Cloud	Cloud	261	259	258	261.00	86.43
8.	CH_593	03_77P_023	45	Cloud	82	Cloud	Cloud	66	82.00	82.22
9.	CH_849	03_82J_019	45	Cloud	Cloud	82	77	Cloud	82.00	82.22
10.	CH_244	02_72I_004	121	210	Cloud	193	Cloud	176	210.00	73.55
11.	CH_404	03_71C_011	119	205	Cloud	173	176	169	205.00	72.27
12.	JK_85	01_43J_007	95	Cloud	Cloud	Cloud	Cloud	163	163.00	71.58
13.	HP_3	01_52H_002	62	106	Cloud	105	88	99	106.00	70.97
14.	CH_188	02_71L_034	46	78	Cloud	68	Cloud	74	78.00	69.57
15.	NP_64	02_72I_011	100	169	163	150	148	156	169.00	69.00
16.	CH_101	01_62F_010	45	74	76	Cloud	66	62	76.00	68.89
17.	JK_159	01_43N_032	49	81	58	59	58	60	81.00	65.31
18.	CH_55	01_61D_003	46	75	53	43	22	25	75.00	63.04
19.	SK_20	03_78A_014	94	Cloud	Cloud	148	Cloud	150	150.00	59.57
20.	CH_132	02_71H_012	89	Cloud	142	134	Cloud	130	142.00	59.55
21.	CH_38	01_61C_010	88	135	140	140	121	125	140.00	59.09
22.	CH_426	03_71K_003	72	114	Cloud	98	94	104	114.00	58.33
23.	CH_39	01_61C_011	408	618	626	608	608	602	626.00	53.43

S. No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
24.	NP_45	02_71D_004	74	112	Cloud	97	Cloud	95	112.00	51.35
25.	CH_59	01_61F_002	55	83	53	Cloud	58	54	83.00	50.91
26.	CH_590	03_77P_019	220	Cloud	Cloud	Cloud	Cloud	332	332.00	50.91
27.	CH_6	01_52O_003	148	223	221	185	189	204	223.00	50.68
28.	JK_187	01_52C_003	45	67	Cloud	61	Cloud	58	67.00	48.89
29.	CH_834	03_82J_004	378	Cloud	Cloud	562	552	558	562.00	48.68
30.	CH_1079	03_91C_033	153	Cloud	225	Cloud	188	Cloud	225.00	47.06
31.	CH_1076	03_91C_025	97	Cloud	141	Cloud	106	112	141.00	45.36
32.	CH_858	03_82K_002	75	Cloud	109	Cloud	Cloud	Cloud	109.00	45.33
33.	SK_26	03_78A_021	56	Cloud	Cloud	68	Cloud	81	81.00	44.64
34.	CH_36	01_61C_008	151	211	218	214	200	208	218.00	44.37
35.	CH_446	03_71O_010	813	1168	1143	1095	1103	1030	1168.00	43.67
36.	CH_165	02_71L_010	47	67	Cloud	56	Cloud	53	67.00	42.55
37.	CH_369	03_62O_024	721	1022	1025	997	997	976	1025.00	42.16
38.	CH_159	02_71L_004	86	119	Cloud	118	Cloud	121	121.00	40.70
39.	SK_5	03_77D_005	79	111	Cloud	Cloud	104	99	111.00	40.51
40.	CH_524	03_77L_008	85	114	119	Cloud	76	81	119.00	40.00
41.	CH_53	01_61D_001	70	97	Cloud	Cloud	72	64	97.00	38.57
42.	CH_347	03_62O_002	52	72	62	53	Cloud	47	72.00	38.46
43.	CH_316	03_62K_012	73	101	Cloud	92	Cloud	88	101.00	38.36
44.	CH_552	03_77L_043	181	250	Cloud	232	Cloud	237	250.00	38.12
45.	SK_19	03_78A_013	63	Cloud	Cloud	71	69	87	87.00	38.10
46.	CH_235	02_71P_047	71	97	Cloud	90	Cloud	88	97.00	36.62

S. No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
47.	CH_288	03_62J_016	44	Cloud	60	Cloud	52	51	60.00	36.36
48.	CH_183	02_71L_028	77	Cloud	Cloud	105	Cloud	104	105.00	36.36
49.	CH_43	01_61C_015	742	1011	948	906	841	851	1011.00	36.25
50.	CH_545	03_77L_029	45	61	Cloud	Cloud	41	52	61.00	35.56
51.	CH_438	03_71O_002	48	63	59	65	53	61	65.00	35.42
52.	CH_838	03_82J_008	156	Cloud	Cloud	210	197	Cloud	210.00	34.62
53.	CH_298	03_62J_026	103	136	138	Cloud	123	129	138.00	33.98
54.	JK_115	01_43K_014	112	130	Cloud	Cloud	150	138	150.00	33.93
55.	CH_420	03_71G_011	1192	Cloud	1583	1593	1580	1581	1593.00	33.64
56.	CH_303	03_62J_031	166	215	221	Cloud	208	211	221.00	33.13
57.	CH_375	03_62O_030	97	129	Cloud	101	Cloud	97	129.00	32.99
58.	CH_128	02_71H_008	94	125	113	108	Cloud	108	125.00	32.98
59.	CH_432	03_71K_009	170	Cloud	Cloud	226	Cloud	214	226.00	32.94
60.	NP_92	02_72M_016	161	Cloud	Cloud	214	Cloud	213	214.00	32.92
61.	CH_621	03_82A_002	319	424	Cloud	367	Cloud	377	424.00	32.92
62.	NP_67	02_72I_014	137	180	Cloud	181	175	167	181.00	32.12
63.	CH_40	01_61C_012	290	381	Cloud	349	320	326	381.00	31.38
64.	CH_313	03_62K_009	250	Cloud	328	323	301	311	328.00	31.20
65.	CH_422	03_71G_013	244	Cloud	Cloud	320	217	161	320.00	31.15
66.	JK_23	01_43A_002	91	Cloud	119	111	86	Cloud	119.00	30.77
67.	CH_377	03_62O_032	49	64	53	55	51	52	64.00	30.61
68.	CH_1075	03_91C_024	239	Cloud	311	Cloud	279	290	311.00	30.13
69.	CH_217	02_71P_029	80	Cloud	Cloud	102	Cloud	104	104.00	30.00

S. No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
70.	HP_1	01_52D_001	688	894	818	809	795	794	894.00	29.94
71.	CH_271	02_78A_005	89	Cloud	Cloud	Cloud	Cloud	115	115.00	29.21
72.	CH_396	03_71C_003	47	60	47	49	45	48	60.00	27.66
73.	CH_526	03_77L_010	47	47	60	43	Cloud	34	60.00	27.66
74.	JK_67	01_43G_001	22154	Cloud	Cloud	Cloud	28210	26121	28210.00	27.34
75.	CH_924	03_82K_068	52	66	Cloud	Cloud	Cloud	Cloud	66.00	26.92
76.	CH_448	03_71P_001	112	142	Cloud	137	124	126	142.00	26.79
77.	JK_100	01_43J_022	60	76	68	56	62	62	76.00	26.67
78.	JK_195	01_52I_003	180	228	221	206	211	201	228.00	26.67
79.	CH_304	03_62J_032	77	Cloud	97	Cloud	85	88	97.00	25.97
80.	CH_46	01_61C_018	1779	2238	Cloud	2084	2038	2086	2238.00	25.80
81.	CH_30	01_61C_002	685	859	855	854	841	834	859.00	25.40
82.	JK_147	01_43N_020	63	69	79	Cloud	63	59	79.00	25.40
83.	CH_547	03_77L_032	88	Cloud	Cloud	110	Cloud	107	110.00	25.00
84.	JK_205	01_52J_009	57	Cloud	Cloud	71	52	52	71.00	24.56
85.	CH_387	03_62O_042	57	71	Cloud	62	59	55	71.00	24.56
86.	SK_4	03_77D_004	106	Cloud	Cloud	107	109	132	132.00	24.53
87.	CH_385	03_62O_040	107	133	130	122	115	107	133.00	24.30
88.	CH_78	01_62E_003	136	168	150	Cloud	Cloud	146	168.00	23.53
89..	NP_49	02_71D_008	98	121	Cloud	Cloud	Cloud	107	121.00	23.47
90.	JK_5	01_42H_005	52	62	62	64	42	Cloud	64.00	23.08
91.	JK_167	01_43P_002	52	64	Cloud	59	Cloud	54	64.00	23.08
92.	CH_178	02_71L_023	116	140	142	127	127	126	142.00	22.41

S. No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
93.	CH_204	02_71P_016	137	167	164	84	82	69	167.00	21.90
94.	CH_90	01_62E_015	51	62	53	Cloud	Cloud	48	62.00	21.57
95.	CH_936	03_82K_080	47	Cloud	Cloud	57	Cloud	57	57.00	21.28
96.	BH_22	03_77L_051	143	173	Cloud	164	Cloud	Cloud	173.00	20.98
97.	BH_36	03_77L_068	86	104	Cloud	72	Cloud	85	104.00	20.93
98.	CH_564	03_77O_001	154	186	Cloud	183	Cloud	169	186.00	20.78
99.	CH_63	01_61G_002	1134	1362	1365	1357	1339	1331	1365.00	20.37
100.	CH_580	03_77P_009	94	113	Cloud	101	99	101	113.00	20.21
101.	CH_269	02_78A_003	124	Cloud	Cloud	146	149	146	149.00	20.16

Table 5(b) - List of GL & WB that have shown DECREASE in water spread area during 2020 with Inventory area 2009 (>20%)

S. No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Area (Max) 2020	
1.	UK_2	02_53K_002	1597	652	603	Cloud	Cloud	1267	1267.00	-20.66
2.	CH_770	03_82G_009	51	Cloud	Cloud	38	40	Cloud	40.00	-21.57
3.	CH_576	03_77P_005	110	Cloud	Cloud	Cloud	Cloud	86	86.00	-21.82
4.	CH_716	03_82D_010	76	59	Cloud	Cloud	45	49	59.00	-22.37
5.	CH_609	03_78E_017	65	Cloud	Cloud	50	Cloud	43	50.00	-23.08
6.	CH_809	03_82G_048	55	Cloud	Cloud	Cloud	Cloud	42	42.00	-23.64
7.	AP_163	03_91D_107	67	Cloud	Cloud	Cloud	51	Cloud	51.00	-23.88
8.	AP_85	03_91C_038	113	Cloud	Cloud	Cloud	82	Cloud	82.00	-27.43
9.	CH_73	01_62B_001	440	318	271	Cloud	148	206	318.00	-27.73
10.	CH_258	02_77D_003	88	Cloud	Cloud	60	42	48	60.00	-31.82
11.	CH_419	03_71G_010	304	Cloud	Cloud	202	179	194	202.00	-33.55
12.	CH_479	03_77H_004	201	Cloud	Cloud	118	110	129	129.00	-35.82
13.	CH_256	02_77D_001	5831	Cloud	Cloud	3663	3664	3713	3713.00	-36.32
14.	UK_8	02_53O_005	1510	802	Cloud	934	954	851	954.00	-36.82
15.	UK_10	02_53P_002	734	101	Cloud	Cloud	362	332	362.00	-50.68
16.	JK_196	01_52I_004	124	Cloud	58	56	44	40	58.00	-53.23
17.	CH_259	02_77D_004	1273	Cloud	Cloud	471	449	374	471.00	-63.00
18.	NP_41	02_63M_002	153	Cloud	Cloud	53	Cloud	43	53.00	-65.36
19.	JK_188	01_52E_001	51	10	12	13	4	Cloud	13.00	-74.51
20.	CH_478	03_77H_003	208	Cloud	Cloud	34	Cloud	Cloud	34.00	-83.65

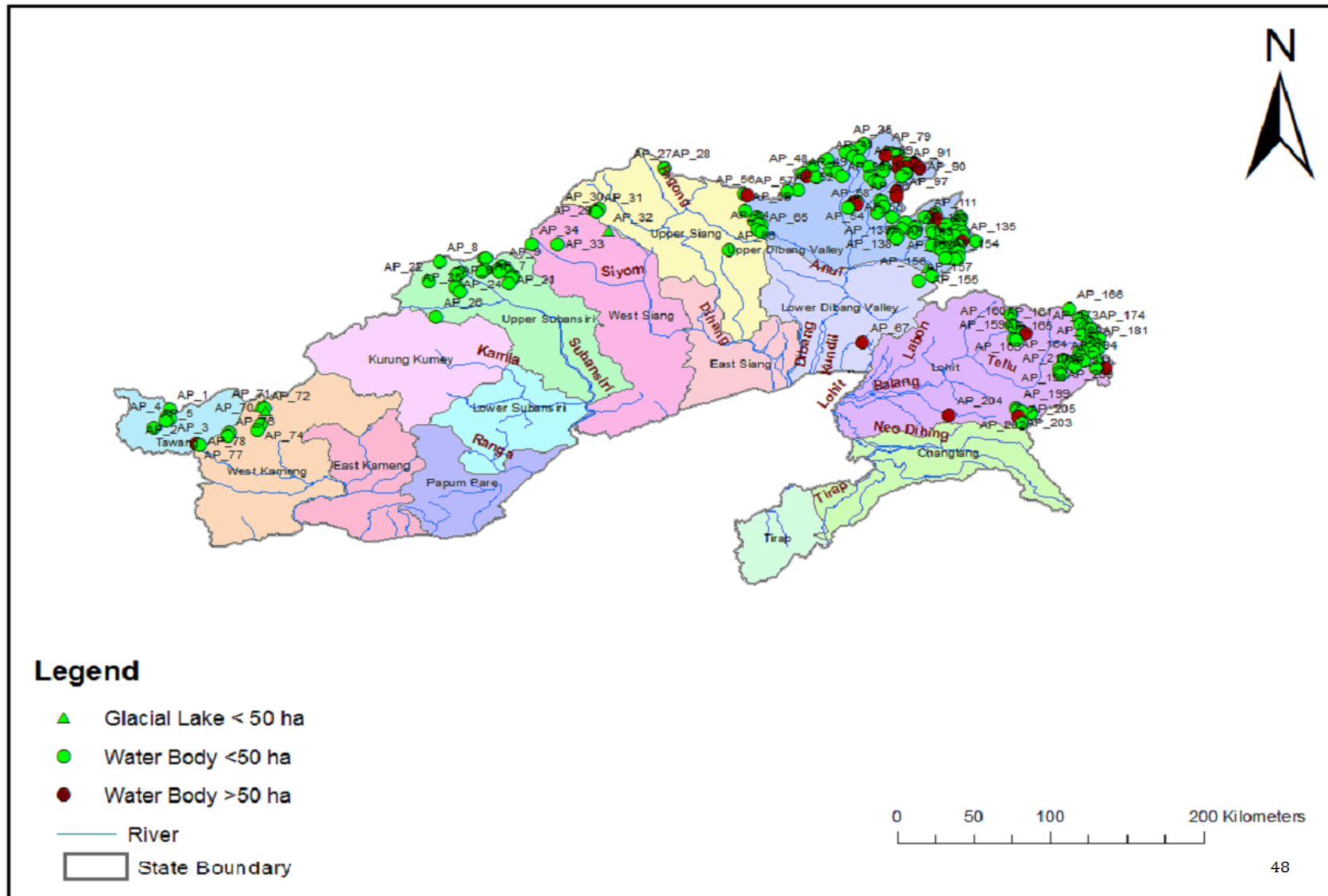


Figure 3 (a): Glacial Lakes & Water Bodies in Arunachal Pradesh

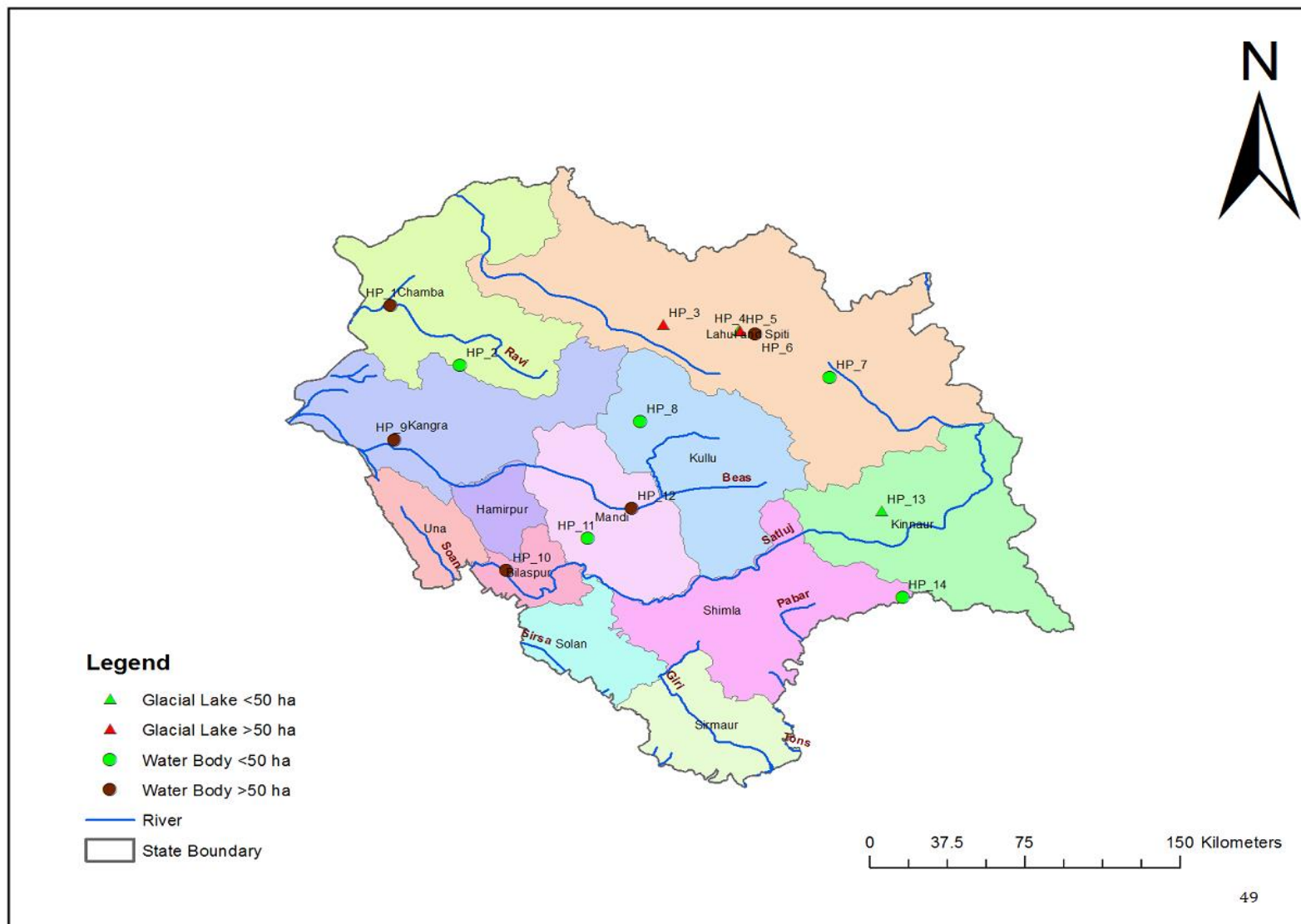


Figure 3 (b): Glacial Lakes & Water Bodies in Himachal Pradesh



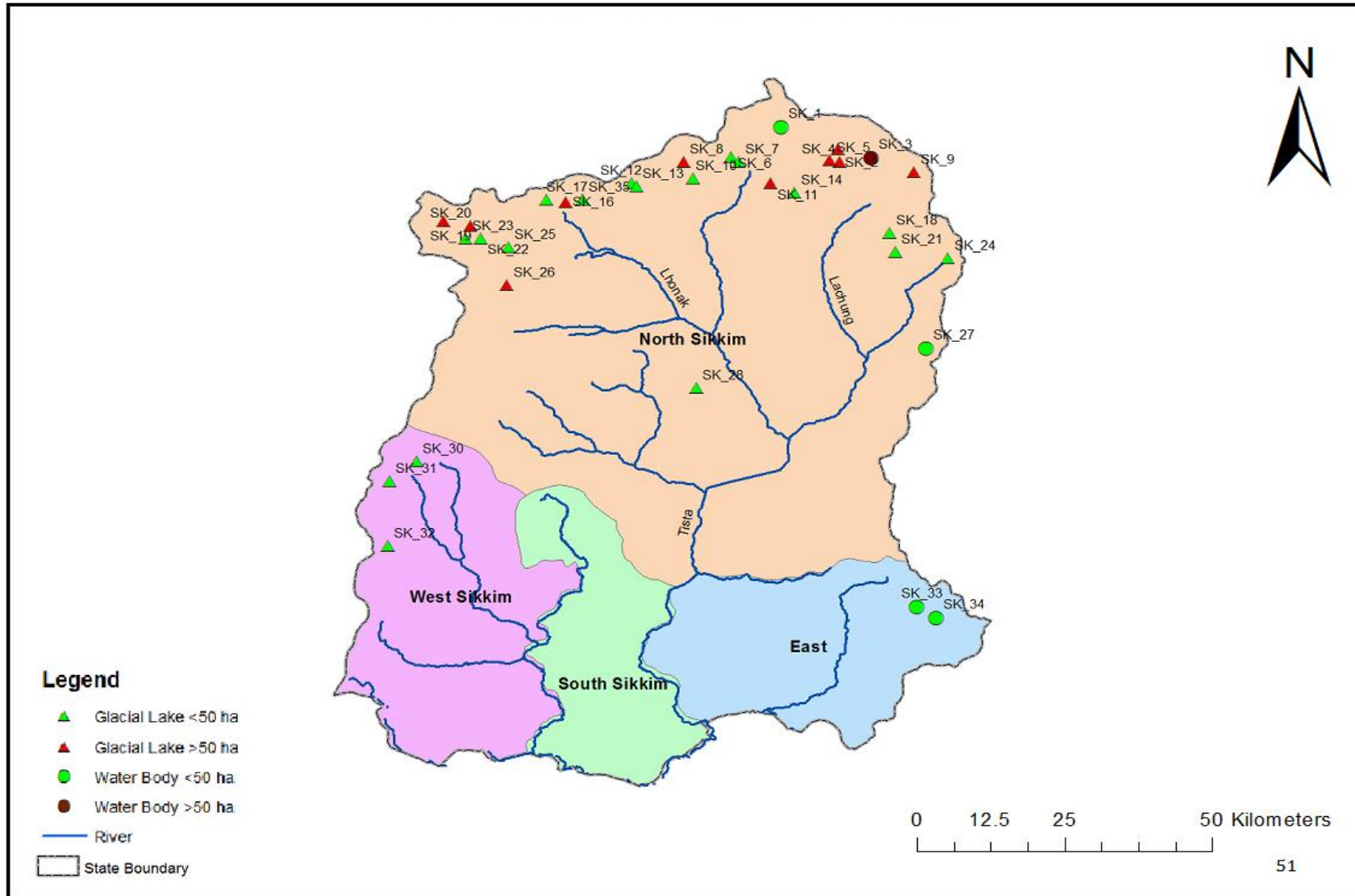


Figure 3 (d): Glacial Lakes & Water Bodies in Sikkim

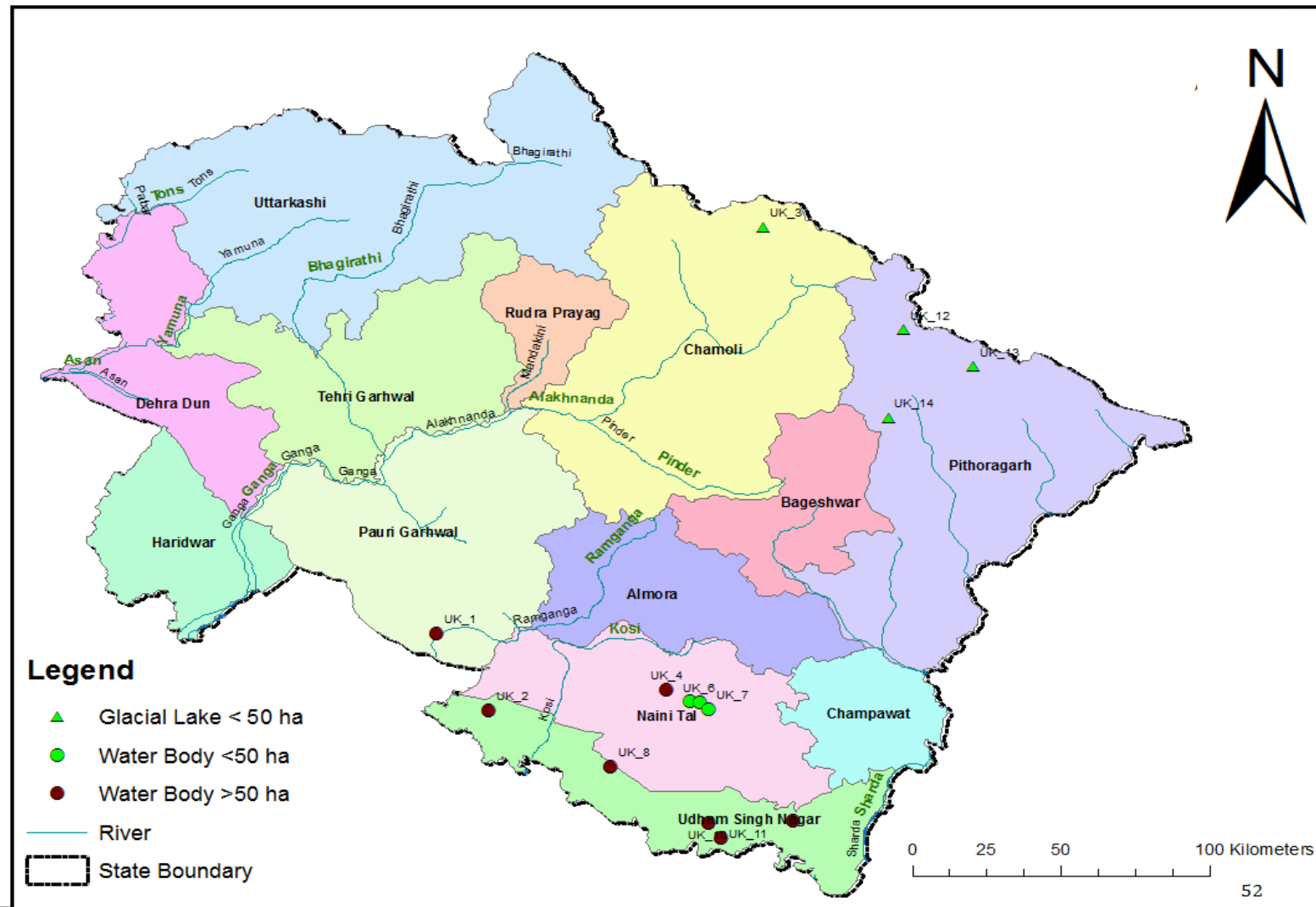


Figure 3 (e): Glacial Lakes & Water Bodies in Uttarakhand

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