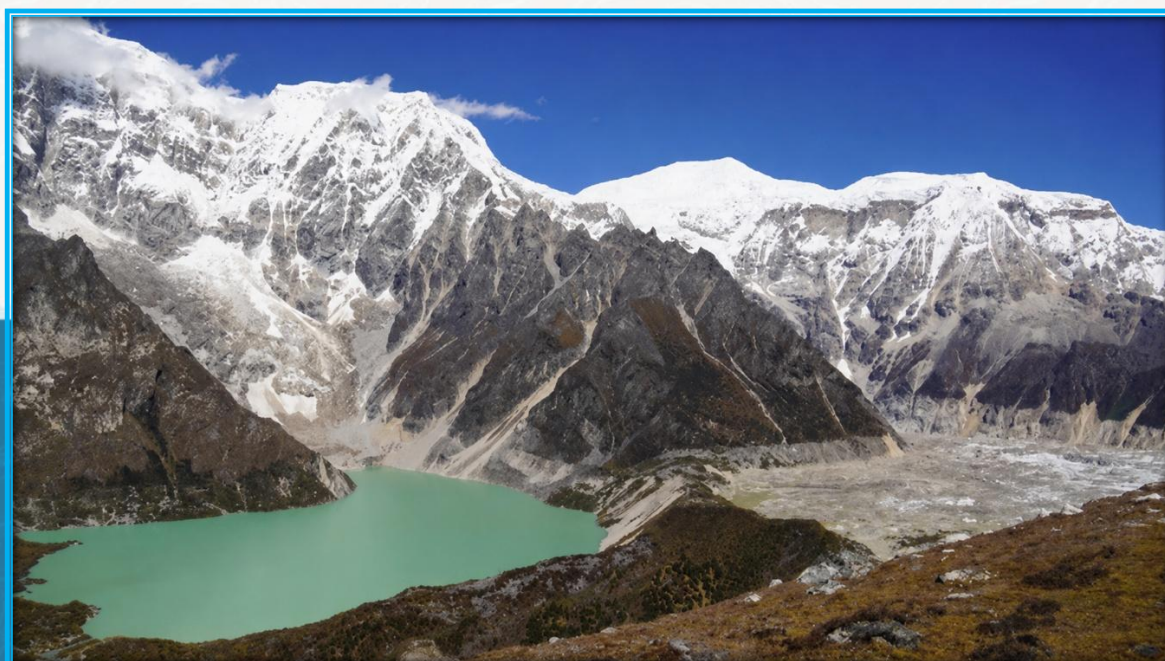




BHUTAN GLACIAL LAKE INVENTORY

2026



NATIONAL CENTRE FOR HYDROLOGY AND METEOROLOGY

ROYAL GOVERNMENT OF BHUTAN

2026

Published by: National Center for Hydrology and Meteorology Royal Government of Bhutan

PO Box: 2017

Thimphu, Bhutan

ISBN#: 978-99980-52-13-0

© CSD, NCHM, 2026

The Cryosphere Services Division on behalf of National Centre for Hydrology and Meteorology has produced this work on Bhutan Glacial Lake Inventory 2026.

Authors:

Phuntsho Tshering, Principal Meteorology/Hydrology Officer, ptshering@nchm.gov.bt

Tshewang Jamtsho, Meteorology/Hydrology Officer, tjamtsho@nchm.gov.bt

Arun Puri, Meteorology/Hydrology Officer, apuri@nchm.gov.bt

Amber Bahadur Rana, Hydro-met Technician, abrana@nchm.gov.bt

Foreword

The Himalayas are among the most sensitive regions to ongoing climate change, and Bhutan, with its extensive glacierized landscapes and high-altitude river systems, is experiencing significant transformations within its cryosphere. The changing state of glaciers and glacial lakes has direct implications for water resources, mountain ecosystems, downstream communities, and national disaster risk management efforts.

It is therefore a privilege to present the **Bhutan Glacial Lake Inventory 2026 (BGLI 2026)**, prepared by the Cryosphere Services Division of the National Centre for Hydrology and Meteorology (NCHM). This updated inventory represents an important milestone in strengthening Bhutan's national capacity for cryosphere observation, scientific assessment, and evidence-based decision-making.

The BGLI 2026 provides an updated assessment of glacial lake distribution, characteristics, and temporal changes across Bhutan's seven major river sub-basins. The inventory has been developed by integrating advanced geospatial technologies, including Sentinel-2 satellite imagery and deep learning-based image analysis, complemented by expert-based manual validation. This improved methodology enhances the efficiency, consistency, and reproducibility of glacial lake mapping while supporting long-term monitoring initiatives.

The findings of this assessment highlight noticeable changes in Bhutan's glacial lake systems. The increase in the number and area of glacial lakes compared to the previous inventory demonstrates the continuing influence of climate-driven glacier retreat and landscape transformation in the high Himalaya. Such changes emphasize the importance of sustained monitoring and improved understanding of glacial lake dynamics, particularly in relation to potential Glacial Lake Outburst Flood (GLOF) hazards.

Beyond scientific documentation, this inventory serves as a valuable national reference for disaster risk reduction, climate adaptation planning, hydrological assessments, and sustainable mountain development. The information generated through this work will support government agencies, researchers, and development partners in identifying emerging risks and prioritizing appropriate interventions.

I would like to acknowledge the dedicated efforts of the Cryosphere Services Division and all contributors involved in the preparation of this important technical document. Their commitment towards advancing cryosphere science and strengthening national climate resilience is highly commendable.

I encourage continued collaboration among scientific institutions, government agencies, and stakeholders to ensure regular updating of glacial lake information and further enhancement of Bhutan's cryosphere monitoring capabilities.



Director General

National Centre for Hydrology and Meteorology

Acknowledgement

The authors of the *Bhutan Glacial Lake Inventory 2026 (BGLI 2026)*, published as part of the 2025–2026 Annual Work Plan of the Cryosphere Services Division, extend our sincere gratitude to all individuals, institutions, and organizations whose invaluable support made this publication possible.

We would like to express our heartfelt appreciation to the International Center for Integrated Mountain Development (ICIMOD), Nepal, for providing advanced training on Machine Learning (ML) and Deep Learning (DL) techniques in the field of cryosphere studies. In particular, we gratefully acknowledge Dr. Sonam Wangchuk for his exceptional guidance and mentorship, generously offered through his voluntary service to the staff of the Cryosphere Services Division (CSD).

We also acknowledge the European Space Agency (ESA) for enabling free and open access to Sentinel satellite imagery, which served as the primary data source for glacial lake mapping and analysis in this study.

Finally, we extend our sincere thanks to the management of the National Centre for Hydrology and Meteorology (NCHM) for their continuous support, encouragement, and guidance throughout the process of developing this updated inventory of glacial lakes in Bhutan.

Executive Summary

Bhutan's glacierized Himalayan landscapes are undergoing rapid transformation driven by climate change. The National Centre for Hydrology and Meteorology (NCHM) has prepared the Bhutan Glacial Lake Inventory 2026 (BGLI 2026) to document the current state and recent evolution of glacial lakes across the country's seven major river sub-basins, superseding BGLI 2021 as the most comprehensive national assessment to date.

BGLI 2026 was developed using a semi-automated deep learning methodology, combining Sentinel-2 multispectral imagery with a DeepLabv3+ segmentation model and expert-led manual validation — improving upon the predominantly manual techniques of BGLI 2021 and establishing a robust framework for future updates.

The inventory records 620 glacial lakes across Bhutan's seven sub-basins, up from 567 in BGLI 2021 — a net increase of 53 lakes (9.4%). Total lake area grew from approximately 55.04 km² to 58.18 km² (+5.7%), reflecting accelerating climate-driven glacier retreat. The Pho Chhu sub-basin remains the most active, accounting for 187 lakes covering 22.79 km² and recording the largest absolute increase. The Chamkhar Chhu, Mangde Chhu, Mo Chhu, and Kuri Chhu sub-basins also show consistent growth, while Wang Chhu and Drangme Chhu show minimal change consistent with their limited glacierization.

The inventory reveals pronounced changes in glacial lake characteristics, including the emergence of new proglacial lakes. Notably, several lakes underwent substantial expansion, with increases in surface area reaching up to 100%, indicating a doubling of their areal extent over the study period. Significantly, Lemthang Tsho — site of a major Glacial Lake Outburst Flood (GLOF) in 2015 — is absent from BGLI 2026, underscoring the ongoing GLOF hazard and the importance of post-outburst monitoring.

BGLI 2026 carries direct implications for disaster risk reduction, climate adaptation, and downstream community safety. The continued expansion of glacial lakes — particularly in the Pho Chhu sub-basin — reinforces the need for intensified monitoring, inventory updates at 5–10-year intervals, and integration of satellite surveillance with field verification. The inventory provides a critical evidence base for agencies and partners strengthening Bhutan's cryosphere resilience in the face of ongoing climate change.

Content

Foreword	ii
Acknowledgement	iii
Executive Summary	iv
List of Figures	vii
List of Tables	vii
1 Introduction.....	1
2 Study Area	3
3 Data and Sources.....	3
4 Methodology	4
4.1 Glacial Lake Mapping	4
4.2 Deep learning based automated glacial lake delineation	5
4.2.1 Input data and compilation.....	5
4.2.2 Reference Labels and target-mask generation	6
4.2.3 Patch extraction and sample preparation	6
4.2.4 Model architecture and training	6
4.2.5 Model evaluation and checkpoint selection	6
4.2.6 Full-scene prediction.....	6
4.2.7 ArcGIS-based post-classification refinement	7
4.2.8 Final outputs.....	7
4.3 Automated Delineation Manual Correction	7
4.4 Assigning Glacial Lake Attributes and Glacial Lake Criteria.....	8
5 Results.....	9
5.1 Sub-basin wise Distribution of Glacial Lakes.....	11
5.1.1 Pho Chhu sub-basin	11
5.1.2 Chamkhar Chhu sub-basin.....	12
5.1.3 Mangde Chhu sub-basin	13

5.1.4	Mo Chhu sub-basin.....	14
5.1.5	Kuri Chhu sub-basin	15
5.1.6	Wang Chhu sub-basin.....	16
5.1.7	Drangme Chhu sub-basin.....	17
5.2	New Lake formations	20
6	Discussion.....	21
7	Conclusions.....	24
8	References.....	25
9	Appendix.....	29

List of Figures

Figure 1. Flow chart showing the deep machine learning based glacial lake polygon generation and manual correction of glacial lake polygons	4
Figure 2. Semi-automatic glacial delineation—deep learning-based automated extraction with manual refinement	8
Figure 3. Spatial Distribution of Glacial Lakes in Bhutan Himalayas	10
Figure 4. Spatial distribution of glacial lakes in Pho Chhu sub-basin	11
Figure 5. Spatial Distribution of glacial lakes in Chamkhar Chhu sub-basin.....	12
Figure 6. Spatial distribution of glacial lakes in Mangde Chhu sub-basin	13
Figure 7. Spatial Distribution of glacial lakes in Mo Chhu sub-basin.....	14
Figure 8. Spatial Distribution of glacial lakes in Kuri Chhu sub-basin	15
Figure 9. Spatial distribution of glacial lakes in Wang Chhu sub-basin.....	16
Figure 10: Figure showing the disappearance of two supra-glacial lakes (left) and formation of completely new lake in 2026 (right)	17
Figure 11. Spatial distribution of glacial lakes in Drangme Chhu sub-basin	18
Figure 12. Sub-basin wise distribution of glacial lakes	19
Figure 13. Sub-basin wise glacial lake area distribution	19
Figure 14. Changes in glacial lake extent between BGLI 2021 and BGLI 2026, highlighting the formation of new lakes (first three panels) and the absence of Lemthang Tsho in BGLI 2026	20
Figure 15. This figure shows expansion of some of the glacial lakes between BGLI 2021 and BGLI 2026. The panels (1, 3 & 4) illustrate the expansions up to 100% between the two inventories.....	21

List of Tables

Table 1. Deep learning workflow and parameter settings used for automated glacial lake mapping.....	5
---	---

1 Introduction

Glacial lakes are among the most dynamic indicators of cryospheric change in High Mountain Asia (HMA). In recent decades, rising air temperatures have accelerated glacier retreat, thinning, and fragmentation, resulting in widespread changes in glacier-fed landscapes. As glaciers retreat, meltwater accumulates in over-deepened basins and behind morainic deposits, leading to the expansion of existing proglacial lakes and the formation of new glacial lakes (Bolch et al., 2012; Carrivick & Tweed, 2016). These changes provide important evidence of climate-driven glacier response while also increasing concerns regarding potential Glacial Lake Outburst Floods (GLOFs), which pose risks to downstream settlements, infrastructure, hydropower facilities, and river ecosystems (Richardson & Reynolds, 2000; Veh et al., 2019).

In addition to their hazard significance, glacial lakes influence mountain hydrology by modifying seasonal runoff patterns, sediment transport processes, and long-term freshwater availability. The Himalayan region, including Bhutan, is particularly sensitive due to its steep terrain, high relief, glacierized catchments, and rapidly changing climatic conditions. Bhutan, located in the eastern Himalaya, contains numerous glaciers and glacial lakes distributed across seven major river basins: Pho Chhu, Mo Chhu, Wang Chhu, Mangde Chhu, Chamkhar Chhu, Kuri Chhu, and Drangme Chhu. The country has experienced widespread glacier retreat and mass loss, accompanied by the expansion of several moraine-dammed lakes associated with receding glacier termini (Bajracharya et al., 2014; National Center for Hydrology and Meteorology [NCHM], 2019).

Considering the increasing influence of climate change on cryospheric systems, systematic monitoring of glacial lakes has become essential for disaster risk reduction, water resource management, and climate adaptation planning. The Bhutan Glacial Lake Inventory (BGLI) serves as the national database for documenting the distribution, characteristics, and temporal changes of glacial lakes across Bhutan. The inventory provides fundamental information for glacial monitoring, GLOF hazard assessment, watershed management, and scientific studies related to Himalayan cryosphere dynamics.

The previous inventory, BGLI 2021, established an important national baseline through the interpretation and digitization of satellite imagery. However, conventional mapping approaches largely depended on manual and semi-automated delineation techniques, which are time-consuming and may introduce inconsistencies due to operator judgement. Furthermore,

medium-resolution satellite data can limit the detection of small or complex lake features, particularly in areas affected by debris cover, shadows, snow, and turbid water conditions.

The present Bhutan Glacial Lake Inventory 2026 (BGLI 2026) introduces an improved methodology by integrating recent advances in remote sensing, deep learning, and geospatial analysis. High-resolution Sentinel-2 multispectral imagery was utilized with a deep learning-based segmentation framework to automatically identify and delineate glacial lake boundaries across Bhutan's glacierized regions. Sentinel-2 data provide enhanced spatial, spectral, and temporal capabilities, allowing improved detection of small and rapidly changing water bodies (Drusch et al., 2012). Deep learning-based image segmentation approaches have demonstrated strong potential for automated water-body extraction by learning complex spatial and spectral characteristics from satellite imagery (Zhang et al., 2018).

The automated outputs from the deep learning model were further refined through expert-based visual interpretation and quality control to remove false detections and improve boundary accuracy. This integrated approach combines the efficiency and reproducibility of artificial intelligence with the reliability of manual validation, providing a consistent framework for large-scale glacial lake mapping. The methodology also supports future inventory updates and improved monitoring of newly emerging supraglacial and proglacial lakes that may develop under continued glacier retreat.

This report presents the results of the Bhutan Glacial Lake Inventory 2026 and evaluates the spatial distribution and temporal evolution of glacial lakes across Bhutan. The objectives of this study are to: (i) describe the methodology for automated and manual glacial lake delineation using Sentinel-2 imagery and deep learning techniques; (ii) analyze basin-wise distribution, number, and area of glacial lakes; (iii) quantify changes in lake number and extent between BGLI 2021 and BGLI 2026; (iv) identify newly formed and significantly expanded lakes requiring further monitoring; and (v) document lakes that have disappeared following recent GLOF events. The findings aim to strengthen national cryosphere monitoring, support climate adaptation strategies, and improve understanding of glacial-lake interactions in Bhutan.

2 Study Area

The study area encompasses the glacierized terrain of Bhutan, spanning the northern high-altitude belt along the Himalayan crest and extending into the inner Himalayan ranges. Glacial lakes are concentrated in the headwater zones of seven sub-basins: Pho Chhu, Chamkhar Chhu, Mangde Chhu, Kuri Chhu, Mo Chhu, Drangme Chhu, and Pa Chhu. Elevations in the glaciated areas typically range from approximately 4,000 m to over 7,000 m above sea level. The region experiences a monsoon-influenced climate with pronounced seasonal variability in temperature and precipitation, which drives significant interannual variability in glacier mass balance and lake dynamics.

3 Data and Sources

The primary input for automated delineation was Sentinel-2 Level-2A multispectral imagery. A three-channel composite was prepared using Sentinel-2 bands B11 (shortwave infrared), B8 (near-infrared), and B4 (red), which together provide strong spectral contrast between glacial lake water, surrounding ice and snow, and bedrock or moraine. Imagery was selected to minimize cloud cover and seasonal snow effects; acquisition dates were targeted for late summer to early autumn.

Reference lake boundaries for model training were derived from the 2018 Bhutan Glacial Lake Inventory (BGLI 2021), which served as the ground truth mask for supervised training. This inventory was also used as the base reference during the manual post-classification correction phase carried out in ArcGIS.

4 Methodology

4.1 Glacial Lake Mapping

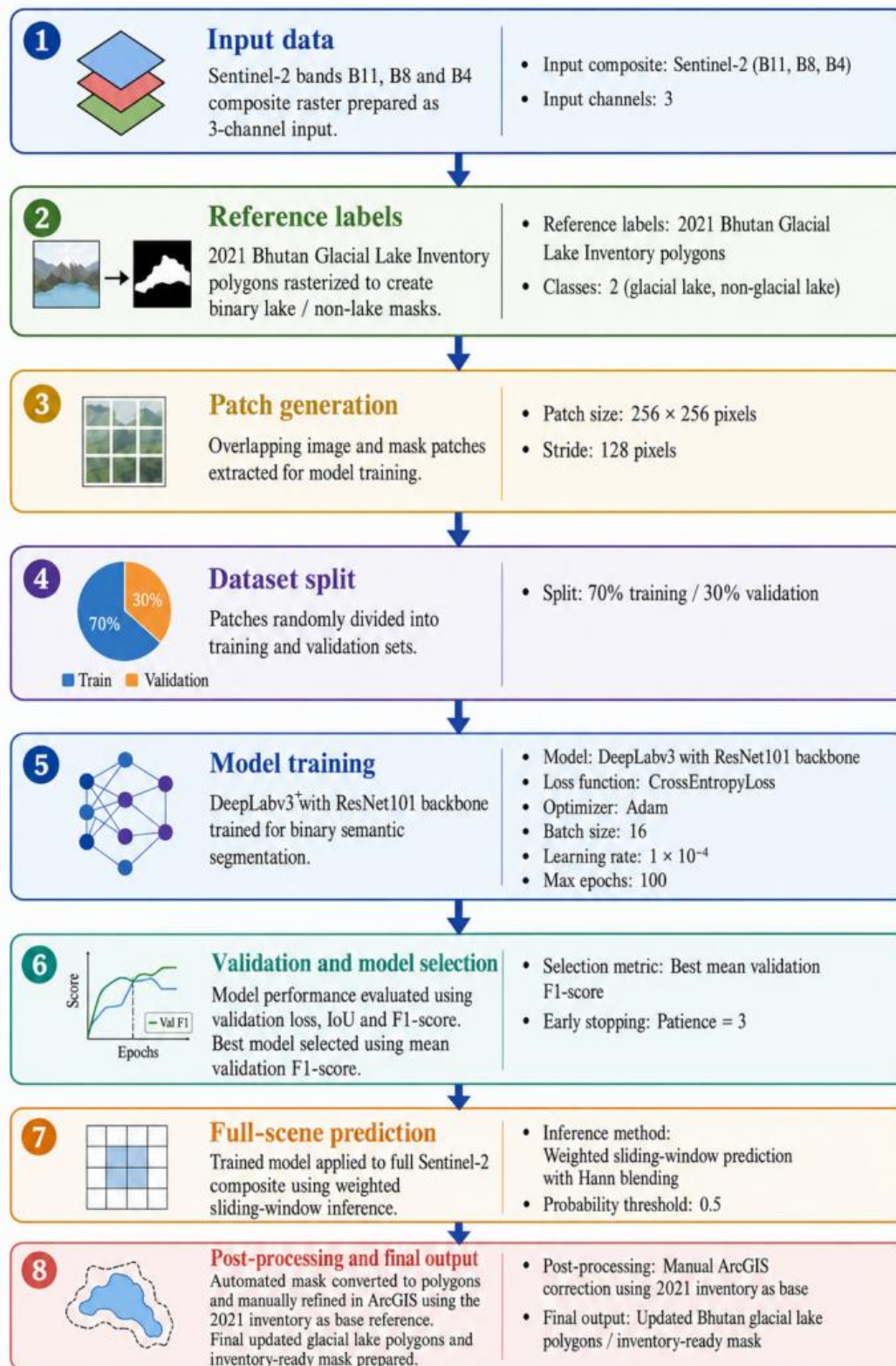


Figure 1. Flow chart showing the deep machine learning based glacial lake polygon generation and manual correction of glacial lake polygons

Glacial lake mapping BGLI 2026 was carried out using a semantic segmentation workflow implemented in PyTorch. A three-channel composite image was used as the predictor dataset, and BGLI 2021 was used to generate reference glacial lake masks for supervised training. After automated prediction, the resulting glacial boundaries were converted to polygons and manually corrected in ArcGIS. Figure 1 shows the complete work flow and table 1 shows the deep learning workflow and parameterization settings.

Table 1. Deep learning workflow and parameter settings used for automated glacial lake mapping

Parameter	Value
Input composite	<i>Sentinel-2 bands B11, B8, B4</i>
Reference labels	<i>2018 Bhutan Glacial Lake Inventory polygons</i>
Input channels	<i>3</i>
Patch size	<i>256 × 256 pixels</i>
Stride	<i>128 pixels</i>
Dataset split	<i>70% training / 30% validation</i>
Batch size	<i>16</i>
Model architecture	<i>DeepLabv3+ with ResNet101 backbone</i>
Output classes	<i>2 – glacial lake and non-glacial lake</i>
Loss function	<i>CrossEntropyLoss</i>
Optimizer	<i>Adam</i>
Learning rate	<i>1 × 10⁻⁴</i>
Maximum epochs	<i>100</i>
Early stopping	<i>Patience = 3 epochs</i>
Selection metric	<i>Best mean validation F1-score</i>
Inference method	<i>Sliding-window with Hann-window blending</i>
Probability threshold	<i>0.5</i>

4.2 Deep learning based automated glacial lake delineation

4.2.1 Input data and compilation

A three-channel composite image was prepared by stacking Sentinel-2 bands B11, B8 and B4 (Shortwave Infrared, Near-Infrared and Red band respectively)

4.2.2 Reference Labels and target-mask generation

Reference glacial lake polygons from the 2019 Bhutan Glacial Lake Inventory were used as the initial training labels. These polygons were checked for null or invalid geometries and reprojected to the raster coordinate reference system where necessary. The glacial lake outlines were then rasterized to the image grid to generate binary target masks, where glacial lake pixels were coded as 1 and non-glacial pixels as 0.

4.2.3 Patch extraction and sample preparation

The three-channel image and its corresponding binary glacial lake mask were divided into overlapping patches of 256×256 pixels with a stride of 128 pixels. Overlapping extraction was adopted to improve spatial continuity and to avoid losing information near patch edges. Patches containing no glacial lake information were excluded from the training pool, so the dataset retained only informative samples. Channel-wise mean and standard deviation values were computed from the retained patches and used to normalize all input samples during training and inference.

4.2.4 Model architecture and training

Semantic segmentation was performed using DeepLabv3+ with a ResNet101 backbone. The standard three-channel configuration was used for the first convolutional layer, and the final classifier head was modified to output two classes: glacial lake and non-glacial lake. The extracted patch dataset was split into 70% training data and 30% validation data. Model optimization used cross-entropy loss and the Adam optimizer with a learning rate of 1×10^{-4} . Training was run for a maximum of 100 epochs, while early stopping with a patience of three epochs was used to prevent overfitting.

4.2.5 Model evaluation and checkpoint selection

During training, both training loss and validation loss were monitored for each epoch. Validation predictions were additionally assessed using Intersection over Union (IoU) and F1-score derived from the confusion matrix. The best model checkpoint was selected on the basis of the highest mean validation F1-score.

4.2.6 Full-scene prediction

The best-performing checkpoint was reloaded and applied to the full five-channel composite using sliding-window inference. The same patch size (256 pixels) and stride (128 pixels) used for training were also used during prediction. A two-dimensional Hann window was applied to each probability patch so that overlapping predictions could be blended smoothly. A probability threshold of 0.5 was then applied to generate the binary automated glacial mask.

4.2.7 ArcGIS-based post-classification refinement

After automated segmentation, the glacial lake mask was converted to vector polygons and reviewed in ArcGIS. Manual correction was carried out using the 2018 glacial lake shapefile as the base reference. This step was used to refine glacial lake boundaries, remove obvious false positives, reconnect or separate fragmented polygons where necessary, and improve divides and margins in complex terrain. The ArcGIS refinement step formed the final quality-control stage before preparation of the updated Bhutan glacial lake inventory.

4.2.8 Final outputs

The final deliverables consisted of corrected glacial lake polygons for the updated inventory, together with derived attribute information and summary products. These outputs can be used for glacial lake statistics, terrain analysis, basin-wise summaries, and comparison with earlier Bhutan glacial lake inventories.

4.3 Automated Delineation Manual Correction

Figure 2 illustrates the spatial correspondence between automated deep learning delineation (blue polygons) and manual boundary refinement (red outlines) across representative areas of northern Bhutan. Once the auto-delineated polygons were generated, the polygons were then overlaid on Sentinel-2 (true-color composite) imagery and then manually corrected.

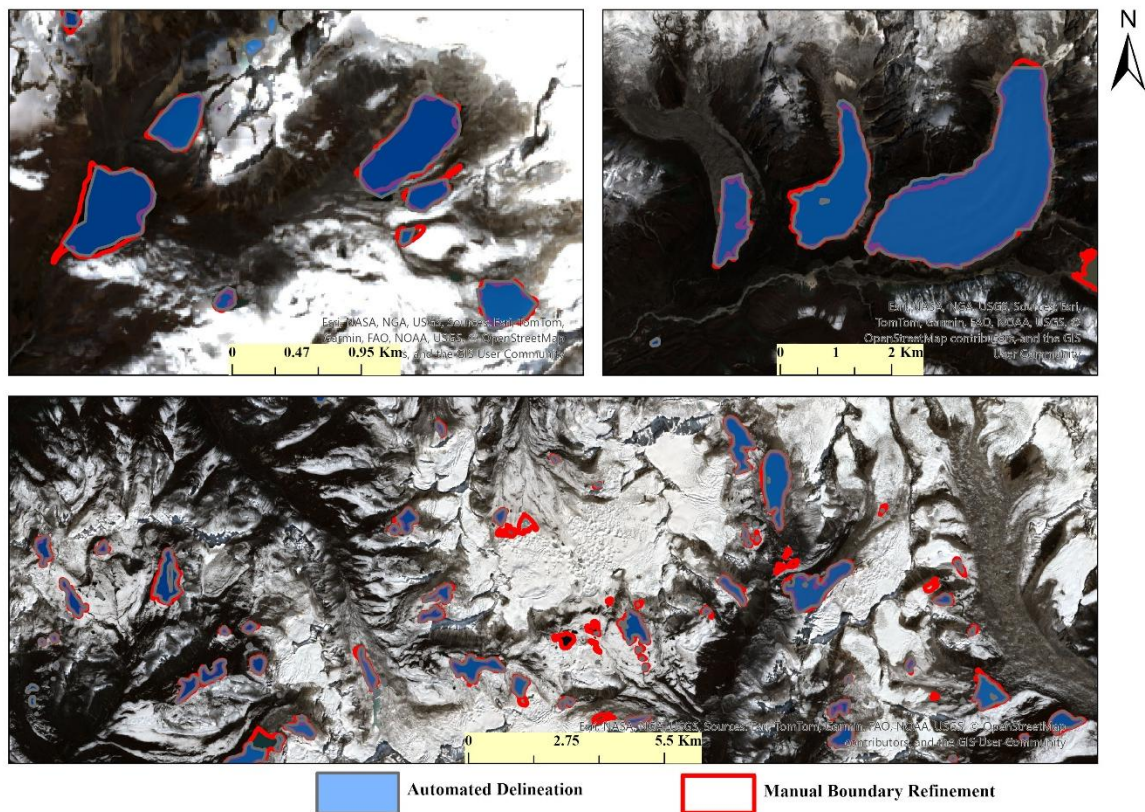


Figure 2. Semi-automatic glacial delineation—deep learning-based automated extraction with manual refinement

4.4 Assigning Glacial Lake Attributes and Glacial Lake Criteria

The assignment of glacial lake attributes, including glacial lake identification numbers, geographic coordinates (latitude and longitude), lake surface area, and elevation, was carried out following the methodology adopted in the Bhutan Glacial Lake Inventory (BGLI, 2021). A detailed description of the attribute assignment procedures is provided in the previous inventory report (BGLI, 2021).

For the delineation and classification of glacial lakes, the criteria established in BGLI (2021) were consistently applied in the present study. Glacial lakes with a surface area greater than 0.01 km² were included in the inventory, while small water bodies and low-elevation water bodies were excluded. An elevation threshold of 3500 m above sea level (a.s.l.) was applied to identify potential glacial lakes within the high-altitude glacial environment.

In addition to the elevation threshold, the proximity of water bodies to Little Ice Age (LIA) glacial features was considered as an important criterion for glacial lake identification. Not all water bodies located above 3500 m a.s.l. were classified as glacial lakes, as some may represent

non-glacial water bodies. Following the methodology of BGLI (2021), water bodies located between LIA moraines and the present glacier terminus, as well as those situated within 2 km downstream of LIA moraine limits, were considered glacial lakes for the current inventory.

5 Results

In the current inventory BGLI, 2026, a total of 620 glacial lakes were mapped across the northern frontiers of the country in seven sub-basins compared to that of 567 in BGLI, 2021. Across all sub-basins, a general trend of increasing glacial lake count and area is observed between 2021 and 2026, consistent with accelerating glacial melt under changing climate conditions. The Pho Chhu and Chamkhar Chhu sub-basins exhibit the most significant absolute increases in both lake number and area, while the Mangde Chhu sub-basin presents an anomalous case of increased lake count accompanied by a slight decrease in total area. The Drangme Chhu and Wang Chhu sub-basins, located in relatively lower-elevation or less glaciated terrain, show the least change and smallest overall glacial lake presence which well agrees with that of BGLI, 2021.

The spatially distributed glacial lakes are represented in figure 3.

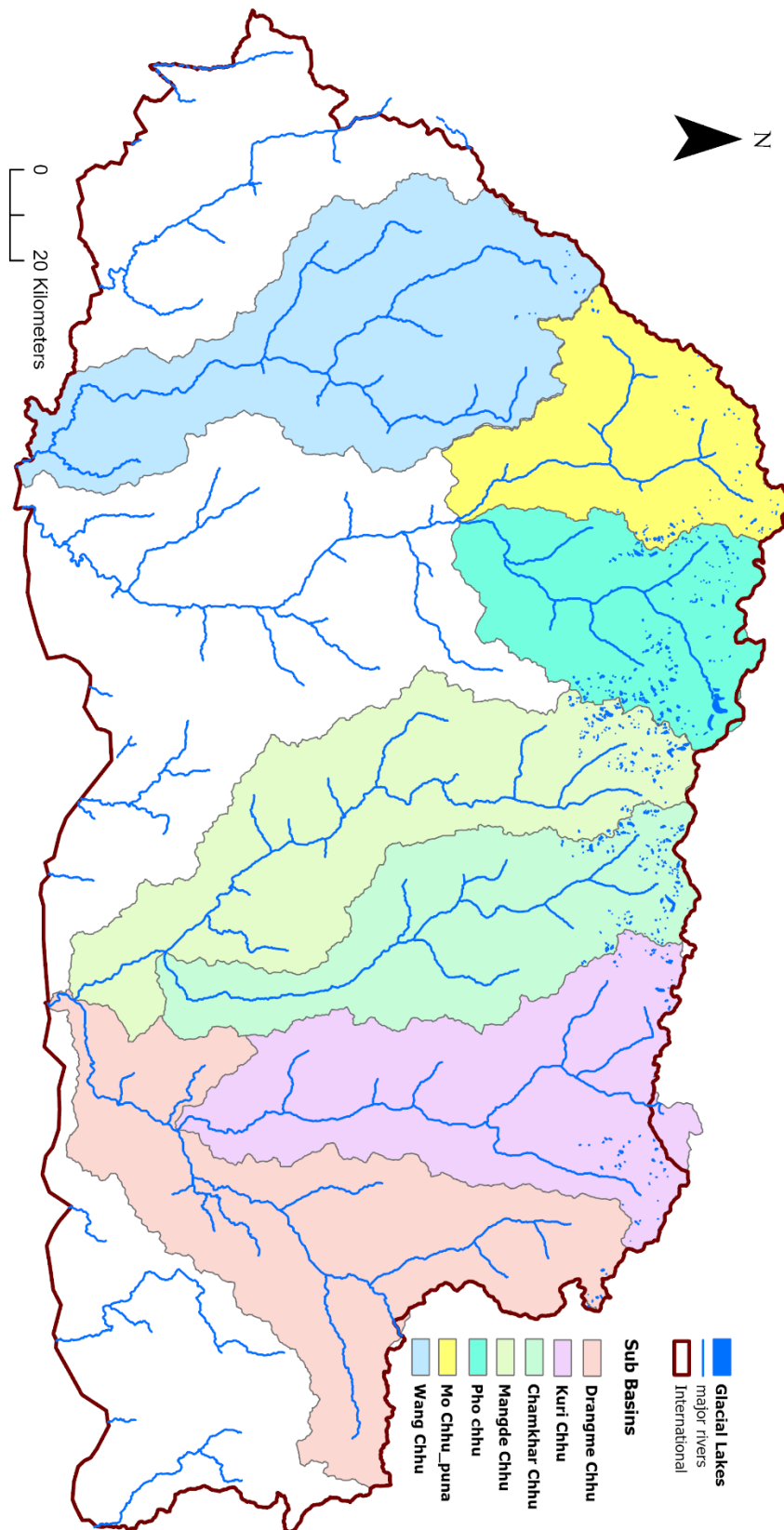


Figure 3. Spatial Distribution of Glacial Lakes in Bhutan Himalayas

5.1 Sub-basin wise Distribution of Glacial Lakes

5.1.1 Pho Chhu sub-basin

The Pho Chhu sub-basin contains the highest number and greatest total area of glacial lakes among all sub-basins in Bhutan. The spatial distribution map (Fig. 4) reveals a dense and widespread clustering of lakes across the northern portion of the basin, including several notably large and potentially dangerous glacial lakes such as Thorthormi (Pho_gl101), Raphstreng (Pho_gl195) and Luggye (Pho_gl111) in northeastern part of the sub-basin. As per the current inventory, the sub-basin hosts 187 glacial lakes covering a total area of 22.79 km², representing a marked increase from 157 lakes and 20.98 km² recorded in BGLI 2021. This increase of 30 lakes and approximately 1.81 km² in area over six years underscores the dynamic nature of glacial retreat and lake expansion in this sub-basin.

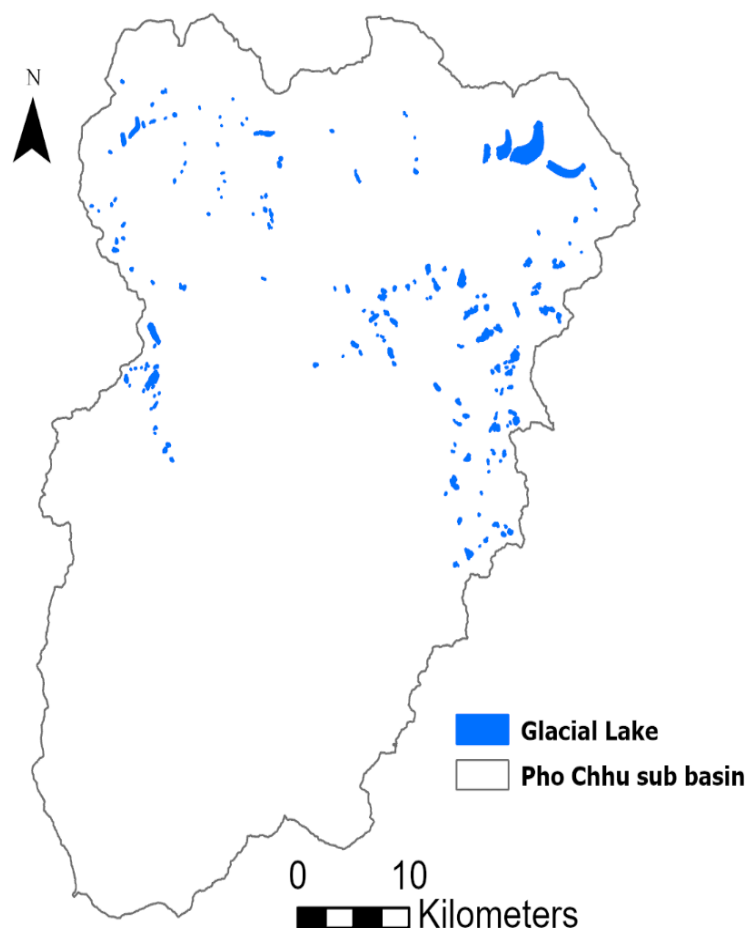


Figure 4. Spatial distribution of glacial lakes in Pho Chhu sub-basin

5.1.2 Chamkhar Chhu sub-basin

The Chamkhar Chhu sub-basin ranks second in terms of both lake count and total glacial lake area. Lakes are concentrated predominantly in the northern highland zone, as visible in the distribution map (Fig. 5). Current inventory records 139 glacial lakes with a combined area of 12.54 km², compared to 131 lakes and 11.56 km² in BGLI 2021 — an addition of 8 lakes and approximately 0.98 km² over the study period.

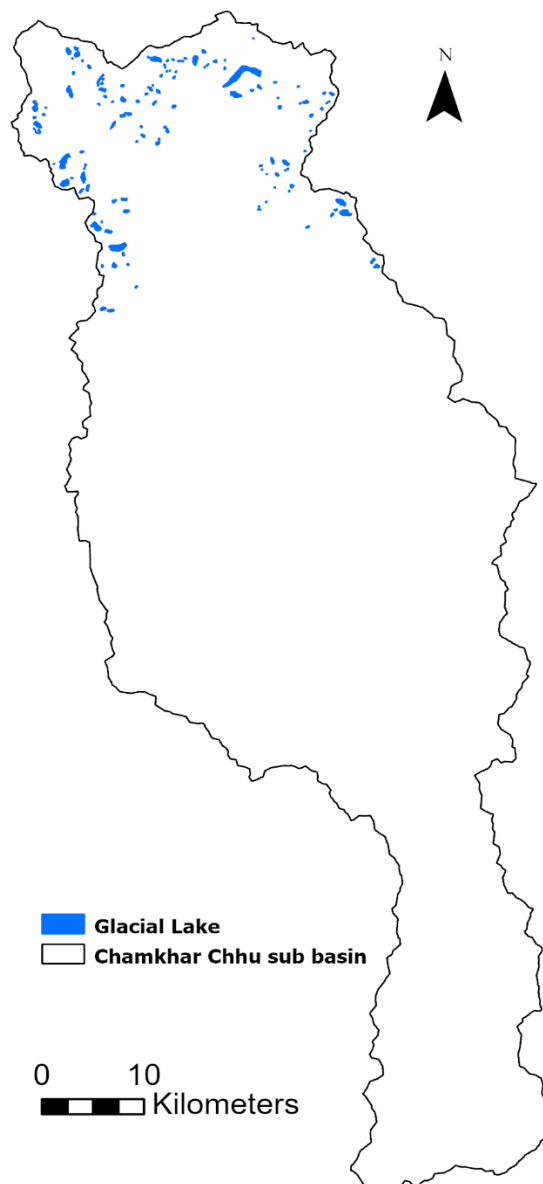


Figure 5. Spatial Distribution of glacial lakes in Chamkhar Chhu sub-basin

5.1.3 Mangde Chhu sub-basin

The Mangde Chhu sub-basin has one of the densest concentrations of glacial lakes in its northern headwater region, as depicted in the distribution map (Fig. 6). Current inventory records 134 lakes covering 11.52 km², a slight increase from 130 lakes in BGLI 2021. Notably, the total lake area in 2019 (11.86 km²) was marginally higher than in 2026 (11.52 km²), suggesting that while the number of individual lakes increased, some existing lakes may have experienced area reduction or fragmentation over the period.

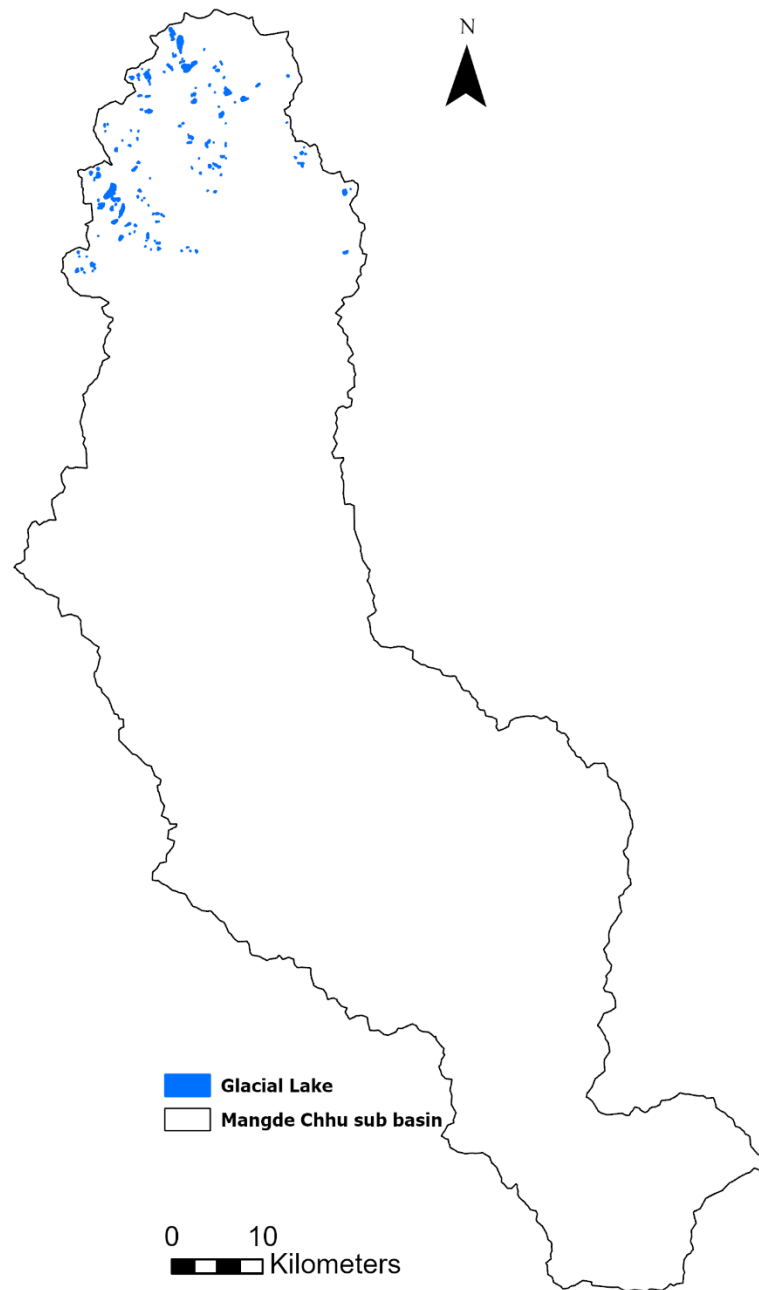


Figure 6. Spatial distribution of glacial lakes in Mangde Chhu sub-basin

5.1.4 Mo Chhu sub-basin

The Mo Chhu sub-basin shows glacial lakes distributed across both the northern boundary and the eastern margin of the basin with fewer towards western sub-basin (Fig. 7). The current inventory records 74 lakes with a total area of 4.56 km², compared to 66 lakes and 4.25 km² in BGLI 2021, reflecting a consistent increase of 8 lakes and 0.31 km² in area.

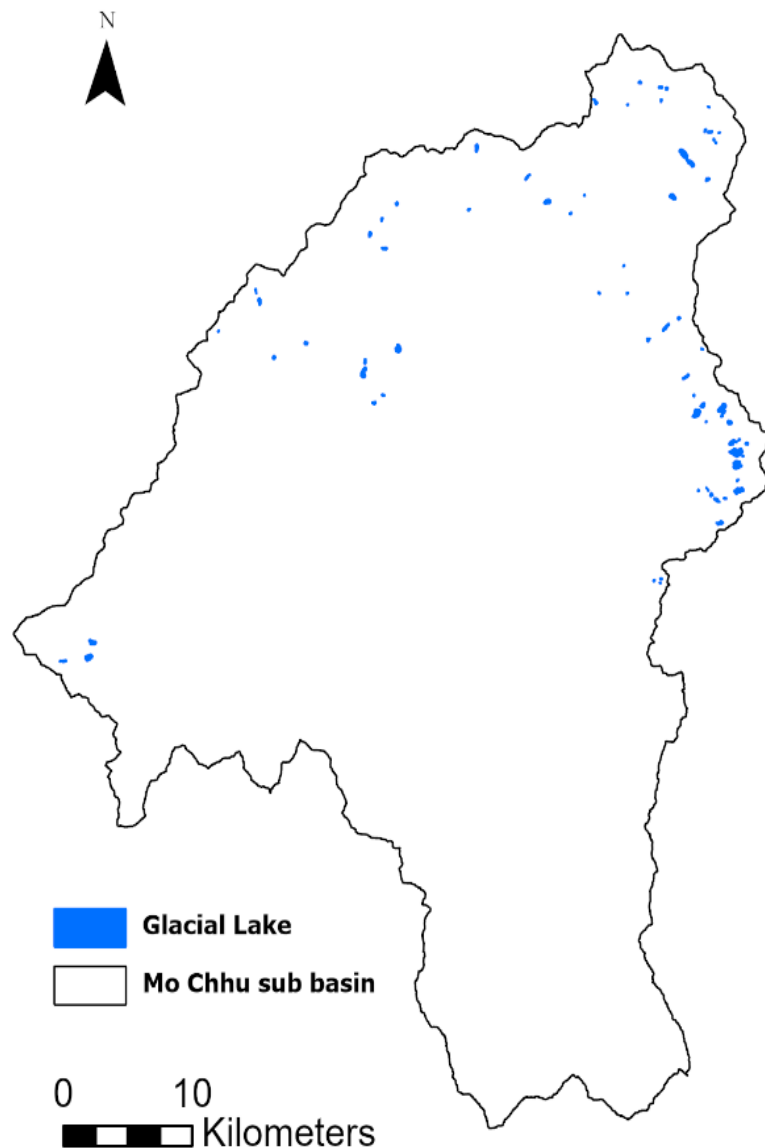


Figure 7. Spatial Distribution of glacial lakes in Mo Chhu sub-basin

5.1.5 Kuri Chhu sub-basin

Lakes in the Kuri Chhu sub-basin are concentrated along the northwestern and northeastern margins of the watershed, as shown in the map (Fig. 8). The current inventory records 65 lakes covering 5.34 km², up from 61 lakes and 5.01 km² in BGLI 2021. The sub-basin thus shows a steady, moderate increase in both lake count and extent.

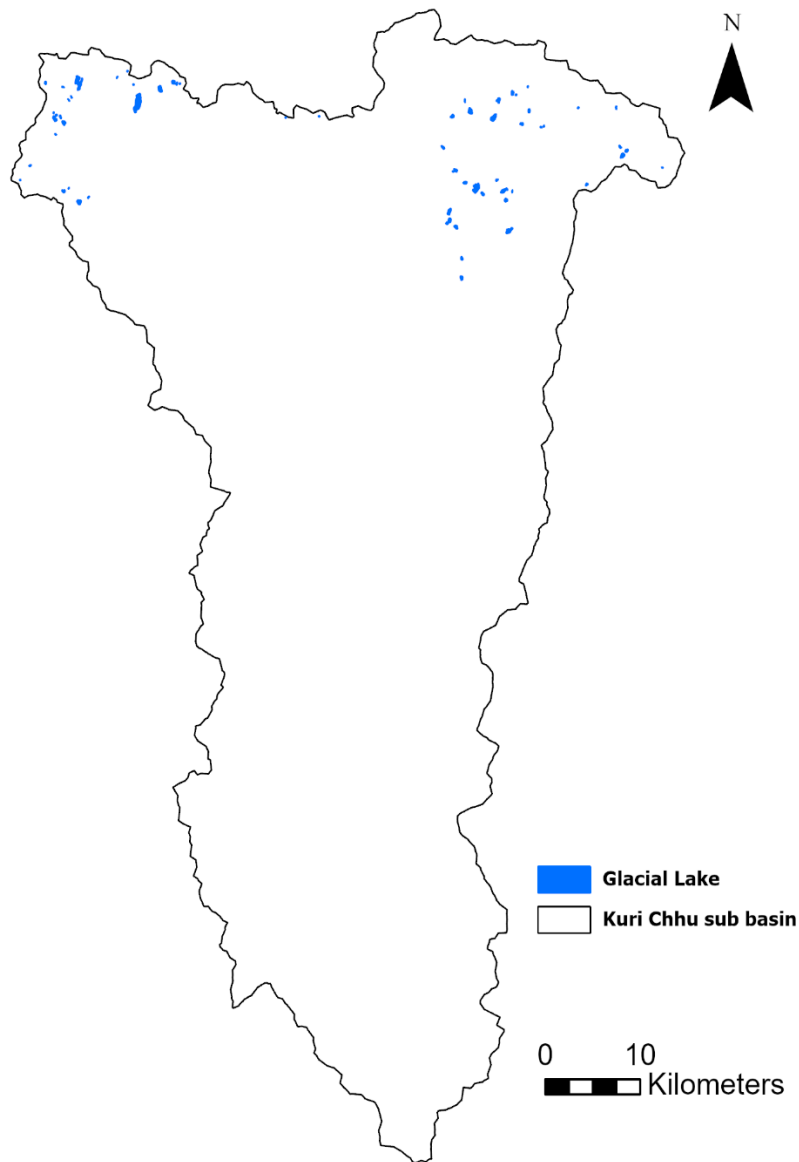


Figure 8. Spatial Distribution of glacial lakes in Kuri Chhu sub-basin

5.1.6 Wang Chhu sub-basin

The Wang Chhu sub-basin (Ha Chhu, Paa Chhu and Thim Chhu) has the fewest glacial lakes among the basins with discernible lake presence, with lakes confined to a small cluster near the northern tip of the basin. BGLI 2026 records 12 lakes covering 0.64 km², a slight decrease from 13 lakes in BGLI 2021, although the total area increased marginally from 0.60 km² to 0.64 km². The decrease in number is due to disappearance of two supra glacial ponds and formation of one new lake at a different location, at the terminus of a different glacier as shown in figure 10. The spatial distribution of the lakes is represented in figure 9.

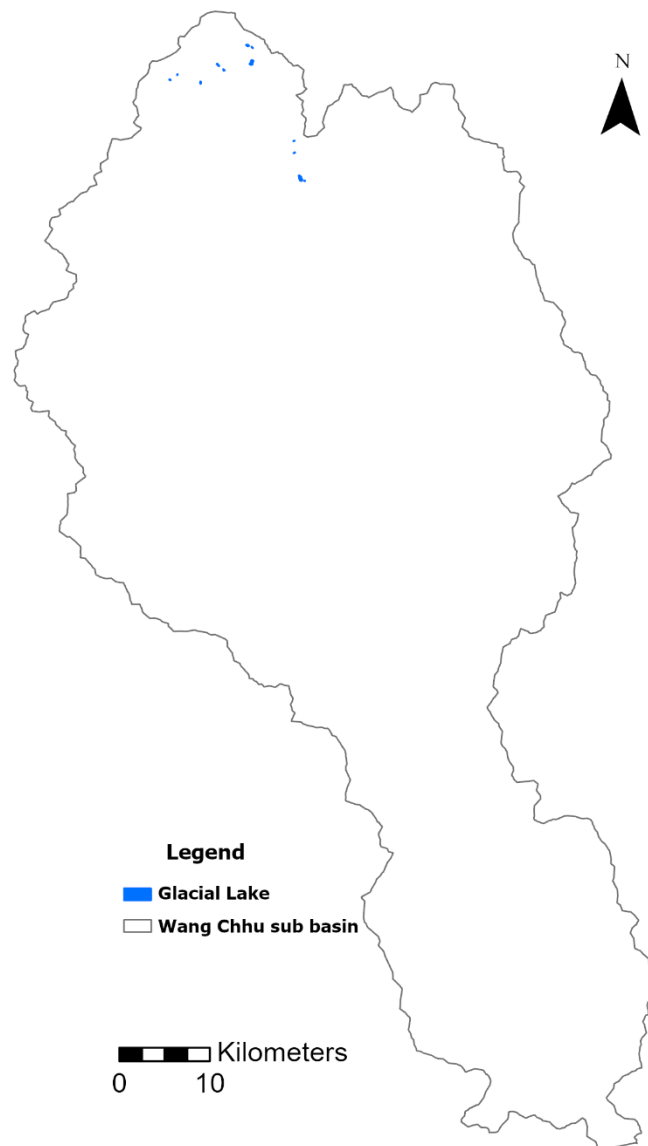


Figure 9. Spatial distribution of glacial lakes in Wang Chhu sub-basin

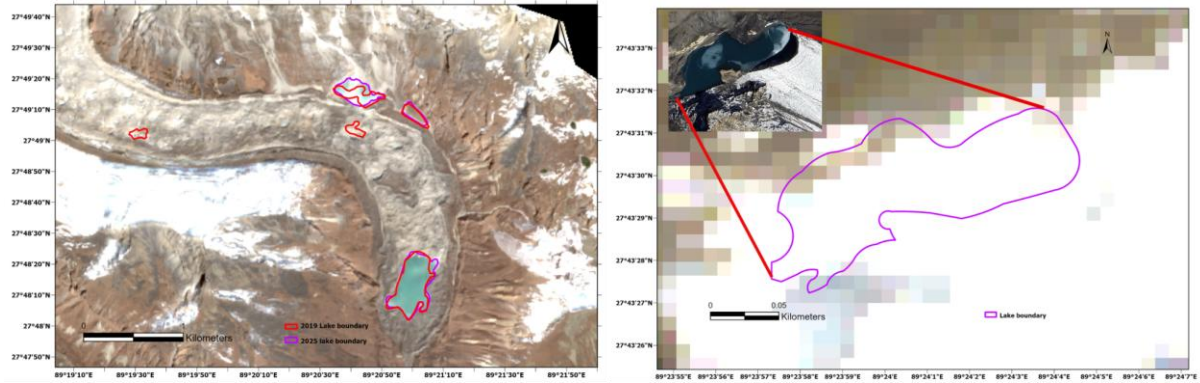


Figure 10: Figure showing the disappearance of two supra-glacial lakes (left) and formation of completely new lake in 2026 (right)

5.1.7 Drangme Chhu sub-basin

The Drangme Chhu sub-basin has the fewest glacial lakes overall, with lakes restricted to a small cluster in the far northern tip of the sub-basin. Both BGLI 2021 and BGLI 2026 record 9 lakes in this sub-basin and the total area increased slightly from 0.77 km² to 0.79 km², indicating stable lake count with marginal area expansion. The spatial distribution of the lakes is represented in figure 11.

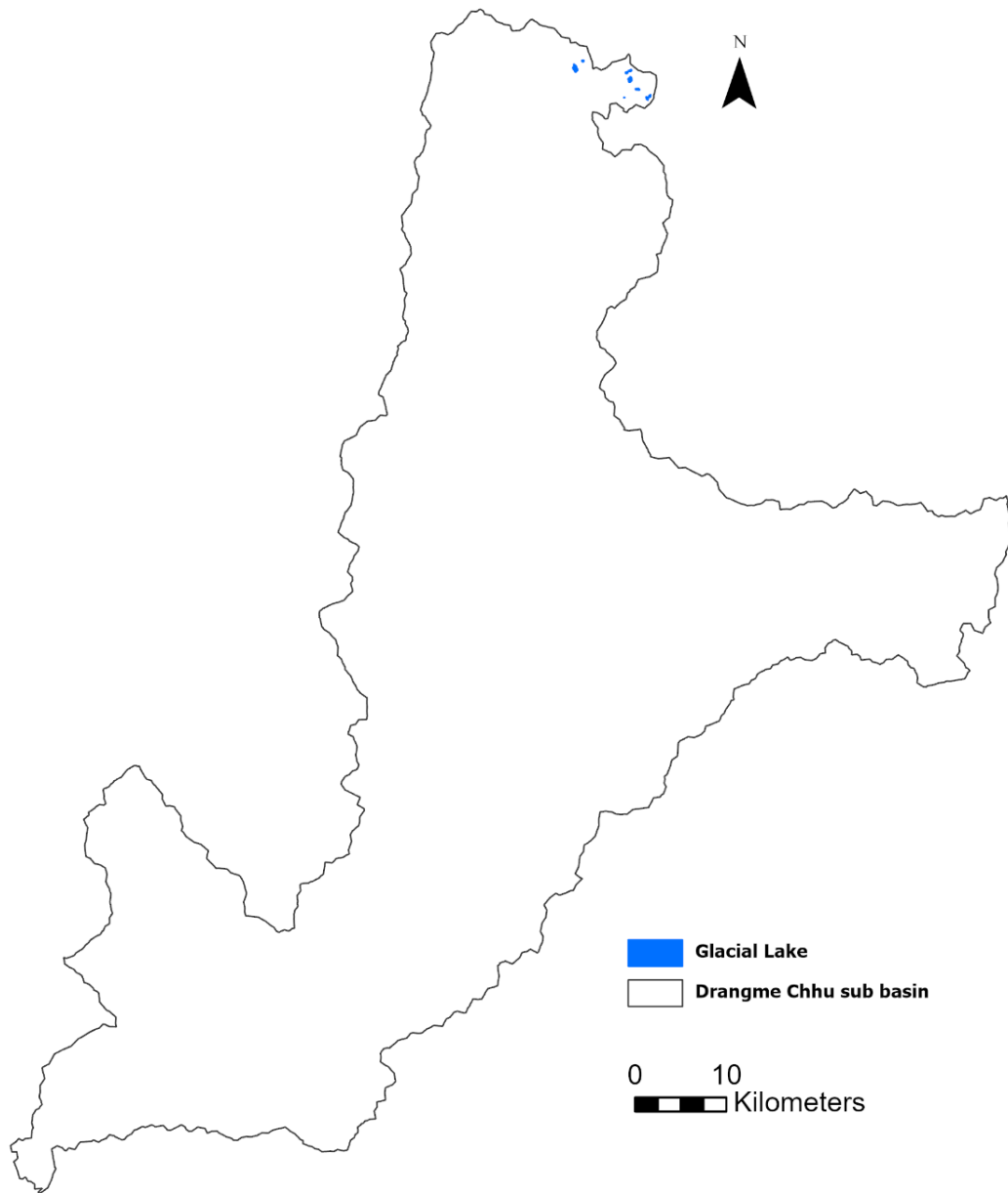


Figure 11. Spatial distribution of glacial lakes in Drangme Chhu sub-basin

The figures 12 and 13 represent the sub-basin wise lake number distribution and the sub-basin wise area distribution respectively. The data sets were compared using the satellite imageries of 2018 and 2025.

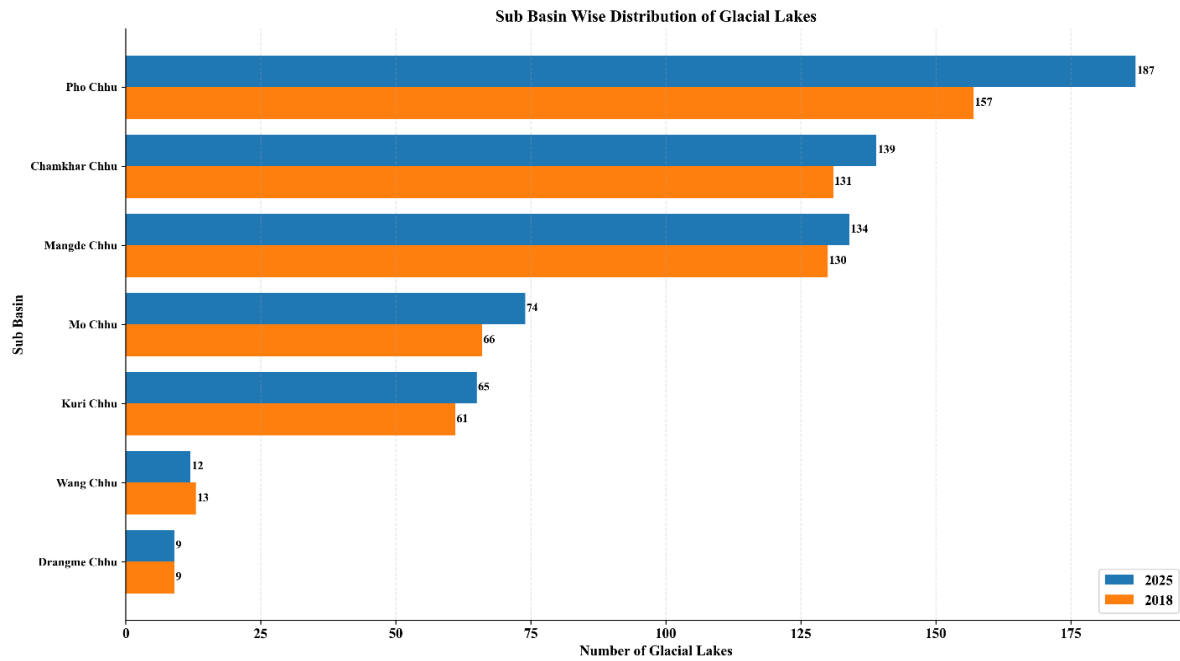


Figure 12. Sub-basin wise distribution of glacial lakes

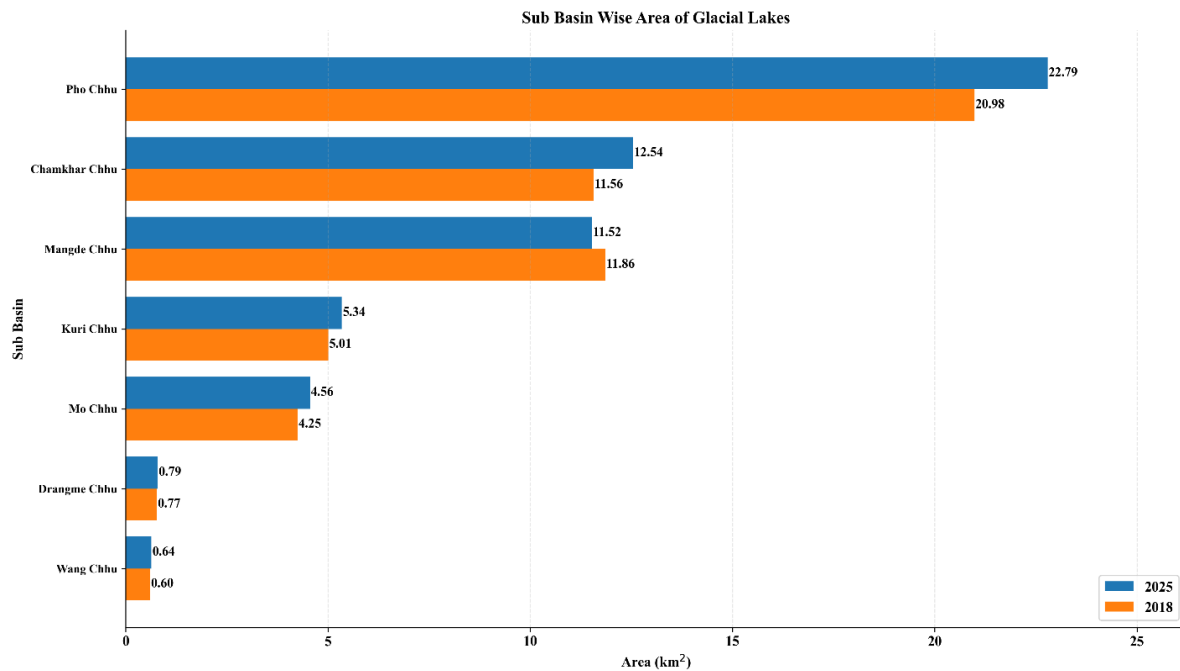


Figure 13. Sub-basin wise glacial lake area distribution

5.2 New Lake formations

Figure 14 illustrates representative examples of new lake formations identified through the comparison of the BGLI 2021 and BGLI 2026 inventories. The top three panels show the false color composite of 2018 satellite images with no lakes and the bottom three panels show the false color composite of 2025 satellite images with clearly visible new lakes. These newly developed water bodies are primarily associated with ongoing glacier retreat and surface down-wasting, where the exposure of over deepened basins and proglacial depressions has facilitated the accumulation of meltwater.

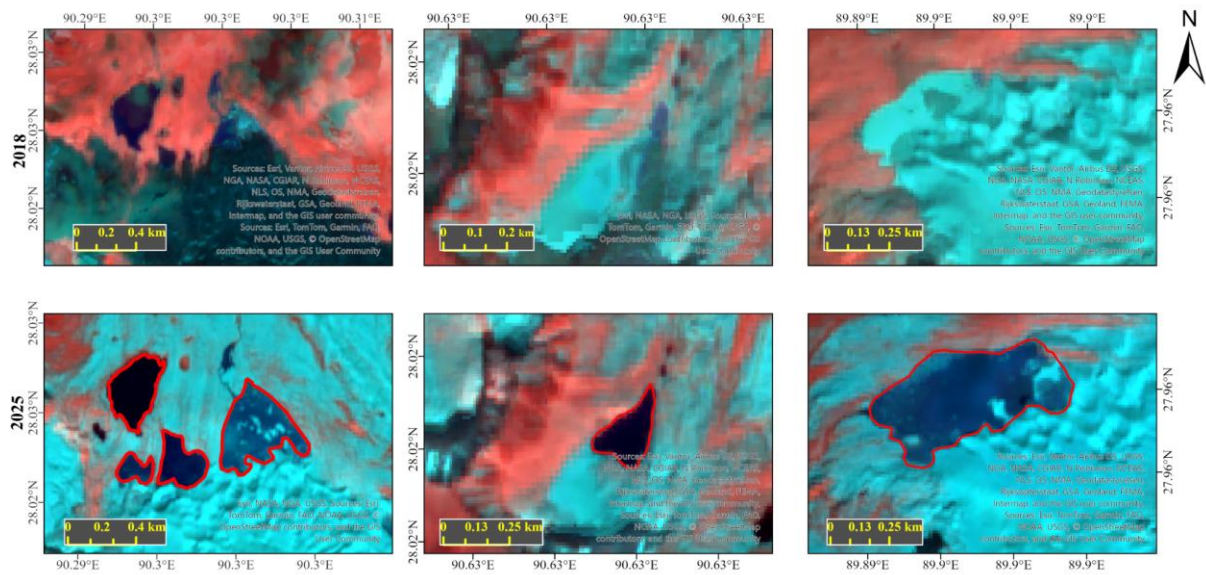


Figure 14. New lake formation. Top three panels show false color composite of 2018 with no lake and new lake formations in 2025 (bottom three panels)

The figure 15 illustrates the spatial changes in selected glacial lake extents between the Bhutan Glacial Lake Inventory (BGLI) 2021 and the updated BGLI 2026. The BGLI 2021 lake boundaries are represented by red outlines, while the BGLI 2026 lake boundaries are shown by orange outlines. The comparison indicates noticeable expansion of glacial lake areas over the six-year period, reflecting ongoing glacier retreat and increasing meltwater accumulation in high-altitude environments.

Across the examples presented, all lakes show an increase in surface area from 2018 to 2025. The lake area expansion ranges from small increases in recently formed or expanding proglacial lakes to significant enlargement of larger glacier-fed lakes. For instance, the

illustrated lakes increased from **0.09 km² to 0.15 km²**, **1.53 km² to 1.84 km²**, **0.07 km² to 0.13 km²**, and **0.17 km² to 0.34 km²**, respectively.

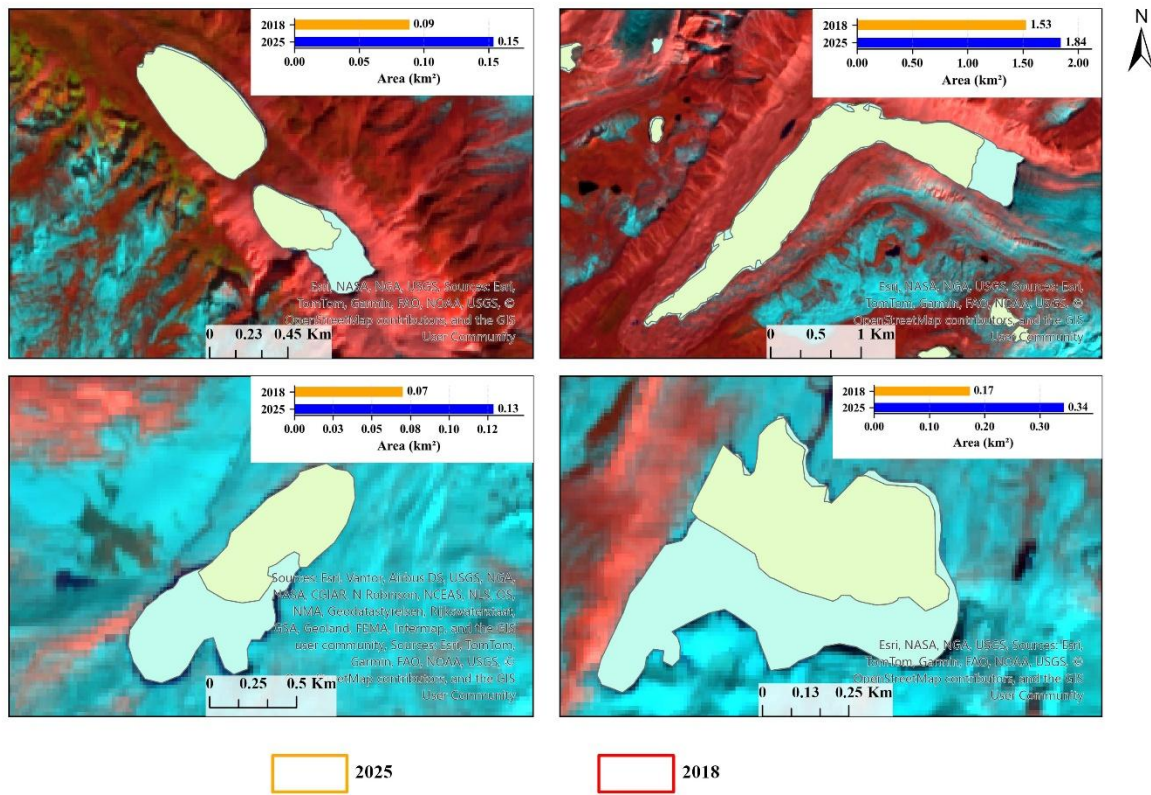


Figure 15. This figure shows expansion of some of the glacial lakes between BGLI 2021 and BGLI 2026. The panels (1, 3 & 4) illustrate the expansions up to 100% between the two inventories

6 Discussion

The comparative analysis between BGLI 2021 and BGLI 2026 reveals a clear and statistically meaningful expansion of glacial lakes across Bhutan's major river sub-basins. The overall increase in lake count from 567 to 620 — representing a 9.4% growth over six years — alongside an approximately 5.5% increase in total glacial lake area, provides compelling evidence of sustained and accelerating deglaciation across the Bhutanese Himalaya. These figures are not merely numerical increments; they reflect fundamental transformations in the high-altitude hydrological landscape driven by progressive glacier mass loss, a pattern increasingly documented across the broader Hindu Kush Himalayan (HKH) region (Nie et al., 2017; Shugar et al., 2020; ICIMOD, 2023).

The observed trajectory aligns closely with regional and global cryospheric trends reported in recent literature. Studies across the Himalayan arc — encompassing Nepal, India, Bhutan,

and the Tibetan Plateau — have consistently documented net expansion of glacial lake extents, particularly moraine-dammed and ice-contact lakes, which are most sensitive to terminus retreat (Gardelle et al., 2011; Zhang et al., 2015; Kapitsa et al., 2017; Nie et al., 2017). The Bhutanese record corroborates these findings and adds temporal resolution to the understanding of lake dynamics in the eastern Himalaya, where monsoon-driven ablation interacts with high-relief glaciated terrain to produce complex patterns of lake formation, expansion, and occasional drainage (Komori, 2008; Carrivick & Tweed, 2013; Veh et al., 2019).

It is important to contextualize the 9.4% increase in lake count alongside the 5.5% increase in area. The relatively more pronounced growth in the number of lakes compared to their cumulative area suggests two concurrent processes. First, the emergence of new, smaller lakes — particularly proglacial and supraglacial water bodies — formed in recently deglaciated terrain where glaciers have retreated to expose over-deepened basins or where ice-surface melt ponds have coalesced (Benn et al., 2012; Salerno et al., 2012; Westoby et al., 2014). Second, the fragmentation or subdivision of existing larger lakes, possibly driven by the exposure of medial moraines or debris ridges as lake levels fluctuate (Reynolds, 2000; Rounce et al., 2017). Together, these dynamics point to a glacial landscape undergoing active transition rather than simple uniform expansion (Bolch et al., 2012; King et al., 2019).

The sub-basin level analysis adds further nuance to this overarching trend. While all sub-basins record net increases in total lake area between 2018 and 2025, the magnitude and character of change vary considerably across the landscape. The Pho Chhu sub-basin stands out as both the most lake-rich and the most dynamically changing basin, recording an increase from 157 to 187 lakes and from 20.98 km² to 22.79 km² — the largest absolute increments of any sub-basin. This concentration of change in a single basin is not coincidental; it reflects the particularly extensive and active glacierization of the Pho Chhu headwaters, where large valley glaciers terminating into moraine-dammed lakes create conditions highly conducive to rapid lake expansion and GLOF generation (Leber et al., 2007; Komori, 2008; Veh et al., 2019). The sub-basin is home to Thorthormi and Raphstreng lakes, among the most closely monitored glacial lakes in Bhutan, and its disproportionate contribution to national glacial lake growth reinforces the case for maintaining — and indeed intensifying — monitoring and risk assessment activities in this region (Ageta et al., 2000; Fujita et al., 2008; UNDP Bhutan, 2012).

The Chamkhar Chhu and Mangde Chhu sub-basins jointly account for a substantial share of

the total lake inventory and exhibit notable increases in lake count, though the Mangde Chhu presents an analytically important anomaly: despite gaining four additional lakes, its total area decreased marginally from 11.86 km² to 11.52 km². Through close analysis of the satellite imageries of 2018 and 2025, this apparent divergence between count and area reflects the drainage of larger lakes and formation of multiple smaller water bodies. This further merits dedicated field verification and high-resolution remote sensing analysis to understand the underlying mechanism (Gardelle et al., 2011; Rounce et al., 2017; Shugar et al., 2020).

At the lower end of the spectrum, the Wang Chhu and Drangme Chhu sub-basins contribute minimally to the national lake inventory, reflecting their comparatively limited glacierization. However, the slight increase in area observed even in these sub-basins — despite stable or slightly reduced lake counts in the case of Wang Chhu — suggests that lake expansion is a near-universal phenomenon across Bhutan's glaciated terrain, irrespective of basin scale (Nie et al., 2017; Shugar et al., 2020).

From a broader scientific and policy perspective, the change trajectory documented between 2018 and 2025 reinforces the urgency of establishing a robust, systematic, and high-frequency national glacial lake monitoring programme. A six-year interval between full inventories, while valuable for detecting medium-term trends, is insufficient for capturing rapid episodic changes — such as sudden lake outbursts, rapid proglacial lake formation following a major ablation season, or ice-dam destabilisation events — that can occur on sub-annual timescales (Richardson & Reynolds, 2000; Westoby et al., 2014; Rounce et al., 2017). Integration of satellite-based monitoring with ground-truth surveys, particularly for the highest-risk lakes in the Pho Chhu sub-basin, should be treated as a national priority given the downstream exposure of communities, infrastructure, and agricultural land to potential GLOF hazards (Bajracharya & Mool, 2009; Carey et al., 2012; ICIMOD, 2023). The data presented here thus serve not only as a scientific record of cryospheric change but also as an evidence base to inform adaptive water resource management and disaster risk reduction strategies in Bhutan's mountain river systems (Immerzeel et al., 2010; Huss & Hock, 2018).

7 Conclusions

BGLI 2026 provides an updated national glacial lake inventory for Bhutan derived through a semi-automated deep learning workflow. Key findings are:

- 620 glacial lakes mapped in BGLI 2026 — an increase of 53 lakes (9.4%) compared to BGLI 2021.
- Total lake area increased from ~55.04 km² to ~58.18 km², a net expansion of ~3 km² over 2018–2025.
- Pho Chhu remains the sub-basin with the greatest lake count and area, showing the largest absolute increases.
- Individual lake expansions of 50–100% over six years were documented for proglacial lakes adjacent to retreating glacier tongues.
- Newly formed lakes were identified across several sub-basins, consistent with ongoing deglaciation.
- Lemthang Tsho was absent from BGLI 2026, reflecting post-GLOF drainage conditions following the 2015 outburst.

Continued monitoring at 5 – 10 years intervals using comparable automated methodology is recommended to maintain temporal consistency and detect emerging high-hazard lake systems.

8 References

- Ageta, Y., Kadota, T., & Naito, N. (2000). *Glaciological studies on the Himalayan glaciers and their relation to climate change*. International Journal of Water Resources Development.
- Bajracharya, S. R., & Mool, P. K. (2009). Glaciers, glacial lakes and glacial lake outburst floods in the Himalayan region. *Annals of Glaciology*, 50(53), 81–86.
- Bajracharya, S. R., Maharjan, S. B., Shrestha, F., Guo, W., Liu, S., Immerzeel, W. W., & Shrestha, B. (2014). *The glaciers of the Hindu Kush Himalayas: Current status and observed changes from the 1980s to 2010*. International Centre for Integrated Mountain Development (ICIMOD).
- Benn, D. I., Bolch, T., Hands, K., Gulley, J., Luckman, A., Nicholson, L., Quincey, D., Thompson, S., Toumi, R., & Wiseman, S. (2012). Response of debris-covered glaciers to climate change: Emerging directions. *Earth-Science Reviews*, 114(1–2), 1–21.
- Bolch, T., Kulkarni, A., Kääb, A., Huggel, C., Paul, F., Cogley, J. G., Frey, H., Kargel, J. S., Fujita, K., Scheel, M., Bajracharya, S., & Stoffel, M. (2012). The state and fate of Himalayan glaciers. *Science*, 336(6079), 310–314.
- Carey, M., Huggel, C., Bury, J., Portocarrero, C., & Haeberli, W. (2012). An integrated socio-environmental framework for glacier-related hazards in the Andes. *Global and Planetary Change*, 90–91, 63–76.
- Carrivick, J. L., & Tweed, F. S. (2013). Proglacial lakes: Processes and geomorphological consequences. *Progress in Physical Geography*, 37(5), 1–26.
- Carrivick, J. L., & Tweed, F. S. (2016). A global assessment of the societal impacts of glacier outburst floods. *Global and Planetary Change*, 144, 1–16.
- Cryosphere Services Division, National Centre for Hydrology and Meteorology (2021). Bhutan Glacial Lake Inventory (BGLI, 2021)
- Drusch, M., Del Bello, U., Carlier, S., Colin, O., Fernandez, V., Gascon, F., Hoersch, B., Isola, C., Laberinti, P., Martimort, P., et al. (2012). Sentinel-2: ESA's optical high-resolution mission for GMES operational services. *Remote Sensing of Environment*, 120, 25–36.
- Fujita, K., Suzuki, R., Nuimura, T., & Sakai, A. (2008). Performance of ASTER and SRTM DEMs for glacier studies in the Nepal Himalaya. *Journal of Glaciology*, 54(185), 233–242.

- Gardelle, J., Arnaud, Y., & Berthier, E. (2011). Contrasted evolution of glacial lakes along the Hindu Kush Himalaya. *Global and Planetary Change*, 75(1–2), 1–10.
- Huss, M., & Hock, R. (2018). Global-scale hydrological response to future glacier mass loss. *Nature Climate Change*, 8, 135–140.
- ICIMOD. (2023). *The Hindu Kush Himalaya Assessment: Climate change, sustainability and people*. International Centre for Integrated Mountain Development.
- Immerzeel, W. W., van Beek, L. P. H., & Bierkens, M. F. P. (2010). Climate change will affect the Asian water towers. *Science*, 328(5984), 1382–1385.
- Kapitsa, V., Shahgedanova, M., Machguth, H., Severskiy, I., & Medeu, A. (2017). Assessment of evolution and risks of glacier lakes in the Tien Shan and Himalaya. *Natural Hazards and Earth System Sciences*, 17, 1431–1446.
- King, O., Quincey, D. J., Carrivick, J. L., & Rowan, A. V. (2019). Spatial variability in the response of Himalayan glaciers. *The Cryosphere*, 13, 119–135.
- Komori, J. (2008). Recent expansions of glacial lakes in the Bhutan Himalayas. *Quaternary International*, 184, 177–186.
- Leber, D., Naito, N., & Ageta, Y. (2007). Glacial lake changes and hazards in the Bhutan Himalaya. *Journal of Glaciology*.
- National Centre for Hydrology and Meteorology (NCHM), (2021). *Bhutan Glacial Lake Inventory 2021*. Royal Government of Bhutan.
- Nie, Y., Liu, Q., Wang, J., Zhang, Y., Sheng, Y., & Liu, S. (2017). Glacial lake expansion in the central Himalayas: Current status and future trends. *Remote Sensing of Environment*, 197, 1–13.
- Reynolds, J. M. (2000). On the formation of supraglacial lakes on debris-covered glaciers. *IAHS Publication*.
- Richardson, S. D., & Reynolds, J. M. (2000). An overview of glacial hazards in the Himalayas. *Quaternary International*, 65–66, 31–47.
- Rounce, D. R., Byers, A. C., McKinney, D. C., & Lala, J. M. (2017). A new remote hazard and risk assessment framework for glacial lakes. *Natural Hazards and Earth System Sciences*, 17, 1231–1247.

- Salerno, F., Buraschi, E., Bruccoleri, G., Tartari, G., & Smiraglia, C. (2012). Glacier surface-area changes in the Karakoram and Himalaya. *Global and Planetary Change*, 98–99, 22–31.
- Shugar, D. H., Burr, A., Haritashya, U. K., Kargel, J. S., Watson, C. S., Kennedy, M. C., et al. (2020). Rapid worldwide growth of glacial lakes since 1990. *Nature Climate Change*, 10, 939–945.
- UNDP Bhutan. (2012). *Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in Bhutan*. United Nations Development Programme.
- Veh, G., Korup, O., Walz, A., & Roessner, S. (2019). Exposure, risk and impacts of GLOFs in the Himalaya. *Science Advances*, 5(12), eaaw4982.
- Westoby, M. J., Glasser, N. F., Brasington, J., Hambrey, M. J., Quincey, D. J., & Reynolds, J. M. (2014). Modelling outburst floods from moraine-dammed lakes. *Earth-Science Reviews*, 134, 137–159.
- Zhang, G., Yao, T., Xie, H., Wang, W., & Yang, W. (2015). An inventory of glacial lakes in the Third Pole region. *Global and Planetary Change*, 131, 148–157.
- Zhang, C., Wei, S., Ji, S., & Lu, M. (2018). Detecting large-scale water bodies using deep learning from satellite images. *Remote Sensing*, 10(9), 1392.

9 Appendix

SI No	BGLI ID	GLIMS ID	Area (km ²)	Elevation (m a.s.l.)	Longitude	Latitude	Lake Type	Local Name	Basin	Sub Basin
Pho Chhu										
1	Pho_gl38	G089897E028146N	0.042634	5126	89.897	28.146	M		Punatsangchu	Pho Chhu
2	Pho_gl36	G089909E028114N	0.447497	4348	89.909	28.114	M	Tarina 2	Punatsangchu	Pho Chhu
3	Pho_gl35	G089899E028106N	0.249253	4274	89.899	28.106	M	Tarina 1	Punatsangchu	Pho Chhu
4	Pho_gl40	G089925E028119N	0.056465	4621	89.925	28.119	I		Punatsangchu	Pho Chhu
5	Pho_gl41	G089924E028131N	0.036656	5091	89.924	28.131	M		Punatsangchu	Pho Chhu
6	Pho_gl46	G089934E028139N	0.034241	5083	89.934	28.139	E		Punatsangchu	Pho Chhu
7	Pho_gl48	G089936E028140N	0.017302	5061	89.936	28.14	E		Punatsangchu	Pho Chhu
8	Pho_gl49	G089945E028124N	0.062502	4753	89.945	28.124	M		Punatsangchu	Pho Chhu
9	Pho_gl52	G089968E028129N	0.015161	4992	89.968	28.129	E		Punatsangchu	Pho Chhu
10	Pho_gl55	G089985E028104N	0.027797	5049	89.985	28.104	E		Punatsangchu	Pho Chhu
11	Pho_gl54	G089990E028085N	0.022253	5015	89.99	28.085	E		Punatsangchu	Pho Chhu
12	Pho_gl50	G089986E028074N	0.012055	5160	89.986	28.074	E		Punatsangchu	Pho Chhu
13	Pho_gl51	G089989E028068N	0.011048	5005	89.989	28.068	M		Punatsangchu	Pho Chhu
14	Pho_gl71	G090028E028113N	0.360808	4696	90.028	28.113	M		Punatsangchu	Pho Chhu
15	Pho_gl75	G090111E028089N	0.012956	4174	90.111	28.089	I		Punatsangchu	Pho Chhu
16	Pho_gl76	G090113E028084N	0.098975	4151	90.113	28.084	I		Punatsangchu	Pho Chhu
17	Pho_gl82	G090165E028113N	0.012114	4318	90.165	28.113	I		Punatsangchu	Pho Chhu
18	Pho_gl83	G090167E028098N	0.023714	4268	90.167	28.098	I		Punatsangchu	Pho Chhu
19	Pho_gl84	G090166E028090N	0.080202	4232	90.166	28.09	I		Punatsangchu	Pho Chhu
20	Pho_gl118	G090313E028059N	0.075274	5105	90.313	28.059	E		Punatsangchu	Pho Chhu
21	Pho_gl91	G090231E028104N	0.474377	4361	90.231	28.104	M	Bechung	Punatsangchu	Pho Chhu
22	Pho_gl95	G090247E028108N	1.370361	4375	90.247	28.108	M	Rapstreng	Punatsangchu	Pho Chhu
23	Pho_gl111	G090303E028093N	1.67114	4539	90.303	28.093	M	Luggye	Punatsangchu	Pho Chhu
24	Pho_gl113	G090327E028086N	0.025949	4706	90.327	28.086	M	Drukchung	Punatsangchu	Pho Chhu
25	Pho_gl114	G090329E028084N	0.035492	4716	90.329	28.084	M	Drukchung	Punatsangchu	Pho Chhu

26	Pho_gl121	G090271E028029N	0.203963	5212	90.271	28.029	M		Punatsangchu	Pho Chhu
27	Pho_gl127	G090295E028030N	0.068871	5313	90.295	28.03	M		Punatsangchu	Pho Chhu
28	Pho_gl133	G090280E028013N	0.137223	5286	90.28	28.013	M		Punatsangchu	Pho Chhu
29	Pho_gl134	G090277E028008N	0.117358	5281	90.277	28.008	M		Punatsangchu	Pho Chhu
30	Pho_gl140	G090288E027997N	0.403443	5327	90.288	27.997	E		Punatsangchu	Pho Chhu
31	Pho_gl141	G090299E027993N	0.132649	5347	90.299	27.993	M		Punatsangchu	Pho Chhu
32	Pho_gl135	G090261E027996N	0.181987	5146	90.261	27.996	M		Punatsangchu	Pho Chhu
33	Pho_gl125	G090222E027995N	0.199191	4937	90.222	27.995	E		Punatsangchu	Pho Chhu
34	Pho_gl124	G090216E027992N	0.172383	4936	90.216	27.992	E		Punatsangchu	Pho Chhu
35	Pho_gl128	G090234E027997N	0.112139	4985	90.234	27.997	M		Punatsangchu	Pho Chhu
36	Pho_gl122	G090231E028005N	0.048512	5072	90.231	28.005	M		Punatsangchu	Pho Chhu
37	Pho_gl120	G090225E028005N	0.025287	5045	90.225	28.005	E		Punatsangchu	Pho Chhu
38	Pho_gl112	G090211E028016N	0.552133	5127	90.211	28.016	E	Tsho Chena	Punatsangchu	Pho Chhu
39	Pho_gl105	G090194E028023N	0.050317	5217	90.194	28.023	M		Punatsangchu	Pho Chhu
40	Pho_gl108	G090187E028012N	0.213908	5145	90.187	28.012	E		Punatsangchu	Pho Chhu
41	Pho_gl100	G090179E028023N	0.17368	5082	90.179	28.023	E		Punatsangchu	Pho Chhu
42	Pho_gl98	G090161E028010N	0.074888	5054	90.161	28.01	E		Punatsangchu	Pho Chhu
43	Pho_gl92	G090149E028009N	0.066967	5032	90.149	28.009	E		Punatsangchu	Pho Chhu
44	Pho_gl88	G090129E027992N	0.022819	5088	90.129	27.992	E		Punatsangchu	Pho Chhu
45	Pho_gl93	G090131E027988N	0.198856	5042	90.131	27.988	M		Punatsangchu	Pho Chhu
46	Pho_gl96	G090133E027984N	0.013128	5147	90.133	27.984	E		Punatsangchu	Pho Chhu
47	Pho_gl85	G090122E027993N	0.018762	5208	90.122	27.993	M		Punatsangchu	Pho Chhu
48	Pho_gl87	G090139E028007N	0.092441	5064	90.139	28.007	M		Punatsangchu	Pho Chhu
49	Pho_gl86	G090135E028003N	0.023337	5065	90.135	28.003	E		Punatsangchu	Pho Chhu
50	Pho_gl90	G090139E028002N	0.144144	5065	90.139	28.002	E		Punatsangchu	Pho Chhu
51	Pho_gl97	G090142E027992N	0.091145	4978	90.142	27.992	E		Punatsangchu	Pho Chhu
52	Pho_gl104	G090149E027986N	0.152903	4912	90.149	27.986	E		Punatsangchu	Pho Chhu
53	Pho_gl110	G090182E028003N	0.021199	5120	90.182	28.003	E		Punatsangchu	Pho Chhu
54	Pho_gl109	G090179E028002N	0.010601	5117	90.179	28.002	E		Punatsangchu	Pho Chhu
55	Pho_gl106	G090139E027975N	0.019731	5023	90.139	27.975	E		Punatsangchu	Pho Chhu
56	Pho_gl103	G090134E027976N	0.011749	5125	90.134	27.976	M		Punatsangchu	Pho Chhu
57	Pho_gl117	G090147E027964N	0.220829	4884	90.147	27.964	E		Punatsangchu	Pho Chhu

58	Pho_gl126	G090150E027957N	0.054591	4826	90.15	27.957	E		Punatsangchu	Pho Chhu
59	Pho_gl102	G090119E027964N	0.042029	4883	90.119	27.964	E		Punatsangchu	Pho Chhu
60	Pho_gl194	G090114E027969N	0.161939	5032	90.114	27.969	M		Punatsangchu	Pho Chhu
61	Pho_gl179	G090078E027954N	0.083082	4784	90.078	27.954	E		Punatsangchu	Pho Chhu
62	Pho_gl132	G089892E028064N	0.030793	4860	89.892	28.064	E		Punatsangchu	Pho Chhu
63	Pho_gl131	G089889E028061N	0.027411	4902	89.889	28.061	E		Punatsangchu	Pho Chhu
64	Pho_gl128	G089877E028056N	0.010684	4988	89.877	28.056	M		Punatsangchu	Pho Chhu
65	Pho_gl127	G089871E028059N	0.032479	5127	89.871	28.059	M		Punatsangchu	Pho Chhu
66	Pho_gl137	G090210E027970N	0.050157	4899	90.21	27.97	E		Punatsangchu	Pho Chhu
67	Pho_gl138	G090245E027983N	0.157737	5102	90.245	27.983	M		Punatsangchu	Pho Chhu
68	Pho_gl139	G090233E027978N	0.635177	5073	90.233	27.978	M		Punatsangchu	Pho Chhu
69	Pho_gl181	G090106E028007N	0.097716	4542	90.106	28.007	E		Punatsangchu	Pho Chhu
70	Pho_gl147	G090190E027942N	0.159215	4627	90.19	27.942	E		Punatsangchu	Pho Chhu
71	Pho_gl144	G090260E027964N	0.460129	5226	90.26	27.964	M		Punatsangchu	Pho Chhu
72	Pho_gl143	G090263E027971N	0.010897	5357	90.263	27.971	I		Punatsangchu	Pho Chhu
73	Pho_gl189	G090103E027961N	0.012793	5115	90.103	27.961	E		Punatsangchu	Pho Chhu
74	Pho_gl156	G090209E027932N	0.112941	4999	90.209	27.932	E		Punatsangchu	Pho Chhu
75	Pho_gl162	G090209E027917N	0.074149	4907	90.209	27.917	M		Punatsangchu	Pho Chhu
76	Pho_gl175	G090207E027876N	0.382518	4914	90.207	27.876	M		Punatsangchu	Pho Chhu
77	Pho_gl172	G090219E027893N	0.164531	4998	90.219	27.893	M		Punatsangchu	Pho Chhu
78	Pho_gl183	G090213E027850N	0.100508	4858	90.213	27.85	E		Punatsangchu	Pho Chhu
79	Pho_gl179	G090230E027854N	0.02868	4893	90.23	27.854	E		Punatsangchu	Pho Chhu
80	Pho_gl186	G090222E027827N	0.297653	4657	90.222	27.827	M		Punatsangchu	Pho Chhu
81	Pho_gl185	G090231E027833N	0.011812	4732	90.231	27.833	E		Punatsangchu	Pho Chhu
82	Pho_gl187	G090210E027820N	0.091065	4669	90.21	27.82	E		Punatsangchu	Pho Chhu
83	Pho_gl184	G090237E027837N	0.068263	4772	90.237	27.837	E		Punatsangchu	Pho Chhu
84	Pho_gl180	G090246E027848N	0.100308	4804	90.246	27.848	E		Punatsangchu	Pho Chhu
85	Pho_gl178	G090255E027847N	0.025922	4878	90.255	27.847	M		Punatsangchu	Pho Chhu
86	Pho_gl182	G090253E027841N	0.083353	5003	90.253	27.841	M		Punatsangchu	Pho Chhu
87	Pho_gl181	G090259E027843N	0.119485	5032	90.259	27.843	M		Punatsangchu	Pho Chhu
88	Pho_gl15	G089933E027908N	0.04353	4844	89.933	27.908	M		Punatsangchu	Pho Chhu
89	Pho_gl13	G089946E027897N	0.078084	4874	89.946	27.897	M		Punatsangchu	Pho Chhu

90	Pho_gl2	G089943E027893N	0.098324	4856	89.943	27.893	E		Punatsangchu	Pho Chhu
91	Pho_gl1	G089949E027886N	0.059148	4573	89.949	27.886	E		Punatsangchu	Pho Chhu
92	Pho_gl9	G089922E027933N	0.022348	4984	89.922	27.933	E		Punatsangchu	Pho Chhu
93	Pho_gl12	G089906E027941N	0.13692	5030	89.906	27.941	E		Punatsangchu	Pho Chhu
94	Pho_gl10	G089909E027937N	0.010473	4994	89.909	27.937	E		Punatsangchu	Pho Chhu
95	Pho_gl15	G089910E027948N	0.013935	5088	89.91	27.948	E		Punatsangchu	Pho Chhu
96	Pho_gl19	G089925E027951N	0.042665	5071	89.925	27.951	E		Punatsangchu	Pho Chhu
97	Pho_gl17	G089923E027948N	0.019417	5075	89.923	27.948	E		Punatsangchu	Pho Chhu
98	Pho_gl8	G089932E027930N	0.016736	4943	89.932	27.93	E		Punatsangchu	Pho Chhu
99	Pho_gl7	G089933E027924N	0.071883	4828	89.933	27.924	E		Punatsangchu	Pho Chhu
100	Pho_gl6	G089929E027921N	0.015667	4829	89.929	27.921	E		Punatsangchu	Pho Chhu
101	Pho_gl11	G089936E027932N	0.017127	4922	89.936	27.932	E		Punatsangchu	Pho Chhu
102	Pho_gl13	G089931E027936N	0.017872	5008	89.931	27.936	E		Punatsangchu	Pho Chhu
103	Pho_gl14	G089930E027941N	0.722874	5002	89.93	27.941	M		Punatsangchu	Pho Chhu
104	Pho_gl20	G089933E027950N	0.065885	5056	89.933	27.95	M		Punatsangchu	Pho Chhu
105	Pho_gl21	G089931E027964N	0.027137	5132	89.931	27.964	M		Punatsangchu	Pho Chhu
106	Pho_gl22	G089930E027973N	0.650101	5078	89.93	27.973	M		Punatsangchu	Pho Chhu
107	Pho_gl24	G089893E028030N	0.107804	5038	89.893	28.03	E		Punatsangchu	Pho Chhu
108	Pho_gl26	G089894E028036N	0.056581	5199	89.894	28.036	E		Punatsangchu	Pho Chhu
109	Pho_gl29	G089900E028038N	0.034231	5224	89.9	28.038	M		Punatsangchu	Pho Chhu
110	Pho_gl30	G089900E028047N	0.046837	5021	89.9	28.047	M		Punatsangchu	Pho Chhu
111	Pho_gl44	G089955E028091N	0.022536	4930	89.955	28.091	E		Punatsangchu	Pho Chhu
112	Pho_gl47	G089955E028104N	0.015073	5149	89.955	28.104	E		Punatsangchu	Pho Chhu
113	Pho_gl39	G089946E028078N	0.033476	4710	89.946	28.078	E		Punatsangchu	Pho Chhu
114	Pho_gl66	G090030E028070N	0.034417	4403	90.03	28.07	I		Punatsangchu	Pho Chhu
115	Pho_gl63	G090026E028069N	0.012322	4418	90.026	28.069	I		Punatsangchu	Pho Chhu
116	Pho_gl64	G090030E028060N	0.063944	4395	90.03	28.06	I		Punatsangchu	Pho Chhu
117	Pho_gl68	G090034E028060N	0.013376	4391	90.034	28.06	I		Punatsangchu	Pho Chhu
118	Pho_gl69	G090035E028057N	0.060364	4382	90.035	28.057	I		Punatsangchu	Pho Chhu
119	Pho_gl70	G090036E028053N	0.022886	4380	90.036	28.053	I		Punatsangchu	Pho Chhu
120	Pho_gl65	G090033E028050N	0.017223	4376	90.033	28.05	I		Punatsangchu	Pho Chhu
121	Pho_gl67	G090034E028048N	0.015533	4370	90.034	28.048	I		Punatsangchu	Pho Chhu

122	Pho_gl73	G090043E028096N	0.067073	5132	90.043	28.096	M		Punatsangchu	Pho Chhu
123	Pho_gl72	G090042E028092N	0.092764	5049	90.042	28.092	E		Punatsangchu	Pho Chhu
124	Pho_gl101	G090271E028108N	4.330649	4477	90.271	28.108	M	Thorthormi	Punatsangchu	Pho Chhu
125	Pho_gl131	G090319E028037N	0.011035	5383	90.319	28.037	M		Punatsangchu	Pho Chhu
126	Pho_gl123	G090308E028043N	0.016966	5279	90.308	28.043	E		Punatsangchu	Pho Chhu
127	Pho_gl145	G090252E027960N	0.021831	5176	90.252	27.96	E		Punatsangchu	Pho Chhu
128	Pho_gl149	G090253E027956N	0.022375	5171	90.253	27.956	E		Punatsangchu	Pho Chhu
129	Pho_gl151	G090259E027957N	0.017874	5196	90.259	27.957	M		Punatsangchu	Pho Chhu
130	Pho_gl152	G090255E027953N	0.148982	5184	90.255	27.953	M		Punatsangchu	Pho Chhu
131	Pho_gl146	G090245E027956N	0.095762	5145	90.245	27.956	E		Punatsangchu	Pho Chhu
132	Pho_gl150	G090245E027954N	0.025718	5145	90.245	27.954	E		Punatsangchu	Pho Chhu
133	Pho_gl148	G090240E027953N	0.047281	5130	90.24	27.953	E		Punatsangchu	Pho Chhu
134	Pho_gl153	G090257E027943N	0.063006	5204	90.257	27.943	M		Punatsangchu	Pho Chhu
135	Pho_gl154	G090249E027941N	0.015661	5139	90.249	27.941	E		Punatsangchu	Pho Chhu
136	Pho_gl157	G090249E027938N	0.025603	5116	90.249	27.938	E		Punatsangchu	Pho Chhu
137	Pho_gl155	G090244E027940N	0.022036	5107	90.244	27.94	E		Punatsangchu	Pho Chhu
138	Pho_gl160	G090244E027922N	0.050277	5113	90.244	27.922	M		Punatsangchu	Pho Chhu
139	Pho_gl164	G090255E027916N	0.013298	5210	90.255	27.916	M		Punatsangchu	Pho Chhu
140	Pho_gl163	G090257E027918N	0.017648	5200	90.257	27.918	M		Punatsangchu	Pho Chhu
141	Pho_gl159	G090259E027925N	0.114299	5128	90.259	27.925	M		Punatsangchu	Pho Chhu
142	Pho_gl161	G090262E027920N	0.227287	5152	90.262	27.92	M		Punatsangchu	Pho Chhu
143	Pho_gl167	G090241E027899N	0.019258	5182	90.241	27.899	M		Punatsangchu	Pho Chhu
144	Pho_gl169	G090243E027897N	0.022307	5154	90.243	27.897	E		Punatsangchu	Pho Chhu
145	Pho_gl168	G090252E027897N	0.0849	5174	90.252	27.897	M		Punatsangchu	Pho Chhu
146	Pho_gl173	G090238E027891N	0.040594	5022	90.238	27.891	E		Punatsangchu	Pho Chhu
147	Pho_gl174	G090238E027884N	0.01343	5007	90.238	27.884	M		Punatsangchu	Pho Chhu
148	Pho_gl171	G090249E027892N	0.016321	5103	90.249	27.892	E		Punatsangchu	Pho Chhu
149	Pho_gl166	G090207E027902N	0.018002	4961	90.207	27.902	E		Punatsangchu	Pho Chhu
150	Pho_gl170	G090205E027898N	0.021165	5148	90.205	27.898	M		Punatsangchu	Pho Chhu
151	Pho_gl77	G090095E028007N	0.023533	4685	90.095	28.007	E		Punatsangchu	Pho Chhu
152	Pho_gl58	G090029E028013N	0.033254	4429	90.029	28.013	E		Punatsangchu	Pho Chhu
153	Pho_gl45	G089978E028056N	0.028525	5005	89.978	28.056	M		Punatsangchu	Pho Chhu

154	Pho_gl60	G090019E028057N	0.01445	4596	90.019	28.057	E		Punatsangchu	Pho Chhu
155	Pho_gl59	G089998E028136N	0.01236	4776	89.998	28.136	I		Punatsangchu	Pho Chhu
156	Pho_gl61	G090007E028119N	0.017438	4665	90.007	28.119	I		Punatsangchu	Pho Chhu
157	Pho_gl62	G090011E028123N	0.011511	4718	90.011	28.123	E		Punatsangchu	Pho Chhu
158	Pho_gl115	G090280E028050N	0.042127	5064	90.28	28.05	E		Punatsangchu	Pho Chhu
159	Pho_gl136	G090244E027985N	0.01518	5101	90.244	27.985	M		Punatsangchu	Pho Chhu
160	Pho_gl99	G090167E028014N	0.019944	5145	90.167	28.014	E		Punatsangchu	Pho Chhu
161	Pho_gl33	G089956E028005N	0.124661	4615	89.956	28.005	M		Punatsangchu	Pho Chhu
162	Pho_gl25	G089928E028008N	0.036924	5037	89.928	28.008	M		Punatsangchu	Pho Chhu
163	Pho_gl23	G089909E028017N	0.047312	5124	89.909	28.017	M		Punatsangchu	Pho Chhu
164	Pho_gl176	G090232E027869N	0.019537	5009	90.232	27.869	E		Punatsangchu	Pho Chhu
165	Pho_gl34	G089887E028097N	0.034991	4757	89.887	28.097	E		Punatsangchu	Pho Chhu
166	Pho_gl177	G090199E027868N	0.031523	4976	90.199	27.868	E		Punatsangchu	Pho Chhu
167	Pho_gl57	G089986E028123N	0.011931	5004	89.986	28.123	M		Punatsangchu	Pho Chhu
168	Pho_gl119	G090331E028067N	0.025952	4745	90.331	28.067	I		Punatsangchu	Pho Chhu
169	Pho_gl78	G090155E028130N	0.019197	4104	90.155	28.13	I		Punatsangchu	Pho Chhu
170	Pho_gl80	G090157E028128N	0.01036	4076	90.157	28.128	I		Punatsangchu	Pho Chhu
171	Pho_gl56	G089988E028117N	0.010558	5283	89.988	28.117	M		Punatsangchu	Pho Chhu
172	Pho_gl42	G089953E028085N	0.012312	5337	89.953	28.085	E		Punatsangchu	Pho Chhu
173	Pho_gl53	G089992E028079N	0.013471	6101	89.992	28.079	E		Punatsangchu	Pho Chhu
174	Pho_gl16	G089914E027948N	0.020652	4978	89.914	27.948	E		Punatsangchu	Pho Chhu
175	Pho_gl37	G089917E028116N	0.06147	4617	89.917	28.116	E		Punatsangchu	Pho Chhu
176	Pho_gl158	G090217E027922N	0.099793	3510	90.217	27.922	M		Punatsangchu	Pho Chhu
177	Pho_gl165	G090243E027915N	0.343756	3957	90.243	27.915	M		Punatsangchu	Pho Chhu
178	Pho_gl142	G090300E027989N	0.031453	4742	90.3	27.989	M		Punatsangchu	Pho Chhu
179	Pho_gl132	G090301E028028N	0.121179	5247	90.301	28.028	M		Punatsangchu	Pho Chhu
180	Pho_gl129	G090295E028027N	0.019895	5166	90.295	28.027	I		Punatsangchu	Pho Chhu
181	Pho_gl130	G090297E028027N	0.047679	5246	90.297	28.027	M		Punatsangchu	Pho Chhu
182	Pho_gl116	G090331E028082N	0.027216	5335	90.331	28.082	M		Punatsangchu	Pho Chhu
183	Pho_gl43	G089937E028121N	0.012412	4895	89.937	28.121	I		Punatsangchu	Pho Chhu
184	Pho_gl4	G089933E027904N	0.012647	4250	89.933	27.904	E		Punatsangchu	Pho Chhu
185	Pho_gl74	G090089E028116N	0.038181	4777	90.089	28.116	M		Punatsangchu	Pho Chhu

186	Pho_gl18	G089920E027949N	0.010268	4732	89.92	27.949	E		Punatsangchu	Pho Chhu
187	Pho_gl107	G090141E027973N	0.019815	4965	90.141	27.973	E		Punatsangchu	Pho Chhu
Chamkhar Chhu										
188	Cham_gl27	G090505E027993N	0.085636	5213	90.505	27.993	E		Manas	Chamkhar Chhu
189	Cham_gl25	G090505E027988N	0.186384	5199	90.505	27.988	E		Manas	Chamkhar Chhu
190	Cham_gl23	G090505E027979N	0.039545	5149	90.505	27.979	E		Manas	Chamkhar Chhu
191	Cham_gl18	G090508E027973N	0.25266	5102	90.508	27.973	E		Manas	Chamkhar Chhu
192	Cham_gl7	G090537E027920N	0.373586	4936	90.537	27.92	M		Manas	Chamkhar Chhu
193	Cham_gl39	G090537E028041N	0.187848	5004	90.537	28.041	E		Manas	Chamkhar Chhu
194	Cham_gl24	G090535E027939N	0.642195	5037	90.535	27.939	E	Phudung Tsho	Manas	Chamkhar Chhu
195	Cham_gl37	G090540E028004N	0.303859	4709	90.54	28.004	I		Manas	Chamkhar Chhu
196	Cham_gl42	G090546E028038N	0.172431	4994	90.546	28.038	E		Manas	Chamkhar Chhu
197	Cham_gl29	G090555E027925N	0.290059	4775	90.555	27.925	E		Manas	Chamkhar Chhu
198	Cham_gl32	G090557E027937N	0.021698	4757	90.557	27.937	E		Manas	Chamkhar Chhu
199	Cham_gl47	G090558E028027N	0.064426	5123	90.558	28.027	E		Manas	Chamkhar Chhu
200	Cham_gl6	G090566E027882N	0.180115	4666	90.566	27.882	E		Manas	Chamkhar Chhu
201	Cham_gl9	G090570E027879N	0.222852	4666	90.57	27.879	E		Manas	Chamkhar Chhu
202	Cham_gl51	G090572E028006N	0.143549	5156	90.572	28.006	E		Manas	Chamkhar Chhu
203	Cham_gl53	G090570E028017N	0.060254	5169	90.57	28.017	M		Manas	Chamkhar Chhu
204	Cham_gl56	G090573E028020N	0.014409	5214	90.573	28.02	E		Manas	Chamkhar Chhu
205	Cham_gl11	G090577E027805N	0.109259	4711	90.577	27.805	E		Manas	Chamkhar Chhu
206	Cham_gl22	G090581E027876N	0.148262	4609	90.581	27.876	E		Manas	Chamkhar Chhu
207	Cham_gl46	G090584E027974N	0.10178	4963	90.584	27.974	E		Manas	Chamkhar Chhu
208	Cham_gl2	G090585E027803N	0.109294	4649	90.585	27.803	E		Manas	Chamkhar Chhu
209	Cham_gl34	G090586E027904N	0.077473	4743	90.586	27.904	M		Manas	Chamkhar Chhu
210	Cham_gl60	G090593E027998N	0.147893	5107	90.593	27.998	E		Manas	Chamkhar Chhu
211	Cham_gl36	G090596E027906N	0.084322	4576	90.596	27.906	M		Manas	Chamkhar Chhu
212	Cham_gl57	G090593E027983N	0.124441	5029	90.593	27.983	E		Manas	Chamkhar Chhu
213	Cham_gl17	G090591E027861N	0.799743	4771	90.591	27.861	M		Manas	Chamkhar Chhu
214	Cham_gl35	G090598E027895N	0.119812	4635	90.598	27.895	M		Manas	Chamkhar Chhu
215	Cham_gl59	G090599E027984N	0.081003	5030	90.599	27.984	E		Manas	Chamkhar Chhu

216	Cham_gl14	G090601E027846N	0.028921	4953	90.601	27.846	E		Manas	Chamkhar Chhu
217	Cham_gl64	G090607E027996N	0.052269	5254	90.607	27.996	E		Manas	Chamkhar Chhu
218	Cham_gl70	G090620E028007N	0.05285	5154	90.62	28.007	E		Manas	Chamkhar Chhu
219	Cham_gl69	G090624E027995N	0.066265	5082	90.624	27.995	E		Manas	Chamkhar Chhu
220	Cham_gl74	G090628E028006N	0.076371	5067	90.628	28.006	E		Manas	Chamkhar Chhu
221	Cham_gl65	G090628E027958N	0.089148	4914	90.628	27.958	E		Manas	Chamkhar Chhu
222	Cham_gl71	G090635E027973N	0.033944	5023	90.635	27.973	E		Manas	Chamkhar Chhu
223	Cham_gl72	G090638E027970N	0.075951	5019	90.638	27.97	E		Manas	Chamkhar Chhu
224	Cham_gl78	G090644E027992N	0.07146	4850	90.644	27.992	E		Manas	Chamkhar Chhu
225	Cham_gl83	G090643E028019N	0.036138	5189	90.643	28.019	M		Manas	Chamkhar Chhu
226	Cham_gl89	G090664E028035N	0.312237	4717	90.664	28.035	M		Manas	Chamkhar Chhu
227	Cham_gl91	G090672E028043N	0.078259	4960	90.672	28.043	M		Manas	Chamkhar Chhu
228	Cham_gl90	G090674E028028N	0.011194	4783	90.674	28.028	M		Manas	Chamkhar Chhu
229	Cham_gl92	G090676E028031N	0.022152	4784	90.676	28.031	E		Manas	Chamkhar Chhu
230	Cham_gl96	G090700E028006N	0.015896	4903	90.7	28.006	E		Manas	Chamkhar Chhu
231	Cham_gl97	G090701E028004N	0.01629	4928	90.701	28.004	E		Manas	Chamkhar Chhu
232	Cham_gl98	G090706E028004N	0.295938	4928	90.706	28.004	E		Manas	Chamkhar Chhu
233	Cham_gl101	G090711E028023N	1.84259	4891	90.711	28.023	M	Chubdra Tsho	Manas	Chamkhar Chhu
234	Cham_gl108	G090728E028012N	0.051595	5161	90.728	28.012	E		Manas	Chamkhar Chhu
235	Cham_gl99	G090730E027901N	0.016678	4860	90.73	27.901	E		Manas	Chamkhar Chhu
236	Cham_gl102	G090731E027939N	0.03257	5020	90.731	27.939	E		Manas	Chamkhar Chhu
237	Cham_gl104	G090737E027906N	0.015976	5026	90.737	27.906	E		Manas	Chamkhar Chhu
238	Cham_gl110	G090743E027944N	0.112705	4848	90.743	27.944	E		Manas	Chamkhar Chhu
239	Cham_gl113	G090744E028016N	0.027371	5119	90.744	28.016	E		Manas	Chamkhar Chhu
240	Cham_gl114	G090747E028002N	0.017962	5061	90.747	28.002	E		Manas	Chamkhar Chhu
241	Cham_gl112	G090748E027931N	0.063872	4988	90.748	27.931	E		Manas	Chamkhar Chhu
242	Cham_gl115	G090749E027993N	0.071219	5012	90.749	27.993	E		Manas	Chamkhar Chhu
243	Cham_gl117	G090756E027942N	0.164242	5034	90.756	27.942	M		Manas	Chamkhar Chhu
244	Cham_gl120	G090763E027921N	0.079227	4956	90.763	27.921	E		Manas	Chamkhar Chhu
245	Cham_gl122	G090769E027997N	0.018211	4843	90.769	27.997	E		Manas	Chamkhar Chhu
246	Cham_gl125	G090779E027883N	0.038592	4571	90.779	27.883	E		Manas	Chamkhar Chhu
247	Cham_gl127	G090781E027986N	0.062168	5065	90.781	27.986	E		Manas	Chamkhar Chhu

248	Cham_gl129	G090793E028007N	0.03415	5070	90.793	28.007	M		Manas	Chamkhar Chhu
249	Cham_gl133	G090803E027895N	0.052585	5034	90.803	27.895	E		Manas	Chamkhar Chhu
250	Cham_gl134	G090807E027899N	0.036062	4817	90.807	27.899	E		Manas	Chamkhar Chhu
251	Cham_gl135	G090812E027907N	0.351544	4805	90.812	27.907	E		Manas	Chamkhar Chhu
252	Cham_gl136	G090816E027897N	0.433987	4713	90.816	27.897	M		Manas	Chamkhar Chhu
253	Cham_gl138	G090846E027855N	0.027078	4668	90.846	27.855	M		Manas	Chamkhar Chhu
254	Cham_gl111	G090746E027919N	0.010774	5184	90.746	27.919	E		Manas	Chamkhar Chhu
255	Cham_gl194	G090694E028028N	0.028527	5038	90.694	28.028	E		Manas	Chamkhar Chhu
256	Cham_gl193	G090684E028034N	0.062288	4797	90.684	28.034	E		Manas	Chamkhar Chhu
257	Cham_gl128	G090791E027992N	0.034613	5086	90.791	27.992	E		Manas	Chamkhar Chhu
258	Cham_gl132	G090801E028006N	0.062175	5077	90.801	28.006	E		Manas	Chamkhar Chhu
259	Cham_gl188	G090654E028036N	0.020189	5127	90.654	28.036	E		Manas	Chamkhar Chhu
260	Cham_gl187	G090651E028034N	0.021625	5011	90.651	28.034	E		Manas	Chamkhar Chhu
261	Cham_gl186	G090648E028034N	0.02785	5012	90.648	28.034	E		Manas	Chamkhar Chhu
262	Cham_gl185	G090642E028035N	0.025578	5039	90.642	28.035	E		Manas	Chamkhar Chhu
263	Cham_gl182	G090636E028034N	0.021645	5196	90.636	28.034	E		Manas	Chamkhar Chhu
264	Cham_gl177	G090625E028035N	0.35362	5177	90.625	28.035	E		Manas	Chamkhar Chhu
265	Cham_gl175	G090617E028037N	0.020359	5179	90.617	28.037	E		Manas	Chamkhar Chhu
266	Cham_gl179	G090634E028029N	0.031675	5153	90.634	28.029	E		Manas	Chamkhar Chhu
267	Cham_gl184	G090645E028024N	0.016955	5066	90.645	28.024	E		Manas	Chamkhar Chhu
268	Cham_gl181	G090639E028025N	0.011316	5126	90.639	28.025	E		Manas	Chamkhar Chhu
269	Cham_gl180	G090636E028024N	0.015333	5150	90.636	28.024	E		Manas	Chamkhar Chhu
270	Cham_gl167	G090616E028003N	0.034962	5241	90.616	28.003	E		Manas	Chamkhar Chhu
271	Cham_gl168	G090618E028009N	0.015045	5208	90.618	28.009	M		Manas	Chamkhar Chhu
272	Cham_gl161	G090592E028010N	0.045703	5152	90.592	28.01	E		Manas	Chamkhar Chhu
273	Cham_gl103	G090721E028008N	0.038916	5086	90.721	28.008	E		Manas	Chamkhar Chhu
274	Cham_gl121	G090767E028012N	0.022571	5086	90.767	28.012	E		Manas	Chamkhar Chhu
275	Cham_gl154	G090582E027995N	0.017351	5284	90.582	27.995	E		Manas	Chamkhar Chhu
276	Cham_gl141	G090569E027993N	0.017557	5206	90.569	27.993	M		Manas	Chamkhar Chhu
277	Cham_gl138	G090543E028021N	0.042223	4843	90.543	28.021	M		Manas	Chamkhar Chhu
278	Cham_gl145	G090552E028032N	0.020236	5159	90.552	28.032	E		Manas	Chamkhar Chhu
279	Cham_gl144	G090546E028043N	0.028555	5072	90.546	28.043	I		Manas	Chamkhar Chhu

280	Cham_gl43	G090544E028044N	0.032868	5121	90.544	28.044	E		Manas	Chamkhar Chhu
281	Cham_gl40	G090541E028034N	0.013048	4986	90.541	28.034	E		Manas	Chamkhar Chhu
282	Cham_gl124	G090775E027998N	0.099153	4864	90.775	27.998	E		Manas	Chamkhar Chhu
283	Cham_gl107	G090722E028056N	0.008576	5235	90.722	28.056	E		Manas	Chamkhar Chhu
284	Cham_gl95	G090694E028035N	0.012013	4937	90.694	28.035	M		Manas	Chamkhar Chhu
285	Cham_gl52	G090571E028012N	0.03469	5176	90.571	28.012	E		Manas	Chamkhar Chhu
286	Cham_gl49	G090567E028013N	0.027502	5166	90.567	28.013	M		Manas	Chamkhar Chhu
287	Cham_gl48	G090568E028011N	0.017675	5164	90.568	28.011	E		Manas	Chamkhar Chhu
288	Cham_gl62	G090614E027964N	0.071878	4953	90.614	27.964	E		Manas	Chamkhar Chhu
289	Cham_gl33	G090553E027949N	0.047222	4624	90.553	27.949	E		Manas	Chamkhar Chhu
290	Cham_gl31	G090556E027933N	0.018911	4769	90.556	27.933	E		Manas	Chamkhar Chhu
291	Cham_gl16	G090544E027924N	0.014261	4904	90.544	27.924	E		Manas	Chamkhar Chhu
292	Cham_gl20	G090553E027913N	0.066725	4968	90.553	27.913	M		Manas	Chamkhar Chhu
293	Cham_gl26	G090559E027916N	0.106866	4935	90.559	27.916	E		Manas	Chamkhar Chhu
294	Cham_gl137	G090844E027852N	0.048929	4685	90.844	27.852	M		Manas	Chamkhar Chhu
295	Cham_gl139	G090849E027848N	0.109958	4742	90.849	27.848	M		Manas	Chamkhar Chhu
296	Cham_gl100	G090731E027899N	0.019606	4862	90.731	27.899	E		Manas	Chamkhar Chhu
297	Cham_gl12	G090510E027966N	0.028945	5060	90.51	27.966	E		Manas	Chamkhar Chhu
298	Cham_gl13	G090509E027968N	0.015941	5077	90.509	27.968	E		Manas	Chamkhar Chhu
299	Cham_gl10	G090507E027966N	0.01983	5062	90.507	27.966	E		Manas	Chamkhar Chhu
300	Cham_gl11	G090505E027969N	0.016193	5072	90.505	27.969	E		Manas	Chamkhar Chhu
301	Cham_gl28	G090514E027982N	0.031172	5171	90.514	27.982	E		Manas	Chamkhar Chhu
302	Cham_gl30	G090516E027989N	0.014913	5261	90.516	27.989	E		Manas	Chamkhar Chhu
303	Cham_gl105	G090733E027935N	0.010937	5064	90.733	27.935	E		Manas	Chamkhar Chhu
304	Cham_gl106	G090738E027931N	0.010692	5144	90.738	27.931	E		Manas	Chamkhar Chhu
305	Cham_gl116	G090756E027935N	0.01014	5125	90.756	27.935	E		Manas	Chamkhar Chhu
306	Cham_gl118	G090758E027936N	0.018107	5132	90.758	27.936	E		Manas	Chamkhar Chhu
307	Cham_gl123	G090775E027953N	0.021328	5160	90.775	27.953	E		Manas	Chamkhar Chhu
308	Cham_gl63	G090611E027973N	0.024722	5044	90.611	27.973	E		Manas	Chamkhar Chhu
309	Cham_gl66	G090630E027962N	0.017816	4927	90.63	27.962	E		Manas	Chamkhar Chhu
310	Cham_gl58	G090607E027959N	0.018899	5058	90.607	27.959	E		Manas	Chamkhar Chhu
311	Cham_gl21	G090574E027885N	0.015083	4799	90.574	27.885	E		Manas	Chamkhar Chhu

312	Cham_gl15	G090567E027892N	0.02615	4949	90.567	27.892	E		Manas	Chamkhar Chhu
313	Cham_gl5	G090610E027825N	0.02851	4466	90.61	27.825	E		Manas	Chamkhar Chhu
314	Cham_gl3	G090576E027844N	0.034856	4987	90.576	27.844	E		Manas	Chamkhar Chhu
315	Cham_gl4	G090587E027845N	0.125707	5138	90.587	27.845	E		Manas	Chamkhar Chhu
316	Cham_gl19	G090596E027855N	0.050378	4936	90.596	27.855	M		Manas	Chamkhar Chhu
317	Cham_gl119	G090760E027916N	0.016844	4883	90.76	27.916	E		Manas	Chamkhar Chhu
318	Cham_gl8	G090525E027937N	0.011485	5175	90.525	27.937	E		Manas	Chamkhar Chhu
319	Cham_gl126	G090780E027972N	0.011382	5648	90.78	27.972	E		Manas	Chamkhar Chhu
320	Cham_gl109	G090730E028010N	0.019192	5278	90.73	28.01	E		Manas	Chamkhar Chhu
321	Cham_gl50	G090575E028000N	0.038536	4855	90.575	28	E		Manas	Chamkhar Chhu
322	Cham_gl130	G090796E027998N	0.012089	5440	90.796	27.998	E		Manas	Chamkhar Chhu
323	Cham_gl73	G090622E028011N	0.012711	5331	90.622	28.011	M		Manas	Chamkhar Chhu
324	Cham_gl131	G090798E027999N	0.011593	5479	90.798	27.999	E		Manas	Chamkhar Chhu
325	Cham_gl55	G090573E028016N	0.011315	4343	90.573	28.016	E		Manas	Chamkhar Chhu
326	Cham_gl76	G090630E028020N	0.028377	5082	90.63	28.02	E		Manas	Chamkhar Chhu
Mangde Chhu										
327	Mang_gl61	G090310E027988N	0.015327	5446	90.31	27.988	M		Manas	Mangde Chhu
328	Mang_gl62	G090312E027989N	0.023513	5446	90.312	27.989	M		Manas	Mangde Chhu
329	Mang_gl2	G090254E027813N	0.106686	4821	90.254	27.813	E		Manas	Mangde Chhu
330	Mang_gl6	G090255E027831N	0.045657	5066	90.255	27.831	M		Manas	Mangde Chhu
331	Mang_gl5	G090257E027827N	0.010084	4945	90.257	27.827	M		Manas	Mangde Chhu
332	Mang_gl14	G090271E027902N	0.010079	5155	90.271	27.902	M		Manas	Mangde Chhu
333	Mang_gl9	G090272E027819N	0.202234	4898	90.272	27.819	E		Manas	Mangde Chhu
334	Mang_gl20	G090275E027913N	0.067231	5185	90.275	27.913	M		Manas	Mangde Chhu
335	Mang_gl12	G090276E027882N	0.027621	5045	90.276	27.882	E		Manas	Mangde Chhu
336	Mang_gl18	G090292E027875N	0.120544	5163	90.292	27.875	M		Manas	Mangde Chhu
337	Mang_gl24	G090290E027891N	1.111861	5060	90.29	27.891	M	Metatshota Tsho	Manas	Mangde Chhu
338	Mang_gl22	G090293E027884N	0.077369	5114	90.293	27.884	M		Manas	Mangde Chhu
339	Mang_gl15	G090295E027862N	0.184976	4963	90.295	27.862	M		Manas	Mangde Chhu
340	Mang_gl27	G090298E027884N	0.1396	5119	90.298	27.884	M		Manas	Mangde Chhu
341	Mang_gl13	G090303E027846N	0.171135	4902	90.303	27.846	M		Manas	Mangde Chhu

342	Mang_gl25	G090303E027873N	0.389032	5048	90.303	27.873	M		Manas	Mangde Chhu
343	Mang_gl21	G090312E027850N	0.018665	5044	90.312	27.85	E		Manas	Mangde Chhu
344	Mang_gl26	G090311E027860N	0.093586	4951	90.311	27.86	M		Manas	Mangde Chhu
345	Mang_gl55	G090311E027951N	0.011653	5387	90.311	27.951	M		Manas	Mangde Chhu
346	Mang_gl29	G090318E027859N	0.049779	5065	90.318	27.859	M		Manas	Mangde Chhu
347	Mang_gl58	G090319E027943N	0.035196	5252	90.319	27.943	M		Manas	Mangde Chhu
348	Mang_gl60	G090320E027951N	0.011759	5309	90.32	27.951	M		Manas	Mangde Chhu
349	Mang_gl39	G090320E027887N	0.035709	5219	90.32	27.887	M		Manas	Mangde Chhu
350	Mang_gl43	G090322E027893N	0.068594	5105	90.322	27.893	E		Manas	Mangde Chhu
351	Mang_gl72	G090329E027985N	0.067642	5270	90.329	27.985	M		Manas	Mangde Chhu
352	Mang_gl30	G090330E027838N	0.014531	4992	90.33	27.838	E		Manas	Mangde Chhu
353	Mang_gl33	G090333E027849N	0.12133	5051	90.333	27.849	M		Manas	Mangde Chhu
354	Mang_gl47	G090338E027870N	0.019907	5118	90.338	27.87	M		Manas	Mangde Chhu
355	Mang_gl52	G090342E027871N	0.062291	5077	90.342	27.871	M		Manas	Mangde Chhu
356	Mang_gl49	G090342E027863N	0.025232	5032	90.342	27.863	E		Manas	Mangde Chhu
357	Mang_gl41	G090344E027842N	0.059212	4997	90.344	27.842	E		Manas	Mangde Chhu
358	Mang_gl38	G090345E027837N	0.067727	4976	90.345	27.837	E		Manas	Mangde Chhu
359	Mang_gl56	G090349E027869N	0.054311	5071	90.349	27.869	M		Manas	Mangde Chhu
360	Mang_gl84	G090353E028014N	0.155919	5302	90.353	28.014	M		Manas	Mangde Chhu
361	Mang_gl91	G090355E028047N	0.467615	5278	90.355	28.047	M		Manas	Mangde Chhu
362	Mang_gl98	G090364E028038N	0.823622	5217	90.364	28.038	M		Manas	Mangde Chhu
363	Mang_gl81	G090366E027957N	0.040801	5258	90.366	27.957	M		Manas	Mangde Chhu
364	Mang_gl82	G090369E027959N	0.029815	5260	90.369	27.959	M		Manas	Mangde Chhu
365	Mang_gl59	G090371E027835N	0.020092	4980	90.371	27.835	M		Manas	Mangde Chhu
366	Mang_gl85	G090378E027946N	0.129505	5268	90.378	27.946	M		Manas	Mangde Chhu
367	Mang_gl63	G090377E027838N	0.02746	4872	90.377	27.838	E		Manas	Mangde Chhu
368	Mang_gl83	G090377E027941N	0.07135	5214	90.377	27.941	M		Manas	Mangde Chhu
369	Mang_gl101	G090374E028015N	0.884346	5184	90.374	28.015	M		Manas	Mangde Chhu
370	Mang_gl96	G090381E027981N	0.188779	5233	90.381	27.981	M		Manas	Mangde Chhu
371	Mang_gl99	G090380E027987N	0.114448	5247	90.38	27.987	M		Manas	Mangde Chhu
372	Mang_gl103	G090383E027994N	0.011563	5293	90.383	27.994	M		Manas	Mangde Chhu
373	Mang_gl70	G090387E027835N	0.054396	4851	90.387	27.835	M		Manas	Mangde Chhu

374	Mang_gl86	G090390E027911N	0.033698	5152	90.39	27.911	E		Manas	Mangde Chhu
375	Mang_gl108	G090398E027997N	0.03872	5355	90.398	27.997	M		Manas	Mangde Chhu
376	Mang_gl102	G090397E027940N	0.178489	5204	90.397	27.94	M		Manas	Mangde Chhu
377	Mang_gl95	G090400E027918N	0.084093	5223	90.4	27.918	M		Manas	Mangde Chhu
378	Mang_gl104	G090408E027919N	0.158673	5145	90.408	27.919	M		Manas	Mangde Chhu
379	Mang_gl118	G090407E028012N	0.075831	5286	90.407	28.012	M		Manas	Mangde Chhu
380	Mang_gl114	G090409E027976N	0.012539	5276	90.409	27.976	M		Manas	Mangde Chhu
381	Mang_gl119	G090410E028019N	0.045413	5377	90.41	28.019	M		Manas	Mangde Chhu
382	Mang_gl115	G090412E027969N	0.229177	5205	90.412	27.969	M		Manas	Mangde Chhu
383	Mang_gl113	G090417E027941N	0.014021	5189	90.417	27.941	E		Manas	Mangde Chhu
384	Mang_gl121	G090418E027991N	0.413942	5181	90.418	27.991	I		Manas	Mangde Chhu
385	Mang_gl123	G090357E027930N	0.254499	5071	90.357	27.93	I		Manas	Mangde Chhu
386	Mang_gl124	G090452E027998N	0.085248	5004	90.452	27.998	E		Manas	Mangde Chhu
387	Mang_gl126	G090485E028008N	0.049656	5013	90.485	28.008	I		Manas	Mangde Chhu
388	Mang_gl128	G090503E027922N	0.125748	5081	90.503	27.922	M		Manas	Mangde Chhu
389	Mang_gl129	G090503E027933N	0.080289	5058	90.503	27.933	M		Manas	Mangde Chhu
390	Mang_gl131	G090507E027932N	0.020412	5062	90.507	27.932	M		Manas	Mangde Chhu
391	Mang_gl132	G090551E027895N	0.229138	4985	90.551	27.895	M		Manas	Mangde Chhu
392	Mang_gl133	G090554E027837N	0.113028	4793	90.554	27.837	E		Manas	Mangde Chhu
393	Mang_gl89	G090357E028025N	0.04408	5341	90.357	28.025	M		Manas	Mangde Chhu
394	Mang_gl76	G090328E028005N	0.355692	5376	90.328	28.005	M		Manas	Mangde Chhu
395	Mang_gl79	G090347E028009N	0.021775	5340	90.347	28.009	E		Manas	Mangde Chhu
396	Mang_gl71	G090318E028005N	0.062446	5422	90.318	28.005	M		Manas	Mangde Chhu
397	Mang_gl23	G090296E027879N	0.028476	5210	90.296	27.879	M		Manas	Mangde Chhu
398	Mang_gl4	G090259E027816N	0.011978	4911	90.259	27.816	E		Manas	Mangde Chhu
399	Mang_gl122	G090427E027981N	0.018954	5130	90.427	27.981	M		Manas	Mangde Chhu
400	Mang_gl111	G090417E027938N	0.013716	5171	90.417	27.938	E		Manas	Mangde Chhu
401	Mang_gl107	G090414E027928N	0.07687	5015	90.414	27.928	M		Manas	Mangde Chhu
402	Mang_gl105	G090404E027941N	0.010731	5237	90.404	27.941	M		Manas	Mangde Chhu
403	Mang_gl130	G090505E027938N	0.011239	5122	90.505	27.938	E		Manas	Mangde Chhu
404	Mang_gl127	G090496E027928N	0.033815	5029	90.496	27.928	M		Manas	Mangde Chhu
405	Mang_gl134	G090558E027899N	0.012442	5113	90.558	27.899	M		Manas	Mangde Chhu

406	Mang_gl80	G090380E027916N	0.021152	5149	90.38	27.916	E		Manas	Mangde Chhu
407	Mang_gl106	G090413E027910N	0.023952	5043	90.413	27.91	M		Manas	Mangde Chhu
408	Mang_gl64	G090380E027835N	0.019188	4976	90.38	27.835	E		Manas	Mangde Chhu
409	Mang_gl32	G090336E027835N	0.009993	4972	90.336	27.835	E		Manas	Mangde Chhu
410	Mang_gl37	G090341E027844N	0.013354	5000	90.341	27.844	E		Manas	Mangde Chhu
411	Mang_gl73	G090322E028011N	0.010965	5508	90.322	28.011	M		Manas	Mangde Chhu
412	Mang_gl66	G090311E028003N	0.111057	5459	90.311	28.003	M		Manas	Mangde Chhu
413	Mang_gl67	G090320E027985N	0.059244	5305	90.32	27.985	M		Manas	Mangde Chhu
414	Mang_gl65	G090322E027972N	0.031639	5365	90.322	27.972	M		Manas	Mangde Chhu
415	Mang_gl68	G090331E027970N	0.207742	5316	90.331	27.97	M		Manas	Mangde Chhu
416	Mang_gl36	G090295E027932N	0.084953	5186	90.295	27.932	E		Manas	Mangde Chhu
417	Mang_gl48	G090317E027914N	0.128807	5206	90.317	27.914	I		Manas	Mangde Chhu
418	Mang_gl45	G090302E027941N	0.01211	5246	90.302	27.941	M		Manas	Mangde Chhu
419	Mang_gl35	G090282E027956N	0.042413	5234	90.282	27.956	E		Manas	Mangde Chhu
420	Mang_gl34	G090283E027950N	0.012058	5215	90.283	27.95	M		Manas	Mangde Chhu
421	Mang_gl16	G090268E027909N	0.089823	5181	90.268	27.909	M		Manas	Mangde Chhu
422	Mang_gl19	G090276E027907N	0.215931	5160	90.276	27.907	M		Manas	Mangde Chhu
423	Mang_gl110	G090391E028032N	0.01566	5379	90.391	28.032	M		Manas	Mangde Chhu
424	Mang_gl51	G090310E027937N	0.027208	5103	90.31	27.937	M		Manas	Mangde Chhu
425	Mang_gl40	G090285E027957N	0.020344	5241	90.285	27.957	E		Manas	Mangde Chhu
426	Mang_gl125	G090485E027962N	0.013208	4399	90.485	27.962	M		Manas	Mangde Chhu
427	Mang_gl120	G090414E028005N	0.022068	4268	90.414	28.005	I		Manas	Mangde Chhu
428	Mang_gl117	G090403E028015N	0.047042	4754	90.403	28.015	M		Manas	Mangde Chhu
429	Mang_gl92	G090365E028019N	0.029063	5056	90.365	28.019	M		Manas	Mangde Chhu
430	Mang_gl97	G090369E028020N	0.025645	4851	90.369	28.02	M		Manas	Mangde Chhu
431	Mang_gl94	G090367E028022N	0.013155	4965	90.367	28.022	M		Manas	Mangde Chhu
432	Mang_gl90	G090359E028025N	0.017252	5263	90.359	28.025	M		Manas	Mangde Chhu
433	Mang_gl75	G090331E027997N	0.013513	5170	90.331	27.997	E		Manas	Mangde Chhu
434	Mang_gl77	G090330E028001N	0.016963	4997	90.33	28.001	E		Manas	Mangde Chhu
435	Mang_gl69	G090319E028001N	0.023052	5121	90.319	28.001	M		Manas	Mangde Chhu
436	Mang_gl74	G090330E027999N	0.010214	5055	90.33	27.999	E		Manas	Mangde Chhu
437	Mang_gl78	G090330E028011N	0.013272	5425	90.33	28.011	M		Manas	Mangde Chhu

438	Mang_gl87	G090398E027894N	0.014655	4966	90.398	27.894	E		Manas	Mangde Chhu
439	Mang_gl93	G090407E027893N	0.044609	5074	90.407	27.893	M		Manas	Mangde Chhu
440	Mang_gl100	G090404E027916N	0.012162	5158	90.404	27.916	M		Manas	Mangde Chhu
441	Mang_gl88	G090388E027925N	0.011987	4990	90.388	27.925	M		Manas	Mangde Chhu
442	Mang_gl109	G090418E027926N	0.009998	4698	90.418	27.926	M		Manas	Mangde Chhu
443	Mang_gl44	G090328E027885N	0.013267	4594	90.328	27.885	E		Manas	Mangde Chhu
444	Mang_gl46	G090333E027879N	0.011857	4512	90.333	27.879	M		Manas	Mangde Chhu
445	Mang_gl42	G090325E027883N	0.011906	4726	90.325	27.883	M		Manas	Mangde Chhu
446	Mang_gl50	G090344E027863N	0.012122	4311	90.344	27.863	E		Manas	Mangde Chhu
447	Mang_gl31	G090331E027844N	0.013933	4274	90.331	27.844	M		Manas	Mangde Chhu
448	Mang_gl28	G090318E027852N	0.015263	4457	90.318	27.852	E		Manas	Mangde Chhu
449	Mang_gl10	G090277E027847N	0.013168	4424	90.277	27.847	E		Manas	Mangde Chhu
450	Mang_gl17	G090272E027904N	0.011099	4269	90.272	27.904	M		Manas	Mangde Chhu
451	Mang_gl53	G090320E027920N	0.024918	4934	90.32	27.92	M		Manas	Mangde Chhu
452	Mang_gl54	G090321E027920N	0.015783	4963	90.321	27.92	M		Manas	Mangde Chhu
453	Mang_gl57	G090334E027905N	0.010272	4975	90.334	27.905	E		Manas	Mangde Chhu
454	Mang_gl112	G090404E027990N	0.01265	5127	90.404	27.99	M		Manas	Mangde Chhu
455	Mang_gl116	G090417E27960N	0.010071	5288	90.417	27.96	M		Manas	Mangde Chhu
456	Mang_gl7	G090272E027813N	0.010961	4896	90.272	27.813	E		Manas	Mangde Chhu
457	Mang_gl8	G090265E027827N	0.012153	5148	90.265	27.827	M		Manas	Mangde Chhu
458	Mang_gl3	G090260E027814N	0.01664	4905	90.26	27.814	E		Manas	Mangde Chhu
459	Mang_gl1	G090263E027812N	0.016733	4976	90.263	27.812	E		Manas	Mangde Chhu
460	Mang_gl11	G090357E027930N	0.312084	5071	90.357	27.93	M		Manas	Mangde Chhu
Mo Chhu										
461	Mo_gl50	G089861E028018N	0.014944	5154	89.861	28.018	E		Punatsangchu	Mo Chhu
462	Mo_gl31	G089830E028206N	0.016268	5279	89.83	28.206	E		Punatsangchu	Mo Chhu
463	Mo_gl14	G089627E028042N	0.169624	4706	89.627	28.042	E		Punatsangchu	Mo Chhu
464	Mo_gl12	G089601E028034N	0.042489	4939	89.601	28.034	E		Punatsangchu	Mo Chhu
465	Mo_gl11	G089600E028026N	0.186581	5012	89.6	28.026	M		Punatsangchu	Mo Chhu
466	Mo_gl4	G089392E027849N	0.112179	4225	89.392	27.849	I		Punatsangchu	Mo Chhu
467	Mo_gl1	G089389E027839N	0.172169	4330	89.389	27.839	E		Punatsangchu	Mo Chhu

468	Mo_gl2	G089370E027836N	0.034925	4426	89.37	27.836	E		Punatsangchu	Mo Chhu
469	Mo_gl6	G089529E028034N	0.039267	4861	89.529	28.034	E		Punatsangchu	Mo Chhu
470	Mo_gl9	G089554E028044N	0.047482	4881	89.554	28.044	E		Punatsangchu	Mo Chhu
471	Mo_gl5	G089484E028050N	0.011269	5148	89.484	28.05	M		Punatsangchu	Mo Chhu
472	Mo_gl7	G089516E028070N	0.070414	4783	89.516	28.07	M		Punatsangchu	Mo Chhu
473	Mo_gl8	G089513E028077N	0.023827	5040	89.513	28.077	M		Punatsangchu	Mo Chhu
474	Mo_gl15	G089602E028115N	0.057682	4163	89.602	28.115	M		Punatsangchu	Mo Chhu
475	Mo_gl16	G089614E028106N	0.054131	4435	89.614	28.106	E		Punatsangchu	Mo Chhu
476	Mo_gl17	G089611E028125N	0.025772	4245	89.611	28.125	M		Punatsangchu	Mo Chhu
477	Mo_gl18	G089623E028135N	0.034268	4363	89.623	28.135	E		Punatsangchu	Mo Chhu
478	Mo_gl20	G089685E028172N	0.094759	4784	89.685	28.172	M		Punatsangchu	Mo Chhu
479	Mo_gl21	G089725E028154N	0.05007	4243	89.725	28.154	E		Punatsangchu	Mo Chhu
480	Mo_gl29	G089829E028214N	0.04193	5287	89.829	28.214	M		Punatsangchu	Mo Chhu
481	Mo_gl30	G089834E028214N	0.028205	5204	89.834	28.214	M		Punatsangchu	Mo Chhu
482	Mo_gl33	G089868E028203N	0.014589	5045	89.868	28.203	E		Punatsangchu	Mo Chhu
483	Mo_gl36	G089865E028187N	0.028155	5016	89.865	28.187	E		Punatsangchu	Mo Chhu
484	Mo_gl38	G089869E028187N	0.039184	5030	89.869	28.187	E		Punatsangchu	Mo Chhu
485	Mo_gl41	G089876E028186N	0.012905	5163	89.876	28.186	M		Punatsangchu	Mo Chhu
486	Mo_gl40	G089872E028182N	0.011244	5211	89.872	28.182	E		Punatsangchu	Mo Chhu
487	Mo_gl34	G089848E028172N	0.235019	4516	89.848	28.172	M	Sintaphu Tsho	Punatsangchu	Mo Chhu
488	Mo_gl37	G089854E028166N	0.153834	4582	89.854	28.166	M		Punatsangchu	Mo Chhu
489	Mo_gl44	G089868E028156N	0.049984	5050	89.868	28.156	E		Punatsangchu	Mo Chhu
490	Mo_gl39	G089841E028145N	0.126185	5119	89.841	28.145	M		Punatsangchu	Mo Chhu
491	Mo_gl71	G089884E027937N	0.084571	4892	89.884	27.937	E		Punatsangchu	Mo Chhu
492	Mo_gl63	G089896E027974N	0.241902	5139	89.896	27.974	M		Punatsangchu	Mo Chhu
493	Mo_gl61	G089896E027982N	0.346817	5144	89.896	27.982	M		Punatsangchu	Mo Chhu
494	Mo_gl62	G089901E027980N	0.011006	5212	89.901	27.98	M		Punatsangchu	Mo Chhu
495	Mo_gl58	G089892E027989N	0.118645	5128	89.892	27.989	E		Punatsangchu	Mo Chhu
496	Mo_gl59	G089898E027991N	0.012306	5131	89.898	27.991	M		Punatsangchu	Mo Chhu
497	Mo_gl57	G089890E028001N	0.079398	5086	89.89	28.001	M		Punatsangchu	Mo Chhu
498	Mo_gl54	G089885E028008N	0.038286	5014	89.885	28.008	E		Punatsangchu	Mo Chhu
499	Mo_gl53	G089884E028011N	0.208723	5017	89.884	28.011	E		Punatsangchu	Mo Chhu

500	Mo_gl55	G089871E028001N	0.010176	4947	89.871	28.001	M		Punatsangchu	Mo Chhu
501	Mo_gl52	G089864E028007N	0.227511	4843	89.864	28.007	E		Punatsangchu	Mo Chhu
502	Mo_gl51	G089868E028012N	0.080223	4894	89.868	28.012	E		Punatsangchu	Mo Chhu
503	Mo_gl49	G089854E028030N	0.071281	4749	89.854	28.03	M		Punatsangchu	Mo Chhu
504	Mo_gl72	G089839E027900N	0.019266	5006	89.839	27.9	E		Punatsangchu	Mo Chhu
505	Mo_gl74	G089838E027898N	0.010415	4958	89.838	27.898	M		Punatsangchu	Mo Chhu
506	Mo_gl73	G089833E027899N	0.016845	4834	89.833	27.899	M		Punatsangchu	Mo Chhu
507	Mo_gl46	G089838E028061N	0.088972	4542	89.838	28.061	M		Punatsangchu	Mo Chhu
508	Mo_gl47	G089848E028067N	0.034142	4764	89.848	28.067	E		Punatsangchu	Mo Chhu
509	Mo_gl48	G089867E028048N	0.014234	5039	89.867	28.048	E		Punatsangchu	Mo Chhu
510	Mo_gl32	G089784E028082N	0.017823	4889	89.784	28.082	E		Punatsangchu	Mo Chhu
511	Mo_gl35	G089803E028100N	0.012284	5137	89.803	28.1	E		Punatsangchu	Mo Chhu
512	Mo_gl22	G089742E028139N	0.119163	4859	89.742	28.139	E		Punatsangchu	Mo Chhu
513	Mo_gl25	G089760E028132N	0.016005	4848	89.76	28.132	E		Punatsangchu	Mo Chhu
514	Mo_gl65	G089866E027957N	0.012451	4936	89.866	27.957	E		Punatsangchu	Mo Chhu
515	Mo_gl66	G089874E027958N	0.0162	4933	89.874	27.958	E		Punatsangchu	Mo Chhu
516	Mo_gl67	G089877E027955N	0.037712	4938	89.877	27.955	E		Punatsangchu	Mo Chhu
517	Mo_gl69	G089881E027952N	0.064161	4963	89.881	27.952	E		Punatsangchu	Mo Chhu
518	Mo_gl70	G089888E027953N	0.020192	4970	89.888	27.953	M		Punatsangchu	Mo Chhu
519	Mo_gl64	G089897E027965N	0.01968	5113	89.897	27.965	M		Punatsangchu	Mo Chhu
520	Mo_gl13	G089616E028012N	0.020293	4856	89.616	28.012	M		Punatsangchu	Mo Chhu
521	Mo_gl10	G089609E028007N	0.039284	5005	89.609	28.007	E		Punatsangchu	Mo Chhu
522	Mo_gl27	G089803E028203N	0.011303	4925	89.803	28.203	E		Punatsangchu	Mo Chhu
523	Mo_gl26	G089771E028144N	0.011323	4999	89.771	28.144	M		Punatsangchu	Mo Chhu
524	Mo_gl56	G089883E028005N	0.012387	4789	89.883	28.005	E		Punatsangchu	Mo Chhu
525	Mo_gl45	G089824E028053N	0.042759	4469	89.824	28.053	E		Punatsangchu	Mo Chhu
526	Mo_gl43	G089807E028082N	0.013713	4469	89.807	28.082	E		Punatsangchu	Mo Chhu
527	Mo_gl3	G089367E027836N	0.011619	5371	89.367	27.836	E		Punatsangchu	Mo Chhu
528	Mo_gl19	G089680E028133N	0.018441	4890	89.68	28.133	E		Punatsangchu	Mo Chhu
529	Mo_gl42	G089874E028180N	0.010425	4475	89.874	28.18	E		Punatsangchu	Mo Chhu
530	Mo_gl28	G089812E028217N	0.031023	4553	89.812	28.217	E		Punatsangchu	Mo Chhu
531	Mo_gl23	G089777E028205N	0.025547	4494	89.777	28.205	E		Punatsangchu	Mo Chhu

532	Mo_gl24	G089778E028203N	0.024094	4537	89.778	28.203	E		Punatsangchu	Mo Chhu
533	Mo_gl68	G089898E027958N	0.201492	5207	89.898	27.958	M		Punatsangchu	Mo Chhu
534	Mo_gl60	G089904E027988N	0.032517	5472	89.904	27.988	M		Punatsangchu	Mo Chhu
Kuri Chhu										
535	Kuri_gl36	G091241E027910N	0.148349	4348	91.241	27.91	E		Manas	Kuri Chhu
536	Kuri_gl61	G091388E027936N	0.040393	4673	91.388	27.936	E		Manas	Kuri Chhu
537	Kuri_gl60	G091418E028006N	0.03172	4725	91.418	28.006	E		Manas	Kuri Chhu
538	Kuri_gl40	G091292E028012N	0.110733	4629	91.292	28.012	E		Manas	Kuri Chhu
539	Kuri_gl43	G091307E028018N	0.087026	4974	91.307	28.018	E		Manas	Kuri Chhu
540	Kuri_gl50	G091325E028002N	0.052173	4802	91.325	28.002	E		Manas	Kuri Chhu
541	Kuri_gl54	G091338E027988N	0.019616	4680	91.338	27.988	E		Manas	Kuri Chhu
542	Kuri_gl55	G091341E027989N	0.01394	4679	91.341	27.989	E		Manas	Kuri Chhu
543	Kuri_gl58	G091378E028006N	0.018333	4726	91.378	28.006	E		Manas	Kuri Chhu
544	Kuri_gl65	G091468E027952N	0.01187	4690	91.468	27.952	M		Manas	Kuri Chhu
545	Kuri_gl63	G091426E027963N	0.13513	4855	91.426	27.963	E		Manas	Kuri Chhu
546	Kuri_gl64	G091430E027967N	0.065865	4824	91.43	27.967	M		Manas	Kuri Chhu
547	Kuri_gl62	G091423E027971N	0.040748	4758	91.423	27.971	E		Manas	Kuri Chhu
548	Kuri_gl59	G091305E027893N	0.203463	4062	91.305	27.893	M		Manas	Kuri Chhu
549	Kuri_gl56	G091301E027921N	0.081241	4561	91.301	27.921	E		Manas	Kuri Chhu
550	Kuri_gl57	G091308E027929N	0.012101	4234	91.308	27.929	E		Manas	Kuri Chhu
551	Kuri_gl52	G091299E027929N	0.166158	4372	91.299	27.929	M	Terja Tse Tsho	Manas	Kuri Chhu
552	Kuri_gl49	G091291E027939N	0.031123	4819	91.291	27.939	E		Manas	Kuri Chhu
553	Kuri_gl47	G091276E027926N	0.066444	4857	91.276	27.926	M		Manas	Kuri Chhu
554	Kuri_gl44	G091269E027931N	0.39819	4733	91.269	27.931	M		Manas	Kuri Chhu
555	Kuri_gl42	G091248E027896N	0.085845	4172	91.248	27.896	E		Manas	Kuri Chhu
556	Kuri_gl37	G091239E027899N	0.046653	4185	91.239	27.899	M		Manas	Kuri Chhu
557	Kuri_gl38	G091241E027902N	0.096481	4184	91.241	27.902	E		Manas	Kuri Chhu
558	Kuri_gl39	G091257E027936N	0.067069	4854	91.257	27.936	M		Manas	Kuri Chhu
559	Kuri_gl34	G091244E027946N	0.011579	4990	91.244	27.946	E		Manas	Kuri Chhu
560	Kuri_gl30	G091233E027968N	0.057669	4561	91.233	27.968	E		Manas	Kuri Chhu
561	Kuri_gl31	G091243E027996N	0.082616	4365	91.243	27.996	E		Manas	Kuri Chhu

562	Kuri_gl33	G091262E028001N	0.179312	4479	91.262	28.001	E		Manas	Kuri Chhu
563	Kuri_gl32	G091256E028011N	0.02829	4381	91.256	28.011	E		Manas	Kuri Chhu
564	Kuri_gl53	G091255E027849N	0.083224	4555	91.255	27.849	E		Manas	Kuri Chhu
565	Kuri_gl51	G091255E027867N	0.052035	4718	91.255	27.867	M		Manas	Kuri Chhu
566	Kuri_gl48	G091317E027990N	0.060941	4768	91.317	27.99	E		Manas	Kuri Chhu
567	Kuri_gl41	G091287E027996N	0.237184	4536	91.287	27.996	E		Manas	Kuri Chhu
568	Kuri_gl6	G090854E027917N	0.022017	4294	90.854	27.917	E		Manas	Kuri Chhu
569	Kuri_gl4	G090844E027913N	0.147335	4514	90.844	27.913	E		Manas	Kuri Chhu
570	Kuri_gl3	G090828E027922N	0.063772	4617	90.828	27.922	E		Manas	Kuri Chhu
571	Kuri_gl5	G090833E027925N	0.012721	4660	90.833	27.925	E		Manas	Kuri Chhu
572	Kuri_gl1	G090781E027932N	0.012075	5071	90.781	27.932	E		Manas	Kuri Chhu
573	Kuri_gl2	G090791E027945N	0.030171	5026	90.791	27.945	E		Manas	Kuri Chhu
574	Kuri_gl10	G090827E027985N	0.10294	4739	90.827	27.985	E		Manas	Kuri Chhu
575	Kuri_gl11	G090823E027990N	0.041043	4847	90.823	27.99	E		Manas	Kuri Chhu
576	Kuri_gl8	G090817E027989N	0.126024	4912	90.817	27.989	E		Manas	Kuri Chhu
577	Kuri_gl9	G090816E027993N	0.015634	4924	90.816	27.993	E		Manas	Kuri Chhu
578	Kuri_gl17	G090840E028023N	0.278457	5004	90.84	28.023	E		Manas	Kuri Chhu
579	Kuri_gl16	G090843E028019N	0.190983	4975	90.843	28.019	E		Manas	Kuri Chhu
580	Kuri_gl21	G090894E028033N	0.015022	4960	90.894	28.033	M		Manas	Kuri Chhu
581	Kuri_gl20	G090901E028021N	0.014017	4864	90.901	28.021	E		Manas	Kuri Chhu
582	Kuri_gl19	G090905E028004N	0.848707	4755	90.905	28.004	E		Manas	Kuri Chhu
583	Kuri_gl24	G090929E028017N	0.184781	4801	90.929	28.017	E		Manas	Kuri Chhu
584	Kuri_gl25	G090943E028023N	0.100211	4595	90.943	28.023	E		Manas	Kuri Chhu
585	Kuri_gl26	G090947E028022N	0.028468	4591	90.947	28.022	E		Manas	Kuri Chhu
586	Kuri_gl27	G090950E028022N	0.016183	4566	90.95	28.022	E		Manas	Kuri Chhu
587	Kuri_gl28	G091064E027993N	0.011786	4317	91.064	27.993	E		Manas	Kuri Chhu
588	Kuri_gl29	G091100E027994N	0.013221	4128	91.1	27.994	M		Manas	Kuri Chhu
589	Kuri_gl18	G090883E028027N	0.011281	5377	90.883	28.027	M		Manas	Kuri Chhu
590	Kuri_gl23	G090900E028030N	0.021481	5804	90.9	28.03	E		Manas	Kuri Chhu
591	Kuri_gl22	G090898E028032N	0.014478	5647	90.898	28.032	E		Manas	Kuri Chhu
592	Kuri_gl12	G090806E028021N	0.034204	5555	90.806	28.021	E		Manas	Kuri Chhu
593	Kuri_gl13	G090832E028005N	0.012283	5188	90.832	28.005	E		Manas	Kuri Chhu

594	Kuri_gl15	G090834E028008N	0.016793	5191	90.834	28.008	E		Manas	Kuri Chhu
595	Kuri_gl14	G090825E028017N	0.018454	5168	90.825	28.017	I		Manas	Kuri Chhu
596	Kuri_gl7	G090818E027974N	0.016964	5424	90.818	27.974	E		Manas	Kuri Chhu
597	Kuri_gl45	G091311E028017N	0.018452	5089	91.311	28.017	M		Manas	Kuri Chhu
598	Kuri_gl46	G091323E028024N	0.013085	4775	91.323	28.024	M		Manas	Kuri Chhu
599	Kuri_gl35	G091247E027947N	0.065808	5125	91.247	27.947	M		Manas	Kuri Chhu
Wang Chhu										
600	Pa_gl1	G089259E027784N	0.023726	4405	89.259	27.784	E		Wang Chhu	Pa Chhu
601	Pa_gl2	G089267E027789N	0.016025	4490	89.267	27.789	E		Wang Chhu	Pa Chhu
602	Pa_gl3	G089294E027782N	0.039724	4722	89.294	27.782	E		Wang Chhu	Pa Chhu
603	Pa_gl4	G089313E027800N	0.044346	4394	89.313	27.8	M	Lhaluphu Gom Tsho	Wang Chhu	Pa Chhu
604	Pa_gl5	G089319E027795N	0.029718	4331	89.319	27.795	M	Lhaluphu Wom Tsho	Wang Chhu	Pa Chhu
605	Pa_gl7	G089350E027804N	0.167211	4354	89.35	27.804	M	Karma Tsho / Bongtong Tsho	Wang Chhu	Pa Chhu
606	Pa_gl6	G089345E027821N	0.065289	4504	89.345	27.821	M		Wang Chhu	Pa Chhu
607	Pa_gl8	G089350E027819N	0.024548	4454	89.35	27.819	M		Wang Chhu	Pa Chhu
608	Pa_gl9	G089400E027725N	0.012628	5037	89.4	27.725	M		Wang Chhu	Pa Chhu
609	Pa_gl10	G089401E027713N	0.020222	5022	89.401	27.713	M		Wang Chhu	Pa Chhu
610	Pa_gl11	G089409E027687N	0.179306	4799	89.409	27.687	M		Wang Chhu	Pa Chhu
611	Pa_gl12	G089413E027684N	0.012479	4857	89.413	27.684	M		Wang Chhu	Pa Chhu
Drangme Chhu										
612	Drang_gl1	G091534E027898N	0.277777	4432	91.534	27.898	E		Manas	Drangme Chhu
613	Drang_gl3	G091592E027894N	0.049516	4751	91.592	27.894	M		Manas	Drangme Chhu
614	Drang_gl4	G091596E027896N	0.05195	4761	91.596	27.896	M		Manas	Drangme Chhu
615	Drang_gl6	G091596E027888N	0.175321	4611	91.596	27.888	E		Manas	Drangme Chhu
616	Drang_gl7	G091604E027878N	0.067673	4443	91.604	27.878	E		Manas	Drangme Chhu
617	Drang_gl9	G091618E027872N	0.047308	2567	91.618	27.872	M		Manas	Drangme Chhu
618	Drang_gl8	G091615E027869N	0.069352	2385	91.615	27.869	M		Manas	Drangme Chhu
619	Drang_gl5	G091589E027870N	0.010658	1902	91.589	27.87	M		Manas	Drangme Chhu
620	Drang_gl2	G091543E27905N	0.04195	4476	91.543	27.905	E		Manas	Drangme Chhu



NATIONAL CENTRE FOR HYDROLOGY AND METEOROLOGY

ROYAL GOVERNMENT OF BHUTAN

www.nchm.gov.bt

ISBN 978-99980-52-13-0



9

789998

052130