BHUTAN GLACIER INVENTORY 2018

NATIONAL CENTER FOR HYDROLOGY AND METEOROLOGY
ROYAL GOVERNMENT OF BHUTAN
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Cryosphere Services Division, NCHM

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Foreword

Bhutan is highly vulnerable to the impacts of climate change. Bhutan is already facing the impacts of climate change such as extreme weather and changing rainfall patterns. The Royal Government of Bhutan (RGoB) recognizes the devastating impacts climate change can cause to the country's natural resources, livelihood of the people and the economy. Bhutan is committed to addressing these challenges in the 12th Five Year Plan (2018-2023) through various commitments, mitigation and adaption plans and actions on climate change at the international, national, regional levels. Bhutan has also pledged to stay permanently carbon neutral at the Conference of Parties (COP) Summit on climate change in Copenhagen.

Accurate, reliable and timely hydro-meteorological information underpins the understanding of weather and climate change. The National Center for Hydrology and Meteorology (NCHM) is the national focal agency responsible for studying, understanding and generating information and providing services on weather, climate, water, water resources and the cryosphere. The service provision of early warning information is one of the core mandates of NCHM that helps the nation to protect lives and properties from the impacts of climate change.

The Strategic Program for Climate Resilience (SPCR) which is being implemented by Gross National Happiness Commission (GNHC) focuses on four main pillars. The pillars are:

- Enhancing information base for hydro-met services and climate resilience
- Preparedness, food and water security
- Sustainable growth and resilient infrastructure
- Strengthening governance, institutional coordination and human resource capacity

NCHM is one of the four technical agencies under the SPCR and it is responsible for undertaking a technical study under the *Pillar I- Enhancing Information Base Hydro-met Services and Climate Resilience*. The fundamental objective of the study is to improve hydro-met base information and identify future investment plans. The list of studies carried out under the Pillar I of SPCR are as follows:

- Analysis of historical climate and climate change projection for Bhutan.
- Re-assessment of potentially dangerous lakes of Bhutan
- Bhutan glacier inventory 2018

It has been about two decades since the publication of first glacier inventory of Bhutan by ICIMOD in 2001. There were few inventories prepared and published in between by foreign researchers on glaciers in Bhutan. Almost all those inventories were prepared using older base materials such as topo maps of 1950s &1960s and coarser resolution satellite imageries. As a part of this SPCR project, an attempt have made to prepared a new glacier inventory for Bhutan using recent high resolution satellite imageries and more importantly by our own national experts. The Bhutan glacier inventory 2018 will form the basis for all cryosphere related activities in the future.

This report is submitted by NCHM to GNHC and the World Bank under the SPCR Project. The findings from this study provide initial assessment of possible future changes of climate over

Bhutan. The report is an outcome of Pillar I of the SPCR Project implemented by NCHM. In this regard, I would like to thank all the Divisions, the SPCR Management of NCHM who have worked hard to bring out this report.

(Karma Dupchu)
Director

Acknowledgement

We express our sincere thanks to Dr. Akiko Sakai and the Geo-Spatial Solution team at ICIMOD for providing us with the glacier polygon shape files of their earlier works. We are grateful to Karma, Head of Division of CSD, NCHM for his initiative and guidance to come up with glacier mapping of Bhutan and for his valuable comments and suggestions on the draft reports. We would also like to express our thanks to SPCR (Strategic Programme for Climate Resilience) Project for providing support in capacity building of the glacier mappers. Thanks to ESA (European Space Agency) for making the Sentinel-2, image freely available on their webpage. The SRTM elevation Model is courtesy of NASA's Jet Propulsion Laboratory and further processed by Group of Consultative Group for International Agriculture research (CGIAR).

Executive Summary

Glacier inventories are very informative dataset for studying and understanding spatial distribution of glaciers. Although few glacier inventories of Bhutan Himalayas are available, the need for an updated glacier inventory was felt necessary to understand the characteristics of Bhutanese Glacier distribution for expansion of in-situ glacier mass balance measurement site. Bhutan Glacier Inventory 2018 (BGI 2018) was updated using the latest available high-resolution imagery i.e. Sentinel-2 MSI (Multispectral Instrument) of European Space Agency (ESA) launched on 23 June 2015. Glacier outlines were delineated using cloud free Sentinel-2 MSI (October to November 2016) as base map. The raw Sentinel-2 MSI imageries were processed using Sen2cor and Sentinel Application Platform (SNAP) tool. Glacier polygons of 2016 were obtained using supervised classification in the SNAP tool. The polygons were later split and edited manually using Digital Elevation Model (DEM), 20 m interval contour, slope and High-resolution Google Earth™ imagery as references. The new inventory 2018 includes 700 glaciers covering total area of 629.55±0.02 km^2 in the Northern Frontiers of Bhutan. Glacier area covers 1.64% of the total land cover in Bhutan.

BGI 2018 represents lesser surface area than the earlier GAMDAM (Glacier Area Mapping for Discharge in High Asia Mountains) inventory of 2015 (Nuimura et al. 2015) by 12%. However, in comparison with the ICIMOD (International Center for Integrated Mountain Development) inventory of 2014, the current inventory shows less surface area by 2%. Likely cause of discrepancies could be due to the exclusion of glacier located in shadow-covered region, glacier recession over time and inclusion of seasonal snow in the source data. Though it is difficult to come up with concrete surface area for glaciers, this refined inventory of Bhutan glaciers would provide new opportunities for reference in future.

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Abbreviations and Acronyms:

ALOS	Advanced Land Observation Satellite
BGI	Bhutan Glacier Inventory
CGIAR	Group of Consultative Group for International Agriculture research
CSD	Cryosphere Services Division
DEM	Digital Elevation Model
DGM	Department of Geology and Mines
DHMS	Department of Hydro-met Services
ESA	European Space Agency
GAMDAM	Glacier Area Mapping for Discharge in High Asia Mountains
GLIMS	Global Land and Ice Measurement from space
GLOF	Glacial Lake Outburst Flood
ICIMOD	International Center for Integrated Mountain Development
MSI	Multispectral Instrument
RGI	Randolph Glacier Inventory
SNAP	Sentinel Application Platform
SPCR	Strategic Program for Climate Resilience Project
SRTM	Shuttle Radar Topography Mission
WGI	World Glacier Inventory

1. Introduction

Bhutan is located in the eastern Part of the Himalayas between Latitude 27.51° N and Longitude of 90.43°E, with elevations ranging from few hundred meters to over 7000 m a.s.l. Glacierized terrain occupies about 1.64% of the total land area of the country. Most of the major river systems begins from glacier terminus ranging from 4075m a.s.l. (Punatshang Chhu basin) to 7361m a.s.l. (Manas Chhu basin). Glaciers of the Himalayan region are crucial for maintaining atmospheric circulation, hydrological cycle, water resources availability and balancing the ecosystem (Zemp 2012). Previous studies concluded that Bhutan's glacier contribution to river flow to be up to 76% at 4500 m a.s.l (approx.10 km from glacier), but still 31% at 3100 m a.s.l elevation for a specific drainage basin in central Bhutan (Williams et al. 2016). Melt water from snow and glaciers feeds major river systems in Bhutan (Wang Chhu, Punatsang Chhu, Manas Chhu, Amo Chhu, and Nyere Ama Chhu). Glaciers feed all the rivers except Amo Chhu and Nyere Ama Chhu. As glacier changes are key Indicator of Climate Change (Bajracharya and Mool, 2009; Bolch et al.2012), their outlines are mandatory for any glacier related studies. This database provides a basis for understanding rate of change of glacier, water resources planning and mitigation of Glacial Lake Outburst Flood (GLOF) risk.

Though the status of glacier and glaciation in Bhutan is not well studied, but as reported by Ageta and Iwata (1999) glacier in Bhutan like the Tarina Glacier retreated around 0.7 km (30 - 35m Year^{-1}) from 1967 to 1998. Raphstrang Glacier retreated about 0.5 km (35 m year^{-1}) during the 14-year interval. While Luggye glacier retreated at a rate of 16m year^{-1} from 1988 to 1993. To have better understanding on the water resource reserve in glaciers for sustainable water availability and risk assessment of glacier related hazards (Kaser et al., 2010) documentation of variability of glaciers in due course of time is very important. In this context, to document changes in glaciers, in-situ measurements on few accessible glaciers (Thana Glacier in the head water of Chamkhar Chhu and Gangju La in the headwaters of Punatshang Chhu) has been carried out for mass balance studies by erstwhile Department of Hydro-met Services (DHMS), Department of Geology and Mines (DGM) in collaboration with Nagoya University, Japan and other international agencies like ICIMOD. These assessments on accessible glaciers were only for mass balance studies at the specific sites and do not represent the glacier status over the region. Inherent inaccessibility of glaciers located in remote and isolated parts of the country hampers the adequate number of in-situ measurements and those available in-situ measurement data are from small number of accessible glaciers. Moreover, inventories using conventional methods require extensive time and resources. Therefore, in recent times, monitoring of glaciers using satellite imageries and aerial photographs have become a better option. The first glacier inventory of Bhutan was prepared by ICIMOD in 2001 based on 1: 50,000 topographic maps from the 1950s to 1970s by survey of India and print of Landsat thematic mapper images, covering an area of nearly 1317km^2 (Mool et al. 2001). This approach of mapping is laborious and time consuming.

To improve and incorporate shortcoming of all these problems, ICIMOD, has come up with a more comprehensive methods to map the glaciers (Bajracharya et al. 2014) of the Hindu Kush-Himalaya region in 2011 using semi-automatic delineation of glacier and glacial lake from Landsat 7 ETM+ imageries (imagery date: 2002 to 2008). In the same year 2011 (Nuimura et al., 2015) also mapped glaciers in Asian region targeting to study the contribution of glacier melt to Asian river system. Mapping here was carried out using Landsat scene prior to 1999 along with

SRTM DEM. Later in 2015, comparison and compiling of an inventory using high resolution ALOS image (from 2007 till 2011) specifically for Bhutan was carried out (Nagai et al. 2016).

In 2018, the Cryosphere Services Division (CSD) under National Center for Hydrology and Meteorology (NCHM) updated the glacier inventory using Sentinel-2A MSI 10 m resolution scenes of the year 2016 focusing only on the glaciers within Bhutan. Basin wise details of glaciers, methodology and procedure to delineate glaciers, comparison of the updated inventory with previous inventories are discussed in this report.

2. Dataset

2.1 Data Used for Glacier Mapping

The earlier inventories were produced using Landsat imageries from late 1990's to early 2000's. However, after decommissioning of Landsat Thematic Mapper(TM) sensor in 2012 after 27 years of operation, Sentinel-2A (S2A) was launched on 23 June 2015. The Sentinel-2A operates with new Multispectral Instrument (MSI), Sentinel imagery has been made freely available to the user through the European Space Agency (ESA) Copernicus Open Access Hub (http://scihubcopernicus.eu), with improved spatial and temporal resolution. Eight scenes covering all the glaciated area of Bhutan with least snow and cloud cover were downloaded for glacier mapping. Among multiple scenes, scenes with least effect from seasonal snow and cloud cover on date of acquisition were used. The imageries of late summer i.e. from October to November 2016 were found to be suitable for glacier outline delineation as glacier boundaries are more distinct from September to early November (Bajracharya et al. 2014)The imageries obtained from Sentinel-2 satellites are subjected to atmospheric scattering and absorption, Top of Atmospheric Reflectance (TOAR)(Figure 1(a). Such effects were corrected and brought to the Bottom of Atmosphere Reflectance (BOAR) using an image correction program from Sentinel toolbox (Sen2Cor) (Figure 1(b)) which assigns new values that gives less effect from shadow, cloud cover and atmosphere intervention. Applying Sen2cor to raw (L1C) image that is radiometric and geometric corrected will be converted and processed to (L2A) image that is ready for post processing in SNAP tools.

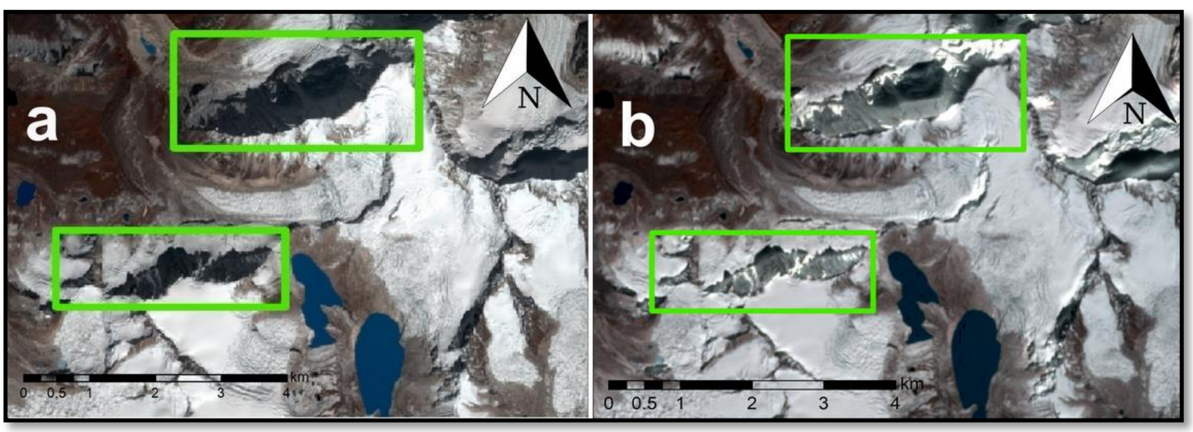

Figure 1a: Sentinel- 2A(L1C Imagery) and 1b: Sentinel-2A (L2A Imagery) at Zanam Area, image acquired on 28th October 2016

Table 1: Characteristics of Sentinel scenes with its capture date.

Scene	Satellite	Sensor	Sensing Date
1	Sentinel 2A	MSI	28 October 2016
2	Sentinel 2A	MSI	28 October 2016
3	Sentinel 2A	MSI	28 October 2016
4	Sentinel 2A	MSI	8 November 2016
5	Sentinel 2A	MSI	16 November 2016
6	Sentinel 2A	MSI	23 November 2016
7	Sentinel 2A	MSI	23 November 2016
8	Sentinel 2A	MSI	23 November 2016

To delineate glacier outlines more accurately, other reference resources like topographic maps, Shuttle Radar Topography Mission (SRTM) DEM, which is freely available from NASA's Earth System Data and Information System (http://reverb.echo.nasa.gov/) were used. Previously SRTM DEM data for region outside USA were available at 90 m resolution, but in 2015 SRTM version 3.0 (SRTMV3) with 30 m resolution was made available for Asia region. This 30 m resolution DEM was used to extract slope and contour information for image topography verification.

2.2 Other Reference Data

Other data used as reference and to compare this inventory were glacier shape files of GAMDAM glacier inventory (GGI, Nuimura et al., 2015) which were mapped from LANDSAT level 1 -Terrain corrected (L1T) imageries acquired from 1999 to 2003. The other reference data used was the glacier shape files of inventory of Glaciers by ICIMOD (Bajracharya et al. 2014) which were mapped from orthorectified LANDSAT 7 ETM + L1G imageries from 2002 till 2008. Dr. Akiko Sakai, Nagoya University, provided data for the GGI for Bhutan region on request. The glacier polygon data of ICIMOD was downloaded from http://apps.geoportal.icimod.org/HKHGlacicer/. The inventory of Glaciers and Glacial Lakes of Bhutan, 2001(Mool et al. 2001) by ICIMOD was also referred but the glacier shape files were not available so only a brief comparison in terms of numbers and area with the 2001 inventory by ICIMOD was done. Henceforth in this report, the inventory of Glaciers and Glacial Lakes of Bhutan, 2001 will be referred as ICIMOD 2001, the GAMDAM Inventory will be mentioned as GGI 2015 and the updated ICIMOD Inventory as ICIMOD 2014 taking into consideration the year of publication of the papers.

3. Methodology:

3.1 Automatic delineation

For Bhutan Glacier Inventory 2018 (BGI 2018), Sentinel-2 images were used for mapping the glacier polygons.

The processed image from Sen2cor was fed into Sentinel Application platform (SNAP) for classification. The processed images contain 13 bands (Table 2) of different spatial resolution (Band 2, 3, 4, 8 = 10 m, Band 5, 6, 7, 8a, 11, 12 = 20 m and Band 1, 9, 10 = 60 m). The bands 5, 6, 7, 8a, 11, 12, 1, 9, 10 were resampled to 10 m resolution using Sen2cor for the ease of further processing in the SNAP tool. Images obtained were then visualized in false color combination (band 8, 4 and 3, corresponding to red, green, and blue respectively) (Figure 2a & 2b). Image classification was done using supervised classification in the SNAP tool. For classification, training samples assigned were clean ice, debris glacier, barren land, lake, and vegetation. As clean glacier ice have high reflectivity in visible (VIS) to near- infrared (NIR) wavelengths (0.4-1.2μm) and low reflectivity in SWIR wavelength region (1.4-2.5μm) it was easier to classify clean ice glacier. A statistical tool in SNAP, Principle Component Analysis (PCA) was used for image processing followed by Random Forest classification using training sample and whole of the scene were classified as shown in figure 3.

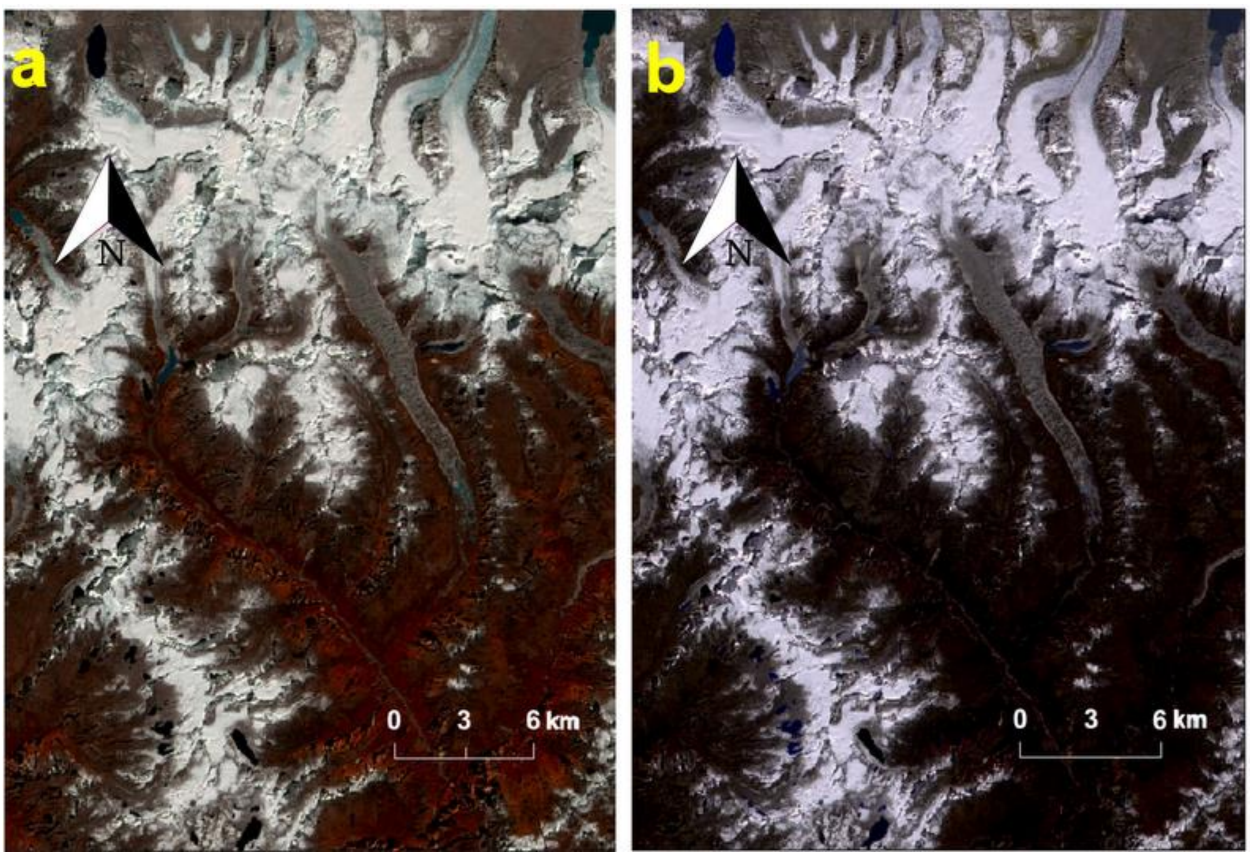

Figure 2 a: Example of False Colour Composite (FCC) (band 8, 4, and 3 as RGB) composite for Sentinel Imagery, taken on 8 November 2016. & 2b: True Colour Composite (band 4, 3, and 2 as RGB) FCC gives clearer image for mapping a glacier.

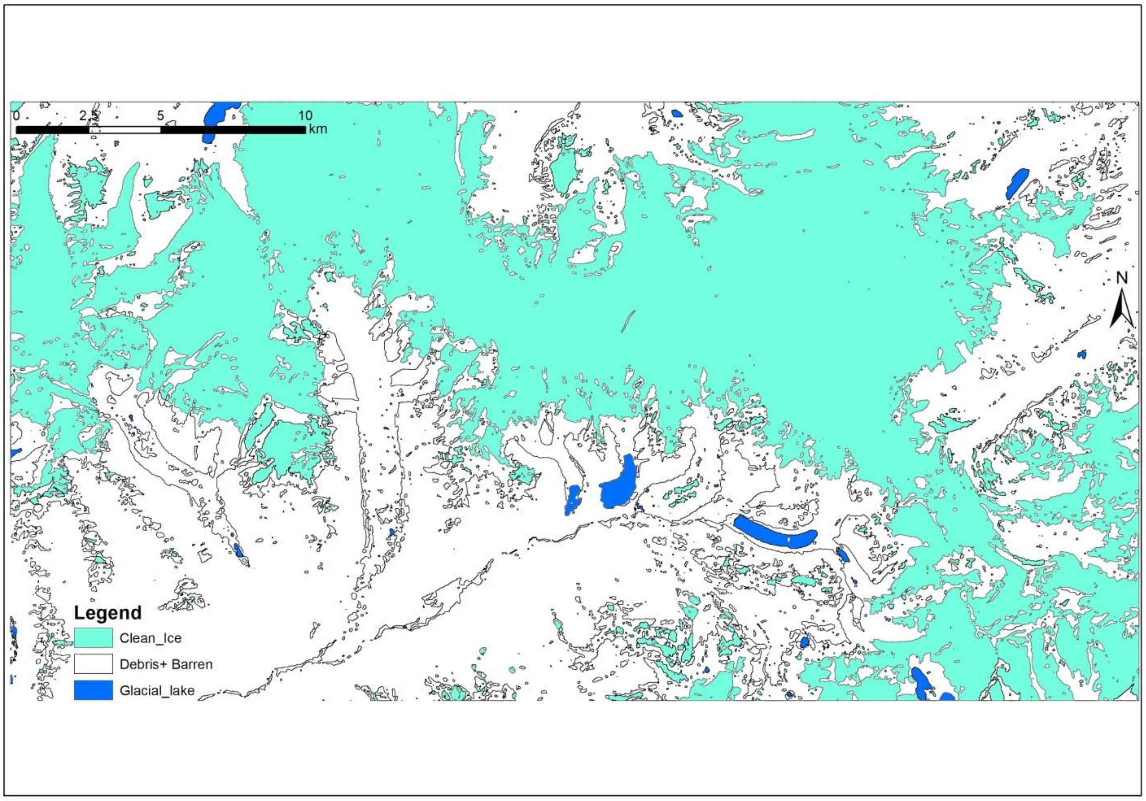

Figure 3: Example of image classified by SNAP tool using Random Forest Classification, where clean ice and Water bodies (Lake) are classified distinctively but barren land and debris glacier are still classified under same group. (Location: Pho Chhu Basin, image acquired on 28th October 2016)

Here, automated supervised classification for clean ice glacier mapping was done. This approach of classification includes both clean ice and snow under same group irrespective of topographic, area feature. Classified image object was merged, and then product was exported in GIS format. Close visualization of sentinel image in false color composites (FCC) shows high contrast for glacier than surrounding snow (Figure.3). However, this distinction is difficult where the glacier is continuous in stretch and shadow is prominent on the glacier, so we have to analyze multiple imageries of different time/season for the same scene.

However, Bhutan being a mountainous country, mountain glaciers are dominant compared to valley glaciers. As mountain glaciers are mostly associated with compound basin in the form of hanging glaciers (Mool et al., 2001), they are considered to be of different types due to their significant size, shape, form and ice thickness. Consideration of slope threshold would compromise mountain and hanging glacier. Though ALOS-derived, GGI, ICIMOD and Global Land and Ice Measurement from space (GLIMS)(Racoviteanu et al. 2015); Raup et al. 2007), have excluded high steep slopes as glaciers on steep rock walls ultimately nourish the low lying glaciers. Moreover, steep headwall glaciers have no change in surface elevation and glacier mass fluctuations due to uncertainty of glacial action on steep slope. However, this current inventory incorporates all steep gradient glaciers as glacier, mapping here is intended to see number of glacier variation within Bhutan to carryout future glacier and hydrological related studies.

Delineation of glaciers along ridges was done laying contour, slope and Google Earth™ imagery Further, the glacier polygons of ICIMOD and GGI were overlaid on Sentinel Image to validate mapping.

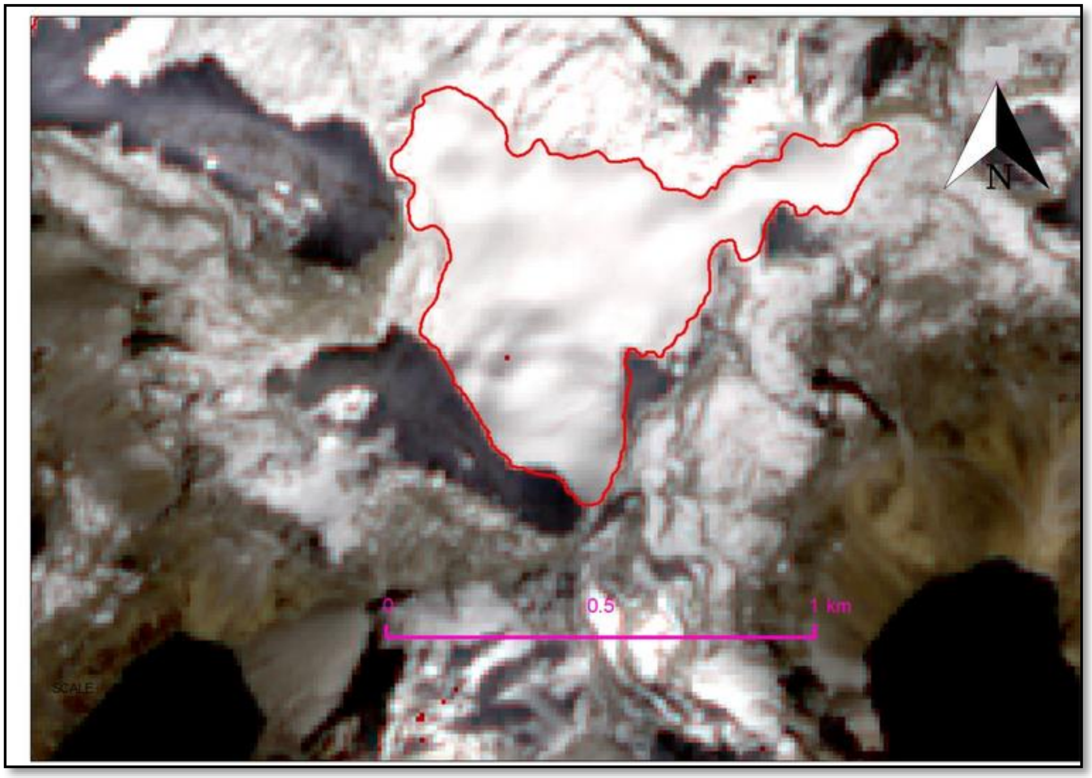

Figure 4: Example of distinction of snow and glacier in Manas Basin. The background is False Color Composite (Band 8, Band 4, and Band 3 as RGB composite Sentinel-2 Image taken on 23 November 2016, 27° 51´N, and 91° 35´E). The Glacier outline is much distinctive.

Table 2: Spectral bands of Sentinel-2 with Central wavelength (μm) and spectral resolution (in m) used for Glacier mapping.

Band	**Band Number**	**Central Wavelength(μm)**	**Resolution(m)**
Coastal aerosol	Band 1	0.443	60
Blue	Band 2	0.490	10
Green	Band 3	0.560	10
Red	Band 4	0.665	10
Vegetation Red Edge	Band 5	0.705	20
Vegetation Red Edge	Band 6	0.740	20
Vegetation Red Edge	Band 7	0.783	20
Near Infrared(NIR)	Band 8	0.842	10
Vegetation Red Edge	Band 8A	0.865	20
Water Vapour	Band 9	0.945	60
SWIR-Cirrus	Band 10	1.375	60
Short Wave Infrared(SWIR)	Band 11	1.610	20
SWIR	Band 12	2.190	20

3.2 Manual Delineation

One of the major challenges in mapping glaciers is the presence of debris. As debris-covered glaciers have similar spectral characteristic to surrounding moraines, spectral information alone is not sufficient for mapping debris-covered glaciers, therefore manual digitization was applied. Since manual digitization and automatic mapping like band-ratio technique for mapping debris covered glacier gives less disparity (2%), (Alifu et al. 2015), we used similar method as Bhutan has few debris covered glaciers. For the manual delineation, data management and editing glacier polygons were carried out using ArcGIS. Further to have improved consistency in result, four operators (Figure 5a & 5b) mapped all of the debris-covered glaciers. Manual delineation was carried out by overlaying contour as reference on sentinel image. Contour lines are sparsely distributed on glacier surface as glaciers being gentle, while neighboring rock walls have dense distribution of contour lines. This junction represents the edge of glaciers, separating it from surrounding rock walls (Fig. 6). Contours were also used to delineate terminus of glacier and separate glacier boundary along the ridgeline. Manual delineation was also carried out by comparing with high resolution Google Earth™ and data of previously mapped inventory of ICIMOD and GAMDAM.

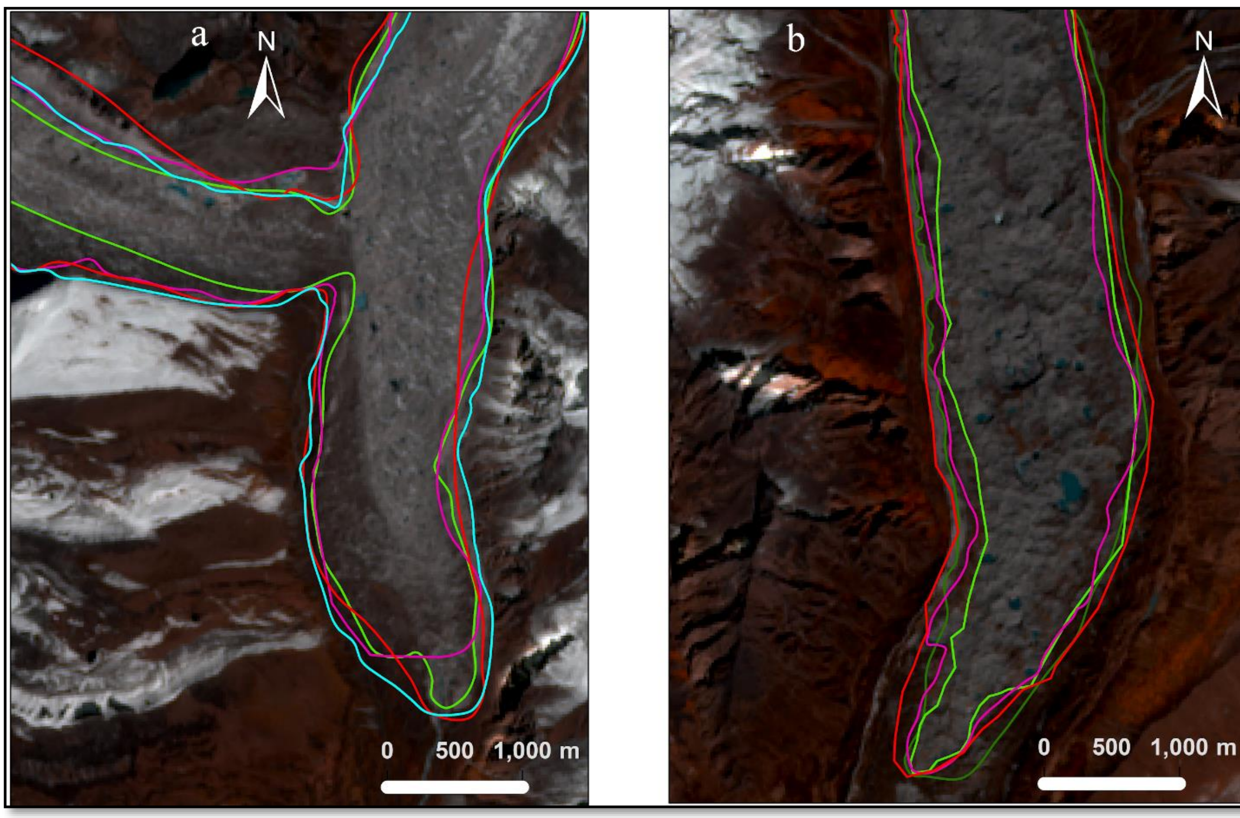

Figure 5: 5a& 5b shows example of glacier outline delineated by different operators (line in different colours) on the same background image (Sentinel-2 image in False colour composite, band 8,4 & 3 as RBG). Image location: Gangkar Puensum Area and the image was acquired on 28th October 2016.

3.3 Area threshold criteria

Depending upon individual's research interest, there are various criteria for area thresholding. For instance, Randolph Glacier Inventory (RGI) (Pfeiffer et al. 2017) considered glaciers with area above or equal to 0.05 km^2, whereas other latest inventories like GGI and ICIMOD inventories considered glaciers with areas above or equal to 0.01 km^2 and 0.02 km^2 respectively.

For BGI 2018, we have considered glaciers with area above or equal to 0.01 km^2 which corresponds to about 1000 grids of 10 m resolution. This area threshold includes all small glacier that is more susceptible to changes in the future. However, area of 0.02 km^2 has been considered just to compare with ICIMOD inventory. Further, after delineating all the glaciers according to the set threshold, glacier polygons were smoothened to have regular polygonal shape.

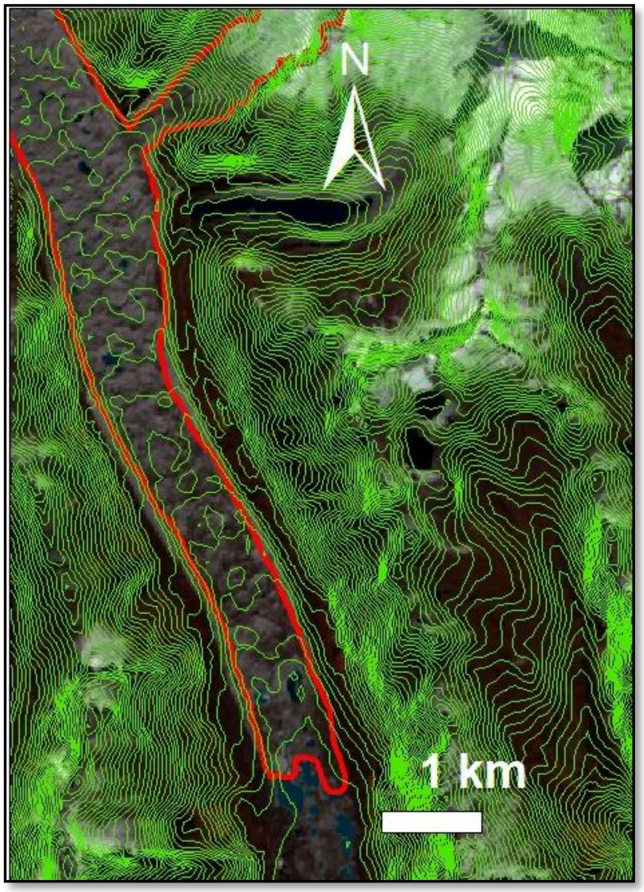

Figure 6: Outline of glacier generated using contour lines at 20 m intervals. The extent of glacier outline from the surrounding features can be identified overlaying contour on Sentinel image. Background imageries is in false colour (bands 8, 4 and 3 as RGB) .Image location: Right of Lunana Complex and image acquired on 8th November 2016.

3.4 Attribute data

Attribute for each glacier were assigned according to the protocol set by Global Land Ice Measurement from Space (GLIMS) community (Racoviteanu et al. 2009; Raup et al. 2007) in ArcGIS. Other attributes like area, elevation range, slope range, mean aspect of the individual glaciers were created. To assign local ID of the glacier, we followed WGI guidelines (Cogley 2009), which assigns glacier ID by numbering glaciers starting from the mouth of major stream and proceeds clockwise round the basin through each and every small tributaries.

3.5 Hypsometry

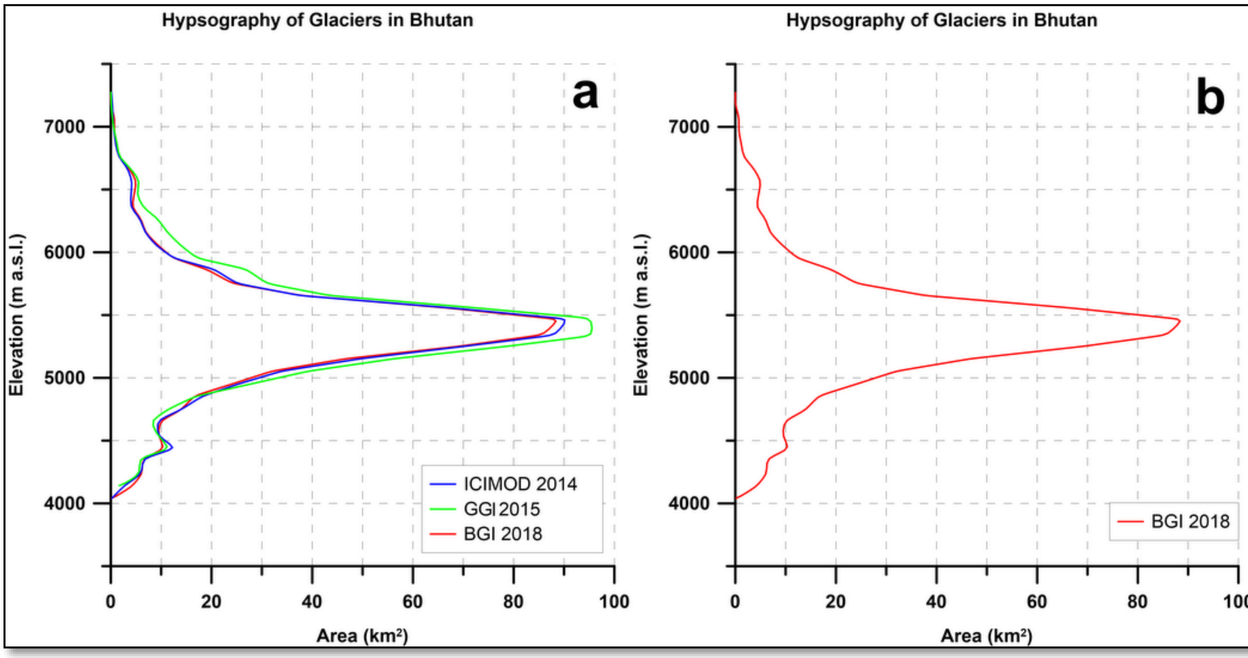

Figure 7:7a shows the hypsometry of glaciers of Bhutan & 7b shows hypsometry comparison of BGI 2018, ICIMOD 2014 & GGI 2015

For the hypsometry, Advanced Land Observation Satellite (ALOS) DEM (10 m) was clipped using polygons of BGI 2018. The clipped DEM was reclassified into 100 m elevation interval. The area in each elevation interval was calculated by counting the number of pixels multiplied by the length of each pixel (DEM resolution). The area was then plotted against elevation (Figure 7a). The hypsometry of other two inventories were also extracted using their glacier polygons and ALOS DEM. Our final hypsometry is then compared with other two inventories (Figure 7b).

4. Accuracy

Accuracy of glacier polygon outlines depends mainly on image resolution, seasonal snow cover, shadow and the contrast as seen in satellite imageries between the glacier and its surroundings. Previous studies suggest the use of high-resolution imagery as an accurate way to assess glacier outlines (Paul et.al. 2013). Hence, for this study, high resolution Sentinel-2 imagery was used. Eight scenes covering all the glaciated area of Bhutan with least snow and cloud cover were used.

The delineated glacier boundaries were affected mainly by shadow and cloud cover. For this study, glacier area uncertainties were estimated by calculating the variation of glacier area from the delineated glacier polygon and the pixel-based area calculation. The pixel-based area is calculated as the product of the total number of pixels bounded by the glacier boundary and the image resolution (Bajracharya et al. 2014). The total uncertainty of the glacier area was calculated as:

$$\sqrt{\frac{\sum_{i=1}^{n}(a_i - \hat{a_i})^2}{n}}$$

Where

a_i is the area of the glacier from the glacier polygon

$\hat{a_i}$ is the pixel based calculated area

n is the number of glaciers.

The total uncertainty of glacier area in this study is calculated at ±0.003 %. The uncertainty estimated in the present study was very minimum compared to previous studies carried out by ICIMOD and Randolph Glacier Inventory, which has estimated errors in the range of 2.3% - 3% (Pfeiffer et. al 2017). The higher precision in the present work can be attributed to the use of high-resolution satellite imageries with minimum cloud and shadow cover.

5. Results

A total of 700 glaciers with an area of 629.55±0.02 km^2 were mapped from the eight scenes of cloud free Sentinel images and considering the area threshold of 0.01 km^2. The Punatsang Chhu basin has the highest number of glaciers (341) with an area of 361.07±0.008 km^2 and the Wang Chhu Basin has the lowest number of glaciers (47) with an area of 33.38±0.001 $km^{2.}$ The largest glacier MMagr16_482, (G090443E28024N) in the Mangde Chhu sub basin covers an area of 45.85 km^2 and length of 15.56 km. Terminal glacier elevation ranges from 4075 m a.s.l. in the Punatsang Chhu sub basin to 7361m a.s.l. in the Mangde Chhu basin.

Figure 8 and 9 shows that BGI inventory (2018) has lesser area and number than that of ICIMOD and GGI inventory. In terms of glacier number, it shows decreasing trend from 2014 till 2016. Number of glaciers is little more for the GGI inventory, while glacier area remains consistent for BGI and ICIMOD 2014. In terms of glacier area, maximum glacier is distributed at the elevation of approximately 5000 - 5750 m a.s.l. Comparing the results, the glacier area change between 2014 (ICIMOD) and 2018 (BGI) is around -2% but the maximum area disparity is shown between 2015 (GAMDAM) and 2018 (BGI) of -12%, within the elevation range of approximately 5300 - 5500 m a.s.l. and 5600 - 6500 m a.s.l. Figure 10 shows the basin wise comparison with regard to glacier numbers and area of each basin of current BGI 2018 to earlier inventories.

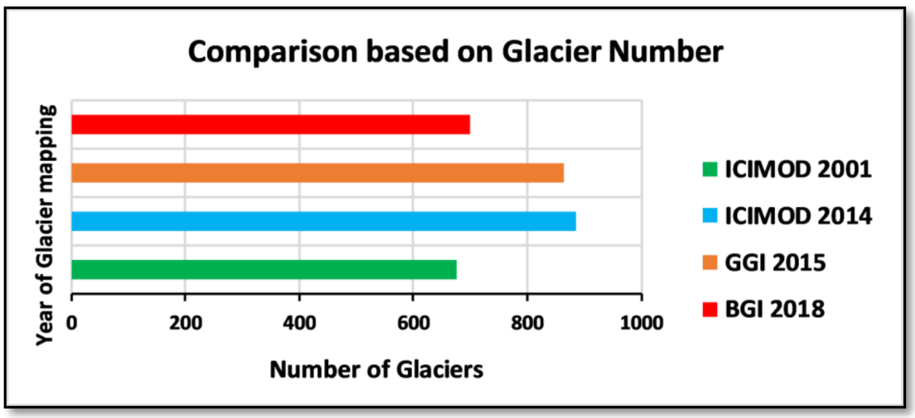

Figure 8: Comparison of different inventories based on glacier numbers.

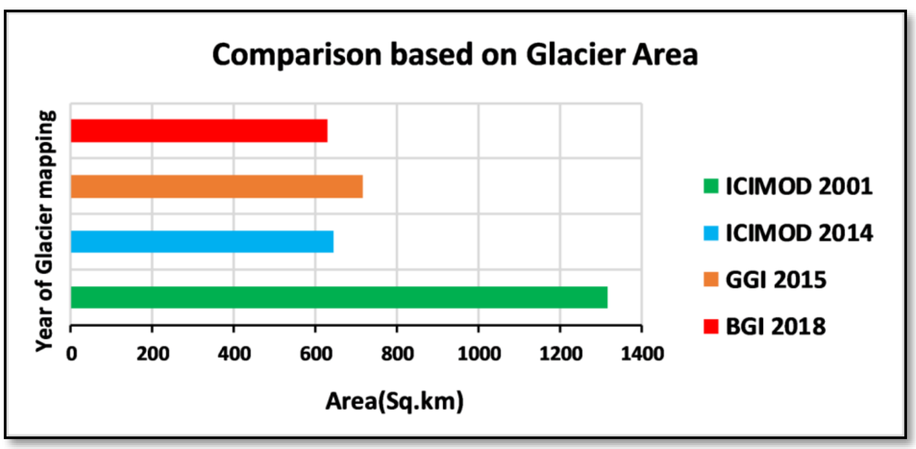

Figure 9: Comparison of different inventories based on glacier area.

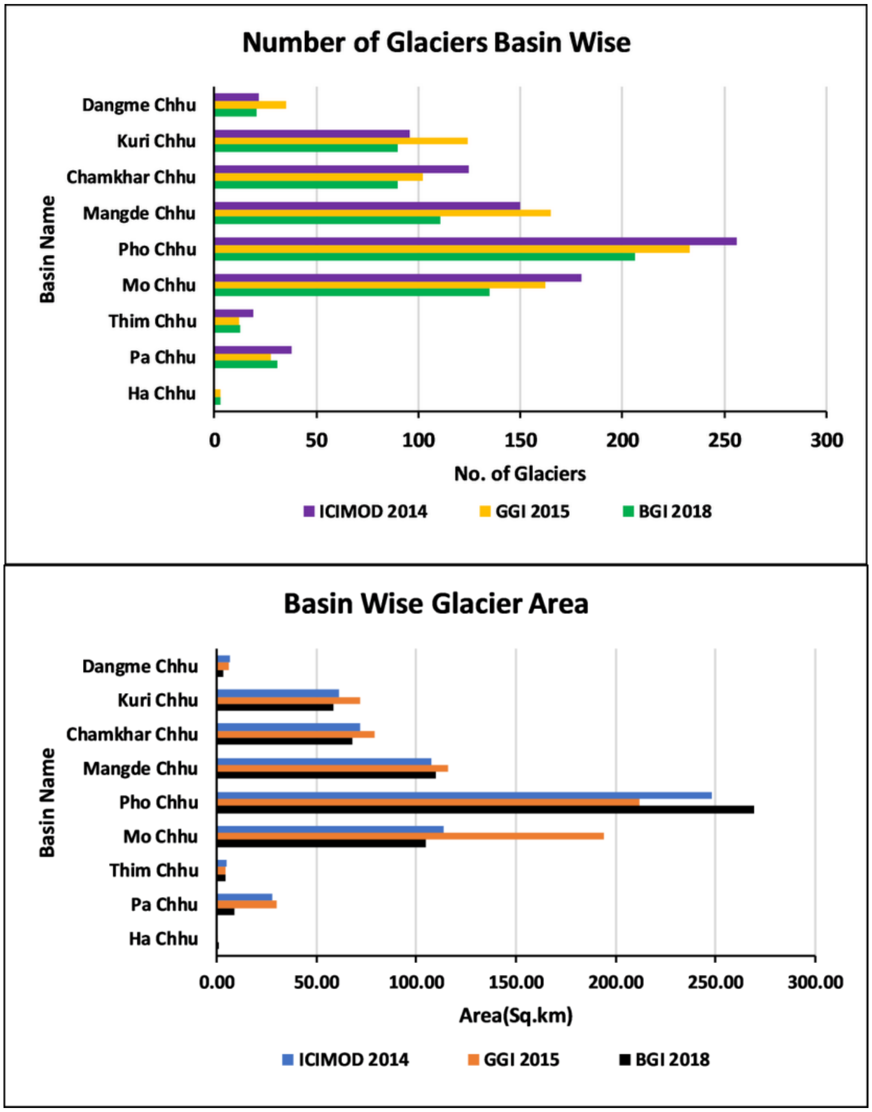

Figure 10: Glacier number and area of glacier in each basin compared to ICIMOD and GGI inventories.

Details of the glaciers in each sub basins are provided in the following sections.

5.1 Wang Chhu Basin

Wang Chhu basin constitutes Pa Chhu, Ha Chhu and Thim Chhu sub basins. The Pa Chhu, Thim Chhu, and Ha Chhu has a total of 31, 13 and 3 glaciers respectively. While Pa Chhu has highest glacier area (28.39 km^2) and Ha Chhu has the smallest (0.27 km^2). Glacier in this region are mostly mountain glacier and few of ice apron and valley glacier having aspect to various direction. The Largest glacier of Wang Chhu covers an area of 9.24 km^2 under Pa Chhu sub basin and the smallest glacier under Wang Chhu sub basin is 0.02 km^2. Glacier tongue elevation ranges from 4799 to 6862 m a.s.l.

5.2 Punatsang Chhu Basin

Punatshang Chhu basin consists of three sub basins namely Pho Chhu, Mo Chhu and Dang Chhu sub basin. The Pho Chhu sub basin in the east and Mo Chhu in the west are the major tributaries of Punatshang Chhu River that converges near Punakha Dzong. Dang Chhu sub basin has no glacier contributing to the river system, while other two combined has the highest number of glaciers in Bhutan than any other river basins.

5.2.1 Mo Chhu sub basin

Mo Chhu is the westernmost branch of the Punatshang Chhu. It consists of two tributaries one originating from Masang Gang region in the East and the other from Gangchen Tag region in the west. This sub basin has 135 glaciers covering an area of 104.69 km^2.The largest glacier, PMogr16_158 has an area of 10.07 km^2 located at latitude 28.1N and longitude of 89.84E at an altitude of 5435 m a.s.l. Mountain glaciers are much dominant in terms of number.

5.2.2 Pho Chhu sub basin

Similar to the Mo Chhu sub Basin, Pho Chhu sub basin has two major tributaries, one originating from Tarina region in the west and the other one from Lunana region in the east. The total number of glaciers in this basin is 206 covering an area of 269.65 km^2. The Largest glacier in western branch of pho Chhu is Wachay glacier (PPhgr16_273) with length of around 15.89 km covering an area of 28.9 km^2. Eastern Lunana region drains through wide inhabited valley of Thanza. The glacier activity in this region feeds several potentially dangerous glacial lake(PDGL)such as , Raphstrang Lake (Pho_gl209), Thorthormi Lake (Pho_glXXX), and Luggye Lake (Pho_gl210) (Mool et al 2001) as shown in Figure 11. The largest glacier, Tshoju Glacier (PPhgr16_293) is also located in this region at latitude of 28.14N and longitude of 90.15E at elevation of 4018 m a.s.l. (tongue elevation).

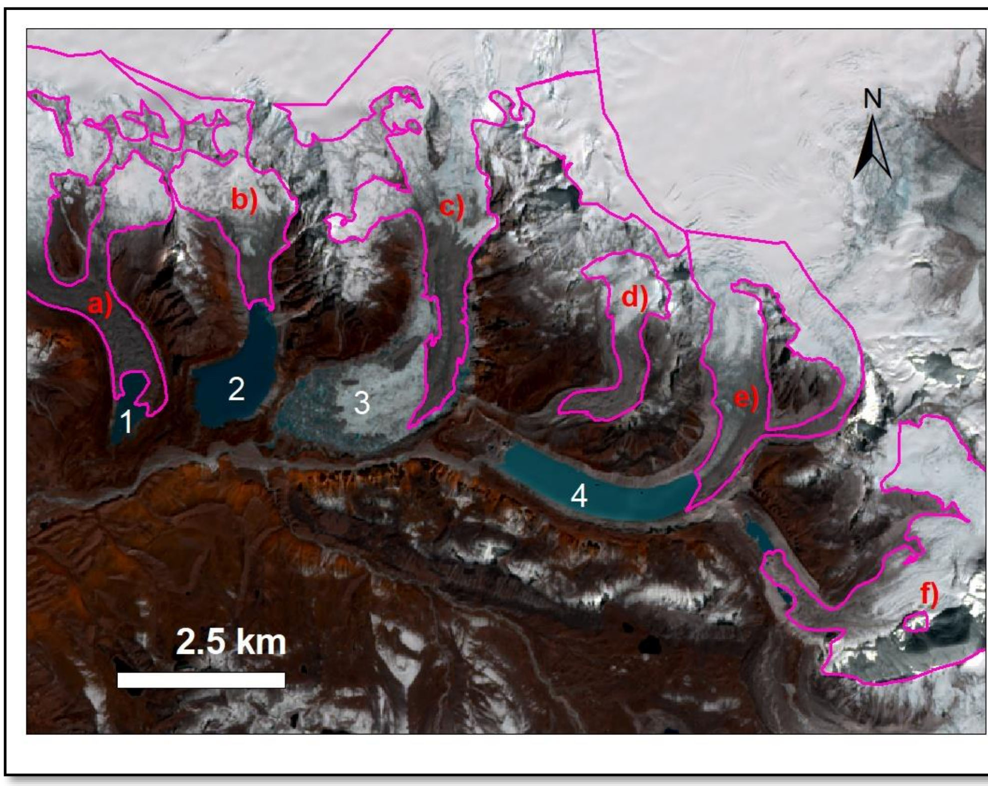

Figure 11: Glacier in Lunana region feeding potentially dangerous glacial lakes(a) Bechung glacier(PPhgr16_297)feeding(1) Bechung glacial lake.(b) Raphtshreng glacier (PPhgr16_298) feeding (2).(c) Thorthomi glacier (PPhgr16_299) feeding (3) Thorthomi glacial lake.(d) Luggye-1 (PPhgr16_301)feeding Luggye

glacier lake .(e) Luggye-2 (PPhgr16_302) feeding Luggye glacial lake & (f)Druk Chhung glacier(PPhgr16_304.). Image acquisition date: 28th October 2016.

5.3 Manas Basin

The Manas Basin is the easternmost basin consisting of Mangde Chhu sub basin, Chamkhar Chhu sub basin, Kuri Chhu sub basin, and Drangme Chhu Sub- basin.

5.3.1 Mangde Chhu sub Basin

The Mangde Chhu Basin is the westernmost part of the Manas basin flowing through the gorges of Trongsa valley. This basin comprises of 111 glaciers covering a total area of 108.25 km^2. The largest glacier (MMagr16_482) in this sub basin measures 15.56 km with an area of 45.85 km^2 at elevation of 4630 m a.s.l. (glacier tongue elevation).

5.3.2 Chamkhar Chhu sub Basin

Chamkhar Chhu consists of three major tributaries, one in the western part from glacier in the Gangkar Puensum region and two from glaciers in the Monla KarChhung region. It consists of 90 glaciers covering an area of 68.277km^2 .The largest Glacier in western branch of Chamkhar Chhu is MChgr16_519 located at an elevation of 4689 m a.s.l. (glacier tongue elevation) with an area of 15.432 km^2 and is 7.69km long. The largest glacier in the eastern branch is the Chhubda glacier (8.78 km^2) (MChgr16_562) sloping southwest at an elevation of 4912 m a.s.l.

5.3.3 Kuri Chhu sub basin

The kuri Chhu originates from Tibet and it drains through Bhutan. Within Bhutan Bahilung Chhu and Khoma Chhu further, add upon it. This trans-boundary river has its headwater in Tibet and there are 90 glaciers identified within Bhutan occupying an area of 55.29km^2. Mountain glaciers are the dominant type of glaciers in this basin.

5.3.4 Drangme Chhu sub Basin

This sub basin has only 21 glaciers covering a total area of 3.28 km^2. The largest glacier MDagr16_691 has maximum area of 0.56 km^2 and length of 1.37 km. Glaciers in this basin have been studied only through remote sensing and satellite imageries due to non-availability of topographic maps for this region. Majority of the glaciers in this basin are also mountain glaciers and the glaciers are oriented towards east.

6. Discussion

The current Bhutan glacier inventory 2018 shows little variation in number and area compared to the existing inventories. In this section, results on such variations comparing to existing inventories are discussed.

6.1 Distribution of Glacier

The updated BGI 2018 includes 700 glaciers with a total area of 629.55 km^2. Debris covered glacier are numerous and more extensive than clean ice glacier, representing 100% of glacier > 10km^2 in area (Nagai et al., 2016). For the current BGI 2018, clean and debris covered glaciers were not segregated. Nyere Ama Chhu and Amo Chhu basin have no glaciers. Majority of glaciers in Bhutan fall into primary classification of mountain glacier with simple basin and with major source of recharge from snow and avalanches (Mool et al 2001). Glaciers in Bhutan generally occurs from elevation of 4075m exhibiting a size distribution of low-altitude region (Nagai et al., 2016).

Among the basins, Wang Chhu Basin has the least number of glaciers (47 glaciers), while Punatsang Chhu has the highest number of glaciers (341 glaciers) which makes up approximately 48.71% of Bhutan's total glacier. Distribution of glaciers in Bhutan is shown in figure 12.

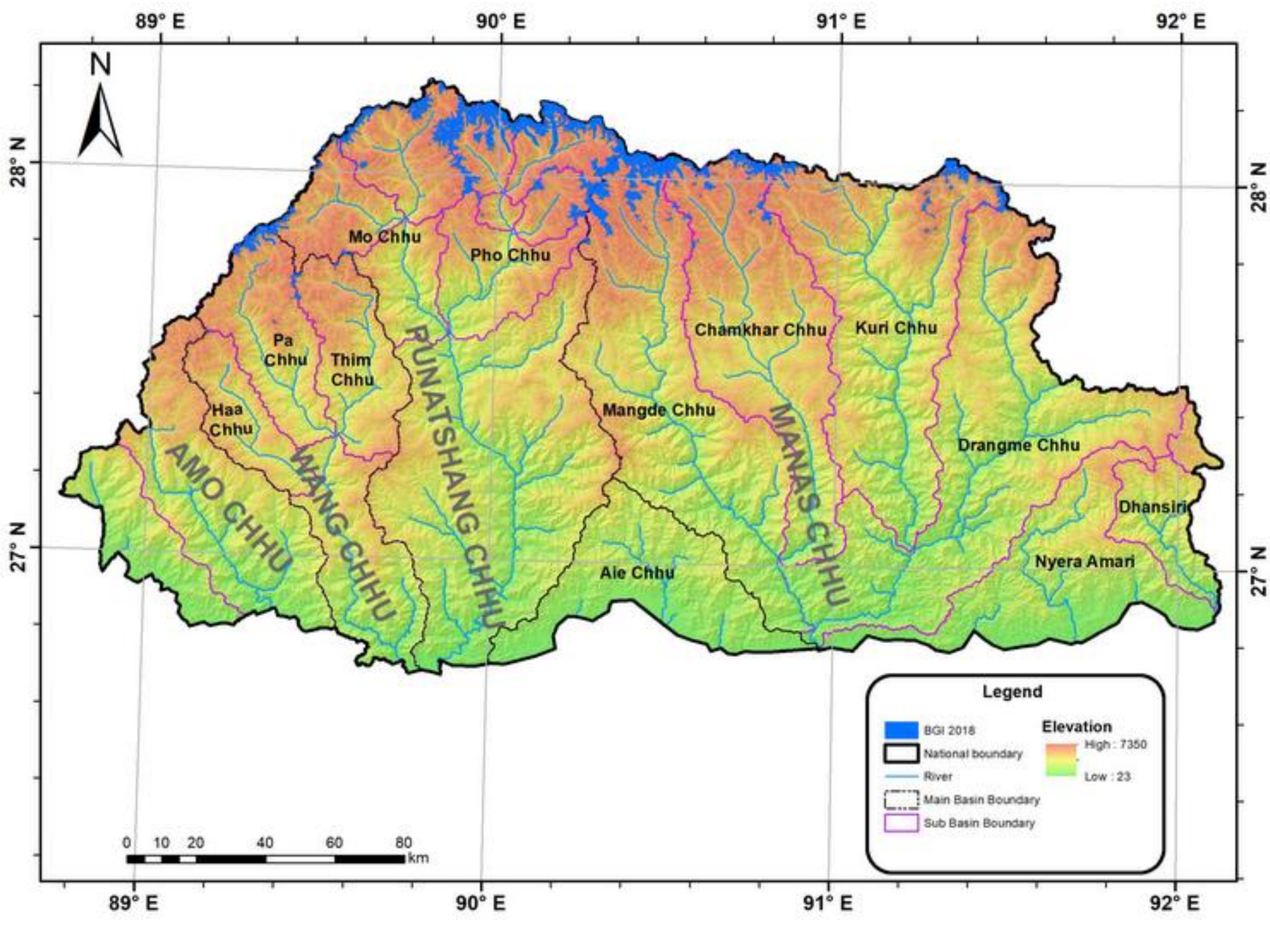

Figure 12: Distribution of glacier in the sub-basins of Bhutan in 2018.

6.2 Inconsistency in glacier mapping

6.2.1 Comparison with ICIMOD Inventory 2014

ICIMOD Inventory (Bajracharya et al. 2014) in HKH region was generated using Landsat-5/-7 imagery from 2002 to 2008 with semi-automatic classification while we have performed supervised classification in SNAP for clean ice mapping and manual delineation for debris glacier. ICIMOD has filtered using slope (>60° for clean ice and >25° for Debris covered glacier) using SRTM3 DEM. For consistency while comparing, BGI 2018 considered similar area threshold (>=0.02km^2). The total number of glaciers mapped using this threshold was 696, which is 21.4% lower than that mapped by the ICIMOD Inventory (Table 3). The area extend of glacier shows a difference of 2%. Such variations in glacier number could be attributed to the following reasons:

1) Splitting of glacier polygons along the ridgelines and terminals while mapping.
2) Inclusion of ice bodies/snow cover on steep slope as separate glacier
3) Use of satellite imageries with improved spatial resolutions
4) Inclusion of seasonal snow cover/ lakes (Figure 13 & 14).

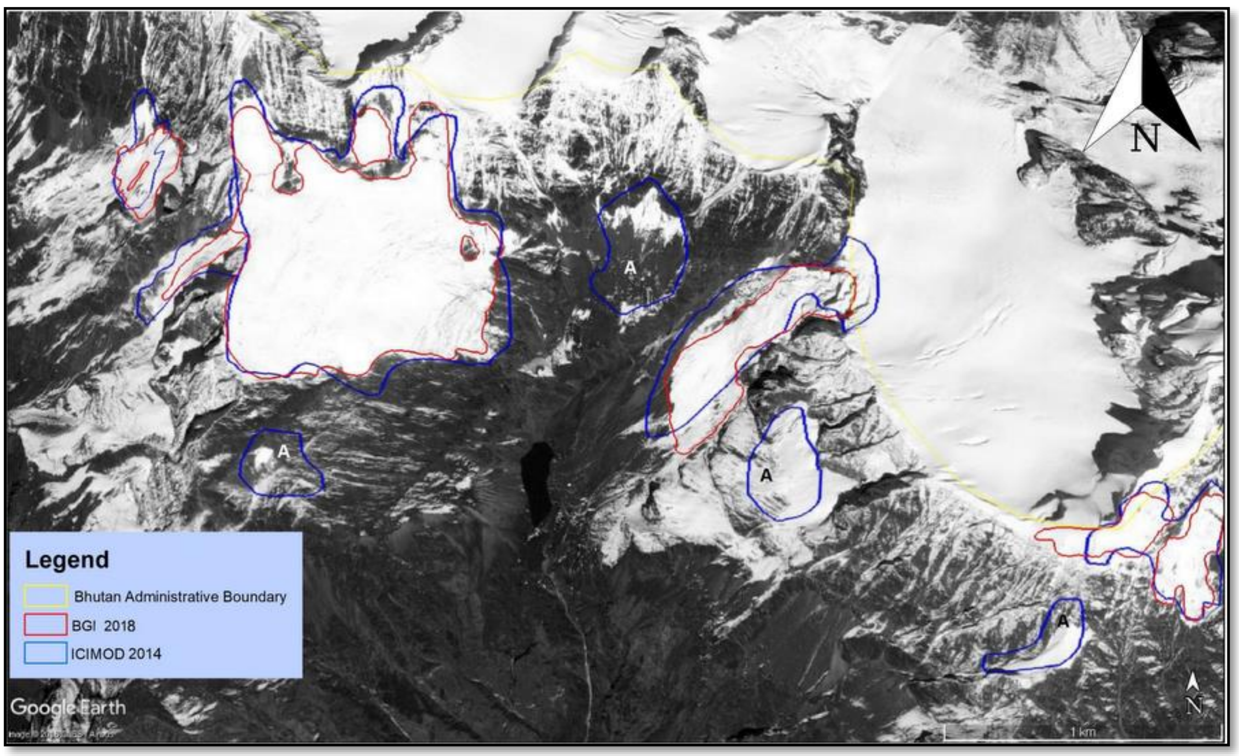

Figure 13: The difference in glacier numbers between 2014 and 2018 in Kuri Chhu Basin of Bhutan. The background image is Google Earth, extra glacier polygons drawn is the example of (A).Image acquisition date: 23rd November 2016.

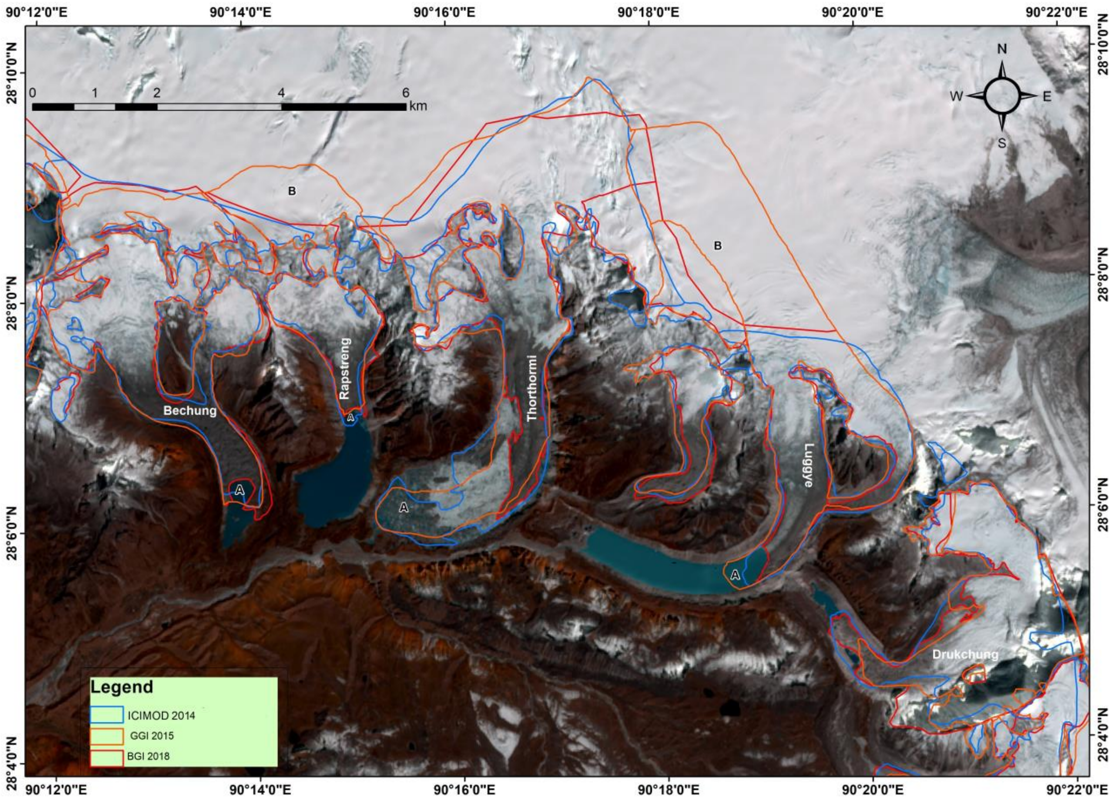

Figure 14: The difference in glacier area between 2014, 2015 and 2018 in Lunana area of Bhutan. The background image is Sentinel-2A after converting to L2A. There is vast difference between 2014 and 2018 area because 2015 has included a part of lake as glacier, example as shown by (A). Image acquisition date: 28th October 2016.

Table 3: Glacier number and area data from the BGI 2018, GGI 2015, ICIMOD 2001 (for comparison, glacier number and area of Northern basin has been excluded) and ICIMOD 2014 in Bhutan.

	BGI 2018	**GGI 2015**	**ICIMOD 2014**	**ICIMOD 2001**
Number	700	864	886	618
Area (Km^2)	629.55	714.86	642.07	928.97

6.2.2 Comparison with GAMDAM inventory (2015)

Though the two inventories use different types of satellite imageries, area threshold of (+=) 0.01 km^2 was considered uniformly. GGI was mapped covering almost all Himalayan region, while the present work have restricted the task to mapping glaciers within Bhutan boundary. For comparison, only glacier polygons within Bhutan's boundary had been considered. Total number of glaciers mapped by BGI was 700 which is 19% lower than that of GGI (Table 3) whereas areal extend shows a disparity of 12 %. GGI shows relatively higher glacier number and area as compared to BGI. This difference could likely be due to:

1) Splitting of glacier polygons along the ridgelines and terminals while mapping.
2) Mapping of ice bodies on the slopes as separate glacier
3) Inclusion of bare slopes along with ice patches as glaciers
4) Use of satellite imageries with improved spatial resolutions
5) Inclusion of seasonal snow cover/ lakes (Figure 15).

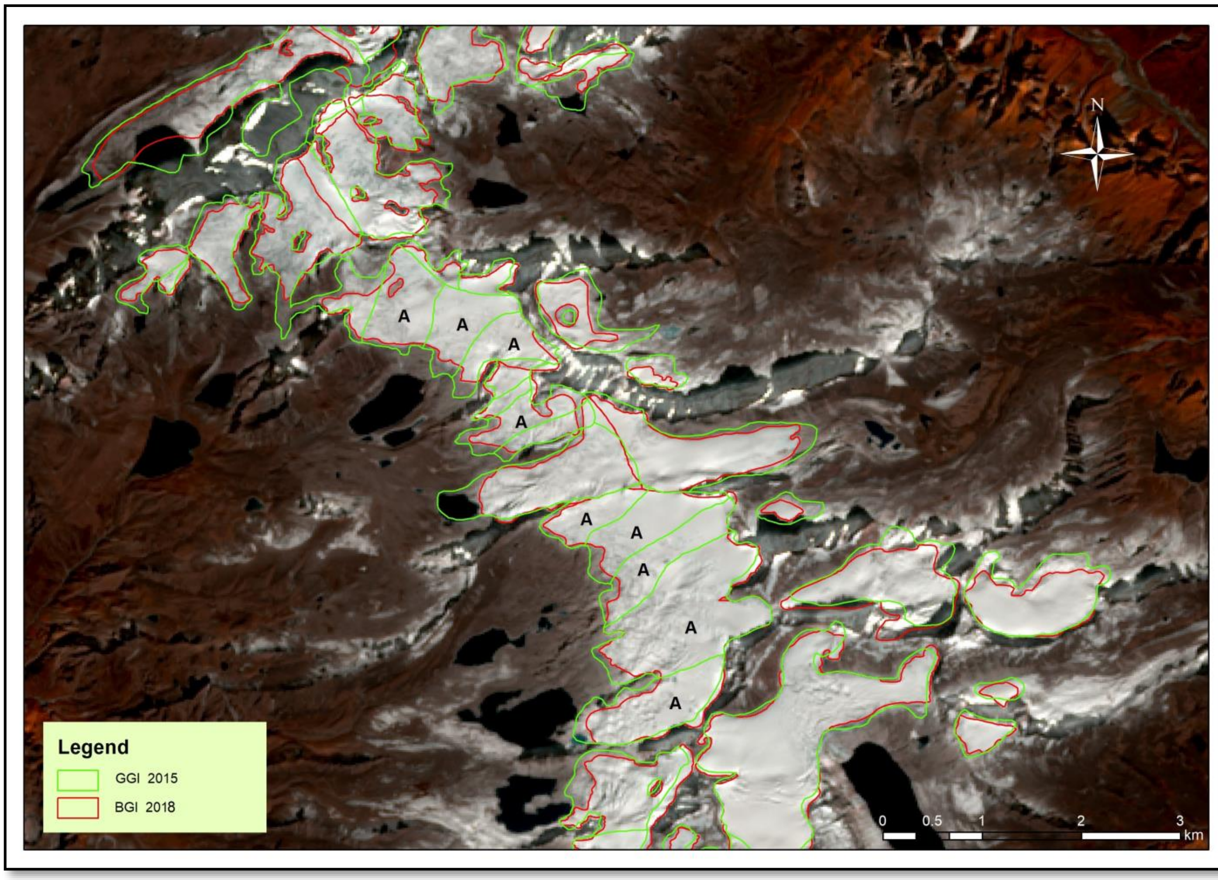

Figure 15:Example of discrepancy in glacier number due to glacier ridgeline that has been considered one for GGI while BGI has further subdivided (denoted A in fig) the overlaying contour and Google Earth to the image. Image acquisition date: 8th November 2016.

6.2.3 Comparison with ICIMOD inventory (2001)

Glacier shape files of ICIMOD Glacier inventory 2001 were not available and this comparison was done based on the total number of Glaciers and the area as reported (Mool et al. 2001). The 2001 ICIMOD Inventory mapped a total number of 618 glaciers, which is 11.7% lower than the current BGI (Table 3). The areal extent shows a difference of 32.2%.The huge disparity in area extent may be due to usage of very coarse resolution satellite imageries and topographic maps in the earlier inventory.

7. Conclusion

In the current work, glaciers of Bhutan were mapped using freely available Sentinel-2 imageries (10x10 m). Although ground work on glacier mapping for Bhutan was initiated by ICIMOD in the Hindu Kush Himalayan Region starting from early 1990's and supplemented later by GGI and ALOS derived inventory (Ukita et al. 2011),this updated BGI 2018 is focused entirely on the glaciers within Bhutan . While the area of interest remains the same for all available inventories, the data sources used were different (Landsat/ALOS/Sentinel-2) and the methodologies (Manual/Semi-automatic/Automatic) adopted were different. The new BGI 2018 consists of 700 glaciers with an area of 629.55 km2 showing an area disparity of 2% and 12% compared to earlier ICIMOD 2014 and GGI inventories respectively.

The updated Bhutan glacier inventory 2018 aims to provide more accurate information on glaciers for future water resource assessment and climate change impacts on glaciers.

8. Recommendation.

Considering the dynamic nature of glaciers in the phase of changing climate, the Cryosphere Services Division would like to recommend the following:

- Regular updating of glacier inventory (every 5 years) so that the time series glacier changes are monitored and recorded. Also with many high resolution satellite imageries which are being distributed free of cost, updating the glacier inventory at regular interval would prove to give precise and accurate information.
- Disseminate information on updated inventory to end-users for further researches pertaining to glacier changes, water resource studies and related studies.
- Distribute the final product to decision and policy makers for plans related to freshwater resources, hydropower, irrigation and disaster prevention for providing information for study of climatic processes and for monitoring climate change.
- Strengthen human resource capacity as well as institutional capacity to further enhancement of the existing capacity and explore other glacier inventories, such as glacier thickness, snow line and debris-covered glacier that are envisaged as essential parameters in understanding the overall behavior of ice through consolidated approach.
- Within the scope of dissemination, include other stakeholders and academia, such as Ugyen Wangchuck Institute for Conservation and Environment, Royal University of Bhutan (Sherubtse College, CNR, CST) and other researchers to avoid the duplication of work.

References:

Alifu, H., Tateishi, R. & Johnson, B., 2015. A new band ratio technique for mapping debris-covered glaciers using Landsat imagery and a digital elevation model. *International Journal of Remote Sensing*, 36(8), pp.2063–2075.

Bajracharya, S.R., Maharjan, S.B. & Shrestha, F., 2014. The status and decadal change of glaciers in Bhutan from the 1980s to 2010 based on satellite data. *Annals of Glaciology*, 55(66), pp.159–166.

Cogley, J.G., 2009. A more complete version of the World Glacier Inventory. *Annals of Glaciology*, 50(53), pp.32–38.

Nagai, H. et al., 2016. Comparison of multiple glacier inventories with a new inventory derived from high-resolution ALOS imagery in the Bhutan Himalaya. *Cryosphere*, 10(1), pp.65–85.

Nuimura, T. et al., 2015. *The GAMDAM Glacier Inventory: A quality controlled inventory of Asian glaciers*,

Pradeep K. Mool et al., 2001. Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods Monitoring and Early Warning Systems in the Hindu Kush-Himalayan Region Bhutan. *Icimod*.

Racoviteanu, A.E. et al., 2015. Spatial patterns in glacier characteristics and area changes from 1962 to 2006 in the Kanchenjunga-Sikkim area, eastern Himalaya. *Cryosphere*, 9(2), pp.505–523.

Ukita, J. et al., 2011. Glacial lake inventory of Bhutan using ALOS data□: Part I . Methods and preliminary results. , 52(58), pp.65–71.

Williams, M.W. et al., 2016. *Using geochemical and isotopic chemistry to evaluate glacier melt contributions to the Chamkar Chhu (river), Bhutan*, Available at: http://www.journals.cambridge.org/abstract_S0260305500000355.

Zemp, M., 2012. The monitoring of glaciers at local, mountain, and global scale. Habilitationsschrift zur Erlangung der Venia Legendi. , p.72.

Appendices

Sl.No.	GLIMS_ID	Glacier_ID	Longitude	Latitude	Area_sqKM	Elev_Max (m)	Elev_Min (m)	Elev_Mean (m)	Slope_Max (degree)	Slope_Mean (degree)	Slope_Min (degree)	Aspect (degree)	Basin
CHAMKHAR CHHU SUB BASIN													
1	G090594E27960N	MChgr16_532	90.594	27.960	0.154	5520	5336	5432	55	24	2	257	Chamkhar Chhu
2	G090606E27981N	MChgr16_533	90.606	27.981	0.136	5405	5205	5300	61	23	0	223	Chamkhar Chhu
3	G090609E27988N	MChgr16_541	90.609	27.988	0.675	5559	5237	5379	80	22	0	240	Chamkhar Chhu
4	G090615E27983N	MChgr16_534	90.615	27.983	0.474	5486	5206	5369	70	20	1	185	Chamkhar Chhu
5	G090621E27980N	MChgr16_535	90.621	27.980	0.543	5601	5222	5426	66	18	0	188	Chamkhar Chhu
6	G090739E27919N	MChgr16_582	90.739	27.919	0.222	5310	5160	5252	58	19	1	268	Chamkhar Chhu
7	G090743E27924N	MChgr16_581	90.743	27.924	0.219	5365	5201	5283	44	17	0	139	Chamkhar Chhu
8	G090753E27923N	MChgr16_580	90.753	27.923	0.070	5238	5114	5173	50	23	0	315	Chamkhar Chhu
9	G090769E27931N	MChgr16_579	90.769	27.931	0.359	5398	5159	5289	43	16	0	220	Chamkhar Chhu
10	G090527E27929N	MChgr16_508	90.527	27.929	0.478	5493	5132	5342	54	20	0	122	Chamkhar Chhu
11	G090505E28000N	MChgr16_514	90.505	28.000	0.764	5559	5230	5372	52	14	0	206	Chamkhar Chhu
12	G090521E27985N	MChgr16_509	90.521	27.985	0.048	5388	5299	5338	53	24	2	269	Chamkhar Chhu
13	G090518E27993N	MChgr16_512	90.518	27.993	0.092	5544	5346	5433	51	21	0	204	Chamkhar Chhu
14	G090521E27990N	MChgr16_510	90.521	27.990	0.093	5453	5326	5387	55	18	0	221	Chamkhar Chhu
15	G090524E27994N	MChgr16_511	90.524	27.994	0.100	5402	5194	5297	52	20	0	104	Chamkhar Chhu
16	G090515E27999N	MChgr16_513	90.515	27.999	0.337	5485	5240	5391	53	16	0	80	Chamkhar Chhu
17	G090502E28006N	MChgr16_515	90.502	28.006	0.082	5455	5294	5385	52	21	2	90	Chamkhar Chhu
18	G090497E28014N	MChgr16_517	90.497	28.014	0.262	5633	5358	5519	70	27	0	124	Chamkhar Chhu
19	G090535E28050N	MChgr16_520	90.535	28.050	0.410	5804	5142	5477	83	34	2	145	Chamkhar Chhu
20	G090547E28044N	MChgr16_521	90.547	28.044	0.876	5903	4994	5222	85	21	0	196	Chamkhar Chhu
21	G090560E28041N	MChgr16_522	90.560	28.041	1.240	5810	5159	5506	79	21	0	221	Chamkhar Chhu

22	G090569E28030N	MChgr16_524	90.569	28.030	0.562	5555	5231	5406	71	18	0	239	Chamkhar Chhu
23	G090578E28024N	MChgr16_525	90.578	28.024	0.519	5554	5209	5429	71	20	1	202	Chamkhar Chhu
24	G090589E28018N	MChgr16_544	90.589	28.018	0.178	5602	5424	5528	52	17	0	179	Chamkhar Chhu
25	G090582E28016N	MChgr16_526	90.582	28.016	0.831	5676	5257	5489	54	15	0	186	Chamkhar Chhu
26	G090593E28018N	MChgr16_545	90.593	28.018	0.218	5610	5309	5495	68	19	0	189	Chamkhar Chhu
27	G090584E28002N	MChgr16_527	90.584	28.002	0.099	5562	5423	5488	68	26	0	96	Chamkhar Chhu
28	G090573E27991N	MChgr16_529	90.573	27.991	0.106	5455	5276	5356	58	21	2	282	Chamkhar Chhu
29	G090572E27986N	MChgr16_531	90.572	27.986	0.082	5494	5269	5354	58	28	3	279	Chamkhar Chhu
30	G090610E27994N	MChgr16_542	90.610	27.994	0.222	5512	5256	5369	67	21	0	260	Chamkhar Chhu
31	G090636E27983N	MChgr16_538	90.636	27.983	0.044	5275	5157	5220	51	25	1	182	Chamkhar Chhu
32	G090629E27984N	MChgr16_536	90.629	27.984	0.237	5406	5035	5217	70	28	1	117	Chamkhar Chhu
33	G090620E27989N	MChgr16_540	90.620	27.989	0.347	5469	5088	5338	84	23	0	121	Chamkhar Chhu
34	G090607E28021N	MChgr16_546	90.607	28.021	3.849	5738	5293	5476	57	10	0	138	Chamkhar Chhu
35	G090638E28017N	MChgr16_550	90.638	28.017	0.178	5425	5270	5323	60	16	0	142	Chamkhar Chhu
36	G090629E28019N	MChgr16_549	90.629	28.019	0.073	5390	5298	5337	42	14	0	113	Chamkhar Chhu
37	G090612E28031N	MChgr16_548	90.612	28.031	0.136	5487	5405	5443	27	11	0	105	Chamkhar Chhu
38	G090625E28044N	MChgr16_551	90.625	28.044	0.097	5511	5305	5400	62	28	0	263	Chamkhar Chhu
39	G090667E28056N	MChgr16_555	90.667	28.056	0.079	5479	5313	5409	55	23	0	202	Chamkhar Chhu
40	G090671E28056N	MChgr16_556	90.671	28.056	0.063	5450	5347	5397	47	22	0	182	Chamkhar Chhu
41	G090691E28062N	MChgr16_557	90.691	28.062	7.409	6100	4879	5472	84	17	0	172	Chamkhar Chhu
42	G090704E28042N	MChgr16_558	90.704	28.042	0.114	5401	5237	5323	58	19	1	90	Chamkhar Chhu
43	G090719E28055N	MChgr16_559	90.719	28.055	4.427	5924	4973	5336	74	20	0	200	Chamkhar Chhu
44	G090733E28039N	MChgr16_560	90.733	28.039	0.375	5701	5269	5519	62	24	1	204	Chamkhar Chhu
45	G090736E28035N	MChgr16_561	90.736	28.035	0.097	5649	5247	5492	58	32	3	233	Chamkhar Chhu

46	G090748E28015N	MChgr16_564	90.748	28.015	0.070	5279	5158	5227	51	20	0	261	Chamkhar Chhu
47	G090732E28007N	MChgr16_563	90.732	28.007	0.382	5417	5182	5290	61	24	1	277	Chamkhar Chhu
48	G090756E28022N	MChgr16_566	90.756	28.022	0.258	5524	5239	5382	64	20	0	147	Chamkhar Chhu
49	G090752E28036N	MChgr16_562	90.752	28.036	8.782	6301	4912	5546	74	16	0	202	Chamkhar Chhu
50	G090769E28024N	MChgr16_567	90.769	28.024	0.115	5543	5370	5446	55	30	11	117	Chamkhar Chhu
51	G090773E28031N	MChgr16_568	90.773	28.031	0.397	5802	5270	5476	66	29	2	151	Chamkhar Chhu
52	G090788E28028N	MChgr16_569	90.788	28.028	5.956	6203	4855	5330	71	18	0	195	Chamkhar Chhu
53	G090796E27989N	MChgr16_573	90.796	27.989	0.036	5327	5203	5256	47	26	1	195	Chamkhar Chhu
54	G090779E27967N	MChgr16_575	90.779	27.967	0.120	5378	5212	5312	45	24	0	195	Chamkhar Chhu
55	G090766E27964N	MChgr16_576	90.766	27.964	0.070	5403	5267	5333	51	21	1	250	Chamkhar Chhu
56	G090781E27955N	MChgr16_577	90.781	27.955	0.053	5359	5278	5324	52	22	3	289	Chamkhar Chhu
57	G090767E27940N	MChgr16_578	90.767	27.940	1.497	5505	5127	5299	62	13	0	258	Chamkhar Chhu
58	G090805E28003N	MChgr16_571	90.805	28.003	0.123	5323	5190	5266	48	22	1	275	Chamkhar Chhu
59	G090806E28011N	MChgr16_570	90.806	28.011	0.182	5419	5222	5304	44	21	1	240	Chamkhar Chhu
60	G090502E28016N	MChgr16_518	90.502	28.016	0.139	5410	5181	5248	67	27	0	126	Chamkhar Chhu
61	G090567E28036N	MChgr16_523	90.567	28.036	0.382	5615	5327	5487	66	18	1	216	Chamkhar Chhu
62	G090645E28047N	MChgr16_552	90.645	28.047	0.051	5343	5244	5296	49	18	1	117	Chamkhar Chhu
63	G090649E28044N	MChgr16_553	90.649	28.044	0.032	5313	5242	5290	44	18	3	150	Chamkhar Chhu
64	G090511E28038N	MChgr16_519	90.511	28.038	15.433	6388	4689	5261	86	24	0	142	Chamkhar Chhu
65	G090741E27915N	MChgr16_583	90.741	27.915	0.039	5304	5227	5266	31	16	1	202	Chamkhar Chhu
66	G090610E28036N	MChgr16_547	90.610	28.036	0.319	5638	5320	5499	79	20	1	104	Chamkhar Chhu
67	G090751E28019N	MChgr16_565	90.751	28.019	0.053	5476	5325	5419	64	30	4	209	Chamkhar Chhu
68	G090784E27970N	MChgr16_574	90.784	27.970	0.117	5297	5168	5226	54	22	1	271	Chamkhar Chhu
69	G090568E27902N	MChgr16_504	90.568	27.902	0.153	5283	5116	5207	60	20	2	72	Chamkhar Chhu

70	G090559E27909N	MChgr16_506	90.559	27.909	0.319	5425	5029	5219	66	27	1	167	Chamkhar Chhu
71	G090550E27907N	MChgr16_507	90.550	27.907	0.207	5447	5105	5271	62	29	1	181	Chamkhar Chhu
72	G090578E27830N	MChgr16_500	90.578	27.830	0.085	5366	5212	5297	46	21	2	90	Chamkhar Chhu
73	G090580E27836N	MChgr16_501	90.580	27.836	0.131	5311	5158	5224	54	19	1	104	Chamkhar Chhu
74	G090574E27838N	MChgr16_502	90.574	27.838	0.295	5261	5092	5175	51	17	0	201	Chamkhar Chhu
75	G090587E27843N	MChgr16_503	90.587	27.843	0.288	5266	5134	5195	40	15	0	201	Chamkhar Chhu
76	G090799E27893N	MChgr16_589	90.799	27.893	0.291	5282	5030	5168	51	18	1	91	Chamkhar Chhu
77	G090792E27909N	MChgr16_588	90.792	27.909	2.759	5441	4973	5257	70	13	0	119	Chamkhar Chhu
78	G090782E27899N	MChgr16_587	90.782	27.899	0.099	5435	5178	5312	66	34	2	180	Chamkhar Chhu
79	G090777E27904N	MChgr16_586	90.777	27.904	0.429	5472	4964	5204	66	23	1	275	Chamkhar Chhu
80	G090782E27915N	MChgr16_584	90.782	27.915	0.051	5325	5175	5255	53	26	3	278	Chamkhar Chhu
81	G090565E27904N	MChgr16_505	90.565	27.904	0.033	5428	5297	5364	48	28	5	143	Chamkhar Chhu
82	G090780E27912N	MChgr16_585	90.780	27.912	0.091	5369	5099	5190	55	25	3	292	Chamkhar Chhu
83	G090652E28043N	MChgr16_554	90.652	28.043	0.048	5316	5132	5224	57	35	4	223	Chamkhar Chhu
84	G090500E28009N	MChgr16_516	90.500	28.009	0.063	5457	5292	5379	61	30	3	88	Chamkhar Chhu
85	G090615E27996N	MChgr16_543	90.615	27.996	0.107	5410	5324	5362	58	16	0	181	Chamkhar Chhu
86	G090626E27987N	MChgr16_539	90.626	27.987	0.057	5362	5142	5235	72	41	8	162	Chamkhar Chhu
87	G090634E27982N	MChgr16_537	90.634	27.982	0.034	5446	5308	5377	70	36	1	124	Chamkhar Chhu
88	G090576E27989N	MChgr16_530	90.576	27.989	0.011	5509	5460	5490	50	26	5	202	Chamkhar Chhu
89	G090800E27993N	MChgr16_572	90.800	27.993	0.035	5400	5228	5304	58	35	16	295	Chamkhar Chhu
90	G090578E27992N	MChgr16_528	90.578	27.992	0.110	5508	5365	5431	52	21	2	93	Chamkhar Chhu
DANGME CHHU SUB BASIN													
91	G091605E27897N	MDagr16_696	91.605	27.897	0.143	5309	5047	5153	65	26	3	279	Dangme Chhu
92	G091594E27860N	MDagr16_699	91.594	27.860	0.448	5235	4902	5057	66	25	1	234	Dangme Chhu

93	G091485E27938N	MDagr16_691	91.485	27.938	0.558	5562	4996	5187	68	28	0	177	Dangme Chhu
94	G091496E27933N	MDagr16_694	91.496	27.933	0.023	5180	5011	5101	52	35	16	209	Dangme Chhu
95	G091475E27933N	MDagr16_690	91.475	27.933	0.365	5290	4936	5140	66	21	1	122	Dangme Chhu
96	G091469E27932N	MDagr16_689	91.469	27.932	0.042	5186	5040	5112	56	26	1	208	Dangme Chhu
97	G091430E27948N	MDagr16_687	91.430	27.948	0.247	5121	4827	4934	56	19	0	220	Dangme Chhu
98	G091445E27945N	MDagr16_688	91.445	27.945	0.055	5147	4965	5045	47	22	4	98	Dangme Chhu
99	G091423E27951N	MDagr16_685	91.423	27.951	0.045	5134	5024	5085	51	22	1	173	Dangme Chhu
100	G091493E27934N	MDagr16_693	91.493	27.934	0.037	5174	5052	5104	54	29	9	206	Dangme Chhu
101	G091428E27953N	MDagr16_686	91.428	27.953	0.069	5163	4991	5081	58	22	2	176	Dangme Chhu
102	G091368E27851N	MDagr16_680	91.368	27.851	0.160	5267	4962	5101	78	29	0	108	Dangme Chhu
103	G091370E27860N	MDagr16_681	91.370	27.860	0.408	5149	4770	4930	75	27	0	96	Dangme Chhu
104	G091378E27906N	MDagr16_682	91.378	27.906	0.083	5156	4947	5053	63	26	1	106	Dangme Chhu
105	G091378E27914N	MDagr16_683	91.378	27.914	0.040	5069	4915	4981	63	25	0	130	Dangme Chhu
106	G091501E27935N	MDagr16_695	91.501	27.935	0.341	5485	4870	5245	66	29	1	129	Dangme Chhu
107	G091419E27949N	MDagr16_684	91.419	27.949	0.043	5023	4930	4973	54	21	1	204	Dangme Chhu
108	G091612E27863N	MDagr16_698	91.612	27.863	0.037	4892	4819	4857	43	23	2	299	Dangme Chhu
109	G091488E27939N	MDagr16_692	91.488	27.939	0.016	5295	5215	5253	61	37	5	190	Dangme Chhu
110	G091570E27850N	MDagr16_700	91.570	27.850	0.042	5101	4970	5021	71	23	2	218	Dangme Chhu
111	G091610E27896N	MDagr16_697	91.610	27.896	0.070	5347	5161	5264	60	26	1	84	Dangme Chhu
HAA CHHU SUB BASIN													
112	G089111E27542N	WHagr16_1	89.111	27.542	0.090	5348	5070	5248	66	36	2	278	Haa Chhu
113	G089116E27549N	WHagr16_2	89.116	27.549	0.080	5579	5317	5460	63	34	4	203	Haa Chhu
114	G089161E27574N	WHagr16_3	89.161	27.574	0.103	5624	5377	5524	67	40	3	283	Haa Chhu
KURI CHHU SUB BASIN													

115	G090773E27933N	MKugr16_593	90.773	27.933	0.117	5468	5181	5318	47	22	2	128	Kuri Chhu
116	G090777E27943N	MKugr16_594	90.777	27.943	0.811	5499	5259	5363	64	16	0	123	Kuri Chhu
117	G090811E28006N	MKugr16_598	90.811	28.006	0.347	5307	5124	5219	50	13	0	145	Kuri Chhu
118	G090806E28017N	MKugr16_599	90.806	28.017	0.315	5424	5162	5268	64	15	0	192	Kuri Chhu
119	G090821E28025N	MKugr16_600	90.821	28.025	8.462	6110	4564	5230	71	15	0	149	Kuri Chhu
120	G090840E28037N	MKugr16_601	90.840	28.037	3.102	5860	4960	5303	76	21	0	172	Kuri Chhu
121	G090853E28027N	MKugr16_602	90.853	28.027	0.102	5283	5086	5187	46	22	0	223	Kuri Chhu
122	G090913E28027N	MKugr16_604	90.913	28.027	0.071	5317	5226	5267	56	25	2	237	Kuri Chhu
123	G090925E28042N	MKugr16_606	90.925	28.042	0.196	5320	5154	5225	55	17	0	206	Kuri Chhu
124	G090863E28040N	MKugr16_603	90.863	28.040	5.195	5867	4665	5294	75	22	0	157	Kuri Chhu
125	G090924E28038N	MKugr16_605	90.924	28.038	0.030	5053	4937	4971	63	23	1	76	Kuri Chhu
126	G090785E27920N	MKugr16_592	90.785	27.920	0.350	5388	5077	5289	56	17	2	87	Kuri Chhu
127	G090791E27972N	MKugr16_595	90.791	27.972	0.162	5331	5111	5175	60	22	0	182	Kuri Chhu
128	G091265E27880N	MKugr16_611	91.265	27.880	0.075	4904	4755	4819	64	21	1	95	Kuri Chhu
129	G091439E27951N	MKugr16_671	91.439	27.951	0.238	5109	4867	5012	55	21	0	120	Kuri Chhu
130	G091423E27955N	MKugr16_673	91.423	27.955	0.413	5236	4887	5075	62	19	0	134	Kuri Chhu
131	G091411E28013N	MKugr16_653	91.411	28.013	0.777	5558	5024	5274	77	25	0	136	Kuri Chhu
132	G091427E28011N	MKugr16_655	91.427	28.011	0.205	5293	4838	5004	58	25	1	240	Kuri Chhu
133	G091466E27942N	MKugr16_669	91.466	27.942	0.265	4866	4693	4776	58	15	0	165	Kuri Chhu
134	G091470E27959N	MKugr16_663	91.470	27.959	0.576	4820	4559	4699	59	17	0	221	Kuri Chhu
135	G091476E27973N	MKugr16_662	91.476	27.973	1.758	5831	4950	5412	80	27	0	184	Kuri Chhu
136	G091465E27992N	MKugr16_660	91.465	27.992	1.064	6124	5098	5625	82	34	0	167	Kuri Chhu
137	G091447E28004N	MKugr16_658	91.447	28.004	0.105	5366	5225	5280	57	22	1	194	Kuri Chhu
138	G091442E28002N	MKugr16_657	91.442	28.002	0.073	5485	5258	5391	59	34	9	131	Kuri Chhu

139	G091279E27916N	MKugr16_613	91.279	27.916	0.128	5329	5037	5160	64	28	2	58	Kuri Chhu
140	G091275E27919N	MKugr16_614	91.275	27.919	0.229	5226	5065	5124	46	13	0	214	Kuri Chhu
141	G091251E27933N	MKugr16_620	91.251	27.933	0.218	5463	5191	5308	75	29	1	152	Kuri Chhu
142	G091251E27936N	MKugr16_621	91.251	27.936	0.093	5322	5119	5216	63	34	5	67	Kuri Chhu
143	G091250E27944N	MKugr16_623	91.250	27.944	0.477	5251	4984	5078	62	12	0	193	Kuri Chhu
144	G091246E27940N	MKugr16_622	91.246	27.940	0.276	5396	5017	5171	62	22	0	237	Kuri Chhu
145	G091265E27951N	MKugr16_624	91.265	27.951	0.061	5302	5097	5208	64	31	3	178	Kuri Chhu
146	G091259E27959N	MKugr16_626	91.259	27.959	1.434	5730	4507	4957	77	29	0	119	Kuri Chhu
147	G091262E27980N	MKugr16_628	91.262	27.980	0.164	5337	4997	5218	62	31	2	91	Kuri Chhu
148	G091253E27978N	MKugr16_627	91.253	27.978	0.665	5247	4827	5020	67	13	0	156	Kuri Chhu
149	G091272E28011N	MKugr16_629	91.272	28.011	0.084	5262	5094	5165	61	26	0	260	Kuri Chhu
150	G091294E28027N	MKugr16_636	91.294	28.027	0.179	5508	5096	5291	72	27	2	165	Kuri Chhu
151	G091302E28026N	MKugr16_637	91.302	28.026	0.209	5587	5188	5429	60	27	0	138	Kuri Chhu
152	G091309E28027N	MKugr16_638	91.309	28.027	0.653	5500	4929	5301	74	19	0	120	Kuri Chhu
153	G091369E28034N	MKugr16_641	91.369	28.034	1.775	5456	4709	5162	82	18	0	46	Kuri Chhu
154	G091368E28019N	MKugr16_642	91.368	28.019	1.629	5594	4757	5171	80	18	0	33	Kuri Chhu
155	G091370E28007N	MKugr16_644	91.370	28.007	0.156	5246	4974	5119	78	23	0	51	Kuri Chhu
156	G091332E28044N	MKugr16_640	91.332	28.044	12.181	5599	4619	5193	78	16	0	171	Kuri Chhu
157	G091317E28028N	MKugr16_639	91.317	28.028	0.541	5312	4858	5107	60	20	0	100	Kuri Chhu
158	G091350E28028N	MKugr16_650	91.350	28.028	0.168	5412	5012	5237	60	31	2	264	Kuri Chhu
159	G091352E28019N	MKugr16_648	91.352	28.019	0.284	5372	5000	5173	69	29	1	252	Kuri Chhu
160	G091360E28015N	MKugr16_646	91.360	28.015	0.064	5236	5019	5156	74	18	0	68	Kuri Chhu
161	G091355E28016N	MKugr16_647	91.355	28.016	0.087	5299	5001	5159	72	35	0	201	Kuri Chhu
162	G091326E27995N	MKugr16_632	91.326	27.995	0.253	5161	4845	4953	61	21	1	249	Kuri Chhu

163	G091331E27994N	MKugr16_633	91.331	27.994	0.066	5030	4904	4979	57	22	1	124	Kuri Chhu
164	G091314E28009N	MKugr16_634	91.314	28.009	0.420	5267	4928	5049	67	19	1	242	Kuri Chhu
165	G091312E28017N	MKugr16_635	91.312	28.017	0.126	5160	5025	5101	52	17	1	228	Kuri Chhu
166	G091277E28011N	MKugr16_630	91.277	28.011	0.042	5234	5093	5175	50	26	1	155	Kuri Chhu
167	G091372E28011N	MKugr16_643	91.372	28.011	0.024	5217	5080	5148	74	21	0	45	Kuri Chhu
168	G091401E28018N	MKugr16_651	91.401	28.018	0.126	5189	4889	5033	79	21	0	79	Kuri Chhu
169	G091405E28013N	MKugr16_652	91.405	28.013	0.036	5364	4995	5226	80	27	0	88	Kuri Chhu
170	G091458E28000N	MKugr16_659	91.458	28.000	0.670	6426	4932	5559	83	36	0	212	Kuri Chhu
171	G091466E27978N	MKugr16_661	91.466	27.978	0.820	5597	4961	5183	70	27	0	282	Kuri Chhu
172	G091483E27961N	MKugr16_664	91.483	27.961	1.664	5805	4930	5331	79	31	0	265	Kuri Chhu
173	G091478E27950N	MKugr16_665	91.478	27.950	0.855	5648	5022	5243	73	29	1	264	Kuri Chhu
174	G091257E27876N	MKugr16_608	91.257	27.876	0.136	5328	5041	5187	66	31	4	198	Kuri Chhu
175	G091363E27858N	MKugr16_679	91.363	27.858	0.188	5366	4940	5152	68	37	5	262	Kuri Chhu
176	G091367E27867N	MKugr16_678	91.367	27.867	0.121	5325	4934	5125	57	32	1	258	Kuri Chhu
177	G091370E27873N	MKugr16_677	91.370	27.873	0.077	5163	4987	5097	56	29	1	270	Kuri Chhu
178	G091376E27908N	MKugr16_675	91.376	27.908	0.076	5063	4923	5007	55	25	1	267	Kuri Chhu
179	G091377E27929N	MKugr16_674	91.377	27.929	0.069	5138	4981	5057	74	23	0	83	Kuri Chhu
180	G091325E27990N	MKugr16_631	91.325	27.990	0.251	5219	4879	5030	60	24	2	269	Kuri Chhu
181	G091429E27956N	MKugr16_672	91.429	27.956	0.030	5238	5090	5161	54	29	8	72	Kuri Chhu
182	G091257E27927N	MKugr16_618	91.257	27.927	0.053	5216	5030	5138	70	30	4	160	Kuri Chhu
183	G091439E28003N	MKugr16_656	91.439	28.003	0.046	5624	5489	5562	64	39	1	166	Kuri Chhu
184	G091351E28025N	MKugr16_649	91.351	28.025	0.084	5407	5072	5278	65	32	2	258	Kuri Chhu
185	G091411E28017N	MKugr16_654	91.411	28.017	0.022	5470	5341	5411	71	34	2	174	Kuri Chhu
186	G091471E27937N	MKugr16_667	91.471	27.937	0.208	5280	4917	5091	60	28	0	224	Kuri Chhu

187	G091472E27943N	MKugr16_670	91.472	27.943	0.113	5059	4913	4977	63	25	1	243	Kuri Chhu
188	G091375E27905N	MKugr16_676	91.375	27.905	0.088	5216	4875	5074	67	33	3	226	Kuri Chhu
189	G091270E27921N	MKugr16_615	91.270	27.921	0.091	5177	5024	5096	53	22	1	167	Kuri Chhu
190	G091467E27936N	MKugr16_668	91.467	27.936	0.129	5254	4877	5056	62	33	0	275	Kuri Chhu
191	G091363E28012N	MKugr16_645	91.363	28.012	0.051	5165	4850	5017	83	27	0	94	Kuri Chhu
192	G091256E27924N	MKugr16_617	91.256	27.924	0.023	5122	5002	5053	49	29	6	244	Kuri Chhu
193	G091282E27885N	MKugr16_612	91.282	27.885	0.266	5035	4728	4810	54	18	0	145	Kuri Chhu
194	G091255E27879N	MKugr16_609	91.255	27.879	0.057	5325	5103	5235	73	43	1	169	Kuri Chhu
195	G091251E27878N	MKugr16_607	91.251	27.878	0.114	5266	4990	5094	62	33	7	282	Kuri Chhu
196	G091258E27882N	MKugr16_610	91.258	27.882	0.233	5172	4822	4966	67	31	1	247	Kuri Chhu
197	G091477E27942N	MKugr16_666	91.477	27.942	0.638	5642	5009	5185	72	30	0	257	Kuri Chhu
198	G090843E27878N	MKugr16_591	90.843	27.878	0.039	5486	5264	5389	67	36	0	157	Kuri Chhu
199	G090836E27874N	MKugr16_590	90.836	27.874	0.036	5325	5079	5184	68	43	3	81	Kuri Chhu
200	G090797E27971N	MKugr16_597	90.797	27.971	0.015	5344	5304	5323	47	20	2	139	Kuri Chhu
201	G090793E27969N	MKugr16_596	90.793	27.969	0.014	5394	5345	5370	45	22	7	113	Kuri Chhu
202	G091242E27932N	MKugr16_619	91.242	27.932	0.139	5121	4887	4968	71	29	1	260	Kuri Chhu
203	G091261E27923N	MKugr16_616	91.261	27.923	0.079	5158	4980	5044	69	27	1	130	Kuri Chhu
204	G091268E27954N	MKugr16_625	91.268	27.954	0.146	5092	4742	4899	75	38	1	126	Kuri Chhu
MANGDE CHHU SUB BASIN													
205	G090280E27916N	MMagr16_411	90.280	27.916	0.172	5462	5261	5387	67	14	0	248	Mangde Chhu
206	G090299E27904N	MMagr16_407	90.299	27.904	3.853	5694	5137	5421	71	14	0	216	Mangde Chhu
207	G090285E27913N	MMagr16_410	90.285	27.913	0.747	5525	5158	5399	64	14	0	223	Mangde Chhu
208	G090315E27900N	MMagr16_406	90.315	27.900	1.020	5661	5269	5434	58	18	0	145	Mangde Chhu
209	G090307E27915N	MMagr16_412	90.307	27.915	2.372	5689	5159	5376	68	17	0	131	Mangde Chhu

210	G090292E27925N	MMagr16_413	90.292	27.925	0.669	5692	5231	5421	64	20	1	135	Mangde Chhu
211	G090281E27936N	MMagr16_414	90.281	27.936	0.187	5684	5385	5511	62	22	0	136	Mangde Chhu
212	G090275E27946N	MMagr16_415	90.275	27.946	0.052	5607	5425	5502	68	34	4	60	Mangde Chhu
213	G090272E27949N	MMagr16_416	90.272	27.949	0.140	5640	5391	5531	59	26	1	111	Mangde Chhu
214	G090293E27967N	MMagr16_418	90.293	27.967	2.559	5791	5300	5575	78	15	0	195	Mangde Chhu
215	G090280E27965N	MMagr16_417	90.280	27.965	1.531	5785	5308	5517	66	16	0	161	Mangde Chhu
216	G090304E27948N	MMagr16_420	90.304	27.948	0.367	5656	5370	5534	52	19	1	239	Mangde Chhu
217	G090324E27955N	MMagr16_422	90.324	27.955	0.106	5605	5389	5503	58	26	2	222	Mangde Chhu
218	G090328E27955N	MMagr16_424	90.328	27.955	0.049	5522	5311	5428	59	29	10	63	Mangde Chhu
219	G090327E27953N	MMagr16_423	90.327	27.953	0.023	5580	5479	5531	64	30	1	178	Mangde Chhu
220	G090310E27959N	MMagr16_421	90.310	27.959	2.095	5700	5326	5519	58	12	0	146	Mangde Chhu
221	G090300E27952N	MMagr16_419	90.300	27.952	0.641	5670	5336	5526	57	14	0	212	Mangde Chhu
222	G090318E27966N	MMagr16_425	90.318	27.966	1.345	5795	5335	5496	71	14	0	73	Mangde Chhu
223	G090309E27979N	MMagr16_426	90.309	27.979	2.583	5842	5280	5559	74	15	0	170	Mangde Chhu
224	G090316E27996N	MMagr16_427	90.316	27.996	0.437	5661	5408	5505	51	16	0	80	Mangde Chhu
225	G090332E28018N	MMagr16_429	90.332	28.018	0.982	5834	5433	5606	66	15	0	219	Mangde Chhu
226	G090338E28017N	MMagr16_430	90.338	28.017	0.217	5803	5520	5660	66	26	1	166	Mangde Chhu
227	G090336E28009N	MMagr16_428	90.336	28.009	0.038	5702	5499	5574	67	36	5	250	Mangde Chhu
228	G090343E28021N	MMagr16_431	90.343	28.021	0.175	5564	5427	5509	61	14	0	132	Mangde Chhu
229	G090345E28029N	MMagr16_432	90.345	28.029	1.632	5829	5390	5615	62	15	0	95	Mangde Chhu
230	G090343E28041N	MMagr16_433	90.343	28.041	2.334	5843	5312	5581	81	14	0	99	Mangde Chhu
231	G090347E28049N	MMagr16_434	90.347	28.049	0.048	5562	5410	5489	41	25	3	54	Mangde Chhu
232	G090390E28047N	MMagr16_438	90.390	28.047	2.756	6045	5343	5615	72	14	0	174	Mangde Chhu
233	G090382E28041N	MMagr16_437	90.382	28.041	0.680	5859	5409	5603	69	19	0	169	Mangde Chhu

234	G090377E28033N	MMagr16_436	90.377	28.033	0.216	5857	5472	5645	61	26	1	147	Mangde Chhu
235	G090388E28017N	MMagr16_440	90.388	28.017	2.733	5742	5270	5464	70	19	0	277	Mangde Chhu
236	G090373E27998N	MMagr16_445	90.373	27.998	0.267	5858	5279	5563	61	27	1	228	Mangde Chhu
237	G090387E27997N	MMagr16_444	90.387	27.997	1.117	5651	5320	5493	64	18	0	222	Mangde Chhu
238	G090392E27981N	MMagr16_448	90.392	27.981	1.033	5668	5288	5462	65	16	0	263	Mangde Chhu
239	G090383E27972N	MMagr16_450	90.383	27.972	0.045	5493	5367	5432	56	28	2	198	Mangde Chhu
240	G090377E27962N	MMagr16_452	90.377	27.962	0.271	5677	5319	5482	62	24	1	277	Mangde Chhu
241	G090375E27959N	MMagr16_456	90.375	27.959	0.032	5506	5379	5427	64	27	3	284	Mangde Chhu
242	G090381E27954N	MMagr16_459	90.381	27.954	0.234	5882	5378	5634	62	30	0	204	Mangde Chhu
243	G090372E27956N	MMagr16_457	90.372	27.956	0.038	5481	5349	5393	71	31	3	198	Mangde Chhu
244	G090384E27956N	MMagr16_460	90.384	27.956	0.108	5883	5670	5780	65	23	0	212	Mangde Chhu
245	G090385E27948N	MMagr16_461	90.385	27.948	0.332	5721	5312	5461	69	28	0	251	Mangde Chhu
246	G090382E27939N	MMagr16_468	90.382	27.939	0.242	5595	5232	5396	73	31	1	245	Mangde Chhu
247	G090383E27934N	MMagr16_470	90.383	27.934	0.162	5557	5289	5389	65	24	1	182	Mangde Chhu
248	G090389E27931N	MMagr16_471	90.389	27.931	0.029	5475	5383	5428	61	31	5	264	Mangde Chhu
249	G090402E27906N	MMagr16_476	90.402	27.906	0.034	5333	5201	5265	55	30	7	278	Mangde Chhu
250	G090390E27918N	MMagr16_475	90.390	27.918	0.084	5394	5216	5317	54	20	1	256	Mangde Chhu
251	G090393E27924N	MMagr16_473	90.393	27.924	0.105	5656	5454	5554	70	30	3	172	Mangde Chhu
252	G090399E27922N	MMagr16_474	90.399	27.922	0.817	5492	5155	5299	75	21	0	165	Mangde Chhu
253	G090395E27931N	MMagr16_472	90.395	27.931	0.579	5529	5162	5375	69	24	0	141	Mangde Chhu
254	G090390E27937N	MMagr16_469	90.390	27.937	0.333	5525	5274	5418	65	22	1	111	Mangde Chhu
255	G090394E27950N	MMagr16_462	90.394	27.950	0.907	5650	5269	5429	67	19	0	167	Mangde Chhu
256	G090403E27953N	MMagr16_463	90.403	27.953	0.389	5623	5313	5432	67	21	0	164	Mangde Chhu
257	G090377E27955N	MMagr16_458	90.377	27.955	0.253	5802	5310	5508	68	28	1	218	Mangde Chhu

258	G090413E27955N	MMagr16_465	90.413	27.955	0.025	5528	5391	5461	65	38	8	98	Mangde Chhu
259	G090414E27948N	MMagr16_467	90.414	27.948	0.206	5506	5307	5398	67	19	0	175	Mangde Chhu
260	G090397E27962N	MMagr16_453	90.397	27.962	3.449	5745	5233	5439	68	14	0	130	Mangde Chhu
261	G090418E27953N	MMagr16_466	90.418	27.953	0.553	5532	5235	5350	82	19	0	116	Mangde Chhu
262	G090428E27967N	MMagr16_455	90.428	27.967	0.200	5380	5231	5297	60	17	0	170	Mangde Chhu
263	G090403E27981N	MMagr16_449	90.403	27.981	0.469	5553	5301	5406	62	15	0	133	Mangde Chhu
264	G090397E27990N	MMagr16_447	90.397	27.990	0.552	5604	5265	5398	61	14	1	94	Mangde Chhu
265	G090396E28004N	MMagr16_443	90.396	28.004	1.598	5751	5323	5476	66	14	0	167	Mangde Chhu
266	G090407E28004N	MMagr16_442	90.407	28.004	0.051	5555	5349	5434	63	28	3	73	Mangde Chhu
267	G090400E28011N	MMagr16_441	90.400	28.011	0.379	5714	5331	5512	58	23	0	89	Mangde Chhu
268	G090439E28028N	MMagr16_483	90.439	28.028	0.167	5771	5490	5605	68	23	1	209	Mangde Chhu
269	G090491E28015N	MMagr16_487	90.491	28.015	0.323	5685	5255	5438	67	28	1	199	Mangde Chhu
270	G090517E27932N	MMagr16_488	90.517	27.932	0.661	5525	5091	5312	60	21	1	282	Mangde Chhu
271	G090502E27912N	MMagr16_489	90.502	27.912	0.094	5303	5153	5233	61	20	1	281	Mangde Chhu
272	G090507E27911N	MMagr16_490	90.507	27.911	0.082	5406	5240	5321	49	24	1	228	Mangde Chhu
273	G090369E27994N	MMagr16_446	90.369	27.994	0.031	5595	5478	5552	55	31	4	94	Mangde Chhu
274	G090421E27966N	MMagr16_454	90.421	27.966	0.113	5471	5360	5415	65	25	0	142	Mangde Chhu
275	G090410E27901N	MMagr16_478	90.410	27.901	0.221	5360	5256	5297	58	12	0	143	Mangde Chhu
276	G090409E27904N	MMagr16_477	90.409	27.904	0.367	5359	5155	5256	67	17	0	112	Mangde Chhu
277	G090283E27908N	MMagr16_409	90.283	27.908	0.034	5447	5285	5374	62	38	9	261	Mangde Chhu
278	G090409E27950N	MMagr16_464	90.409	27.950	0.311	5512	5251	5380	66	20	0	212	Mangde Chhu
279	G090271E27836N	MMagr16_392	90.271	27.836	0.128	5348	5036	5238	63	21	2	144	Mangde Chhu
280	G090269E27832N	MMagr16_391	90.269	27.832	0.231	5413	5168	5276	50	18	2	184	Mangde Chhu
281	G090261E27833N	MMagr16_389	90.261	27.833	0.203	5341	5078	5239	57	19	1	233	Mangde Chhu

282	G090266E27830N	MMagr16_390	90.266	27.830	0.117	5337	5126	5243	50	18	0	172	Mangde Chhu
283	G090266E27843N	MMagr16_393	90.266	27.843	0.044	5302	5203	5257	40	21	2	48	Mangde Chhu
284	G090284E27905N	MMagr16_408	90.284	27.905	0.030	5448	5354	5404	50	23	1	185	Mangde Chhu
285	G090311E27884N	MMagr16_404	90.311	27.884	1.855	5490	5114	5316	50	13	0	254	Mangde Chhu
286	G090317E27819N	MMagr16_394	90.317	27.819	0.133	5312	5119	5202	68	21	1	255	Mangde Chhu
287	G090321E27825N	MMagr16_395	90.321	27.825	0.035	5259	5161	5204	57	23	3	60	Mangde Chhu
288	G090322E27868N	MMagr16_400	90.322	27.868	0.353	5463	5252	5365	51	16	0	202	Mangde Chhu
289	G090334E27861N	MMagr16_399	90.334	27.861	0.384	5393	5103	5274	78	15	0	120	Mangde Chhu
290	G090334E27857N	MMagr16_398	90.334	27.857	0.270	5338	5190	5249	78	12	0	196	Mangde Chhu
291	G090326E27858N	MMagr16_397	90.326	27.858	0.691	5398	5140	5262	74	12	0	248	Mangde Chhu
292	G090329E27872N	MMagr16_401	90.329	27.872	0.993	5453	5137	5271	72	14	0	115	Mangde Chhu
293	G090324E27881N	MMagr16_403	90.324	27.881	0.070	5387	5233	5316	61	25	0	100	Mangde Chhu
294	G090417E27893N	MMagr16_479	90.417	27.893	0.240	5300	5125	5187	69	15	0	153	Mangde Chhu
295	G090493E27894N	MMagr16_494	90.493	27.894	0.074	5333	5181	5250	65	22	2	246	Mangde Chhu
296	G090502E27895N	MMagr16_493	90.502	27.895	0.187	5345	5149	5225	48	17	1	168	Mangde Chhu
297	G090505E27901N	MMagr16_491	90.505	27.901	0.084	5251	5143	5191	46	21	2	300	Mangde Chhu
298	G090509E27900N	MMagr16_492	90.509	27.900	0.166	5305	5179	5256	50	15	1	127	Mangde Chhu
299	G090560E27903N	MMagr16_497	90.560	27.903	0.408	5417	5134	5268	59	18	1	191	Mangde Chhu
300	G090548E27898N	MMagr16_496	90.548	27.898	0.068	5161	5087	5126	22	12	1	148	Mangde Chhu
301	G090573E27826N	MMagr16_499	90.573	27.826	0.060	5239	5045	5144	64	26	1	272	Mangde Chhu
302	G090574E27832N	MMagr16_498	90.574	27.832	0.211	5337	5052	5238	58	22	1	236	Mangde Chhu
303	G090545E27901N	MMagr16_495	90.545	27.901	0.104	5321	5168	5246	65	20	1	124	Mangde Chhu
304	G090318E27875N	MMagr16_402	90.318	27.875	0.412	5522	5115	5365	65	21	0	225	Mangde Chhu
305	G090320E27884N	MMagr16_405	90.320	27.884	0.101	5427	5209	5292	45	21	4	72	Mangde Chhu

306	G090371E28054N	MMagr16_435	90.371	28.054	3.930	6061	5239	5680	69	17	0	218	Mangde Chhu
307	G090443E28024N	MMagr16_482	90.443	28.024	45.850	7361	4630	5485	80	20	0	177	Mangde Chhu
308	G090456E28046N	MMagr16_485	90.456	28.046	0.174	6686	6382	6519	61	29	2	93	Mangde Chhu
309	G090469E28048N	MMagr16_486	90.469	28.048	0.045	6488	6290	6390	60	39	11	177	Mangde Chhu
310	G090454E28020N	MMagr16_484	90.454	28.020	0.054	5948	5588	5780	60	37	6	186	Mangde Chhu
311	G090434E27873N	MMagr16_481	90.434	27.873	0.171	5204	4940	5076	63	23	1	84	Mangde Chhu
312	G090429E27877N	MMagr16_480	90.429	27.877	0.020	5248	5140	5195	52	30	8	186	Mangde Chhu
313	G090402E28030N	MMagr16_439	90.402	28.030	0.210	5739	5427	5551	66	24	2	70	Mangde Chhu
314	G090321E27851N	MMagr16_396	90.321	27.851	0.047	5271	5126	5180	65	31	3	303	Mangde Chhu
315	G090379E27968N	MMagr16_451	90.379	27.968	0.050	5485	5329	5406	70	39	3	203	Mangde Chhu
MO CHHU SUB BASIN													
316	G089398E27897N	PMogr16_65	89.398	27.897	1.731	5779	4990	5348	64	22	0	106	Mo Chhu
317	G089358E27853N	PMogr16_57	89.358	27.853	4.055	6384	4205	5029	81	28	0	118	Mo Chhu
318	G089359E27866N	PMogr16_59	89.359	27.866	0.600	5671	5198	5428	75	25	1	179	Mo Chhu
319	G089385E27882N	PMogr16_63	89.385	27.882	1.220	6032	4783	5343	70	29	0	100	Mo Chhu
320	G089483E27773N	PMogr16_55	89.483	27.773	0.156	5316	5137	5224	42	22	0	305	Mo Chhu
321	G089535E27764N	PMogr16_53	89.535	27.764	0.057	5241	5121	5178	41	22	2	307	Mo Chhu
322	G089532E27760N	PMogr16_54	89.532	27.760	0.076	5391	5134	5231	47	22	1	201	Mo Chhu
323	G089552E27790N	PMogr16_51	89.552	27.790	0.264	5595	5109	5425	55	25	1	276	Mo Chhu
324	G089554E27794N	PMogr16_50	89.554	27.794	0.182	5539	5094	5419	63	28	1	268	Mo Chhu
325	G089350E27842N	PMogr16_56	89.350	27.842	1.818	6233	4907	5521	81	28	0	113	Mo Chhu
326	G089372E27869N	PMogr16_61	89.372	27.869	0.233	6509	5721	6100	65	43	3	166	Mo Chhu
327	G089381E27871N	PMogr16_62	89.381	27.871	1.272	6491	4474	5482	71	41	2	97	Mo Chhu
328	G089550E27788N	PMogr16_52	89.550	27.788	0.190	5566	5011	5318	64	31	1	277	Mo Chhu

329	G089559E27791N	PMogr16_49	89.559	27.791	0.212	5541	5312	5447	70	29	0	102	Mo Chhu
330	G089568E28109N	PMogr16_102	89.568	28.109	3.339	6140	4075	5131	75	28	0	111	Mo Chhu
331	G089578E28026N	PMogr16_84	89.578	28.026	0.108	5370	5151	5261	55	21	1	277	Mo Chhu
332	G089616E28027N	PMogr16_92	89.616	28.027	0.035	5402	5261	5324	54	27	1	104	Mo Chhu
333	G089612E28154N	PMogr16_106	89.612	28.154	4.360	5871	4304	5066	76	26	0	160	Mo Chhu
334	G089463E28008N	PMogr16_66	89.463	28.008	0.724	5791	5017	5391	65	25	1	213	Mo Chhu
335	G089475E28016N	PMogr16_67	89.475	28.016	0.512	5750	5197	5443	62	23	1	146	Mo Chhu
336	G089469E28029N	PMogr16_70	89.469	28.029	0.135	5482	5052	5341	57	30	1	56	Mo Chhu
337	G089512E28084N	PMogr16_76	89.512	28.084	0.571	5831	5166	5414	59	24	1	175	Mo Chhu
338	G089513E28092N	PMogr16_78	89.513	28.092	0.119	6357	5636	6072	68	51	35	184	Mo Chhu
339	G089525E28077N	PMogr16_79	89.525	28.077	0.821	5752	4757	5147	64	23	0	190	Mo Chhu
340	G089534E28057N	PMogr16_80	89.534	28.057	0.373	5304	5136	5220	56	19	1	266	Mo Chhu
341	G089535E28074N	PMogr16_93	89.535	28.074	0.040	5551	5325	5433	68	35	4	153	Mo Chhu
342	G089539E28076N	PMogr16_95	89.539	28.076	0.089	5539	5285	5400	59	30	9	142	Mo Chhu
343	G089545E28079N	PMogr16_96	89.545	28.079	0.163	5563	5178	5371	67	34	15	167	Mo Chhu
344	G089550E28079N	PMogr16_97	89.550	28.079	0.053	5501	5251	5393	68	35	1	196	Mo Chhu
345	G089555E28075N	PMogr16_99	89.555	28.075	0.035	5560	5354	5476	60	37	2	193	Mo Chhu
346	G089552E28077N	PMogr16_98	89.552	28.077	0.053	5542	5281	5438	67	41	2	196	Mo Chhu
347	G089559E28074N	PMogr16_100	89.559	28.074	0.111	5274	5142	5223	60	21	0	113	Mo Chhu
348	G089580E28122N	PMogr16_103	89.580	28.122	0.719	6049	4831	5396	74	42	1	114	Mo Chhu
349	G089591E28135N	PMogr16_104	89.591	28.135	2.862	6017	4213	5125	74	33	0	126	Mo Chhu
350	G089638E28170N	PMogr16_108	89.638	28.170	0.364	5300	5029	5177	57	17	2	171	Mo Chhu
351	G089671E28165N	PMogr16_110	89.671	28.165	0.319	5460	4948	5202	64	28	2	263	Mo Chhu
352	G089602E28012N	PMogr16_88	89.602	28.012	0.079	5360	5161	5269	60	24	1	124	Mo Chhu

353	G089607E28017N	PMogr16_89	89.607	28.017	0.361	5409	5137	5232	60	15	0	110	Mo Chhu
354	G089540E28051N	PMogr16_82	89.540	28.051	0.269	5273	5047	5149	59	18	2	56	Mo Chhu
355	G089538E28059N	PMogr16_81	89.538	28.059	0.044	5346	5232	5286	52	22	0	104	Mo Chhu
356	G089631E28165N	PMogr16_107	89.631	28.165	0.397	5594	4953	5304	71	31	2	92	Mo Chhu
357	G089585E28023N	PMogr16_85	89.585	28.023	0.030	5318	5172	5254	52	29	2	148	Mo Chhu
358	G089585E28015N	PMogr16_86	89.585	28.015	0.108	5387	5125	5243	55	26	1	263	Mo Chhu
359	G089676E28172N	PMogr16_111	89.676	28.172	0.448	5247	4971	5122	70	18	1	80	Mo Chhu
360	G089479E28020N	PMogr16_69	89.479	28.020	0.240	5359	5067	5205	60	24	1	69	Mo Chhu
361	G089467E28039N	WMogr16_71	89.467	28.039	0.069	5644	5471	5555	62	25	1	136	Mo Chhu
362	G089480E28048N	PMogr16_72	89.480	28.048	0.221	5382	5162	5232	57	15	1	74	Mo Chhu
363	G089486E28059N	PMogr16_73	89.486	28.059	0.268	5769	5168	5480	58	31	1	160	Mo Chhu
364	G089487E28062N	PMogr16_74	89.487	28.062	0.035	5723	5400	5570	62	40	6	94	Mo Chhu
365	G089491E28062N	PMogr16_75	89.491	28.062	0.050	5361	5224	5269	58	24	1	84	Mo Chhu
366	G089492E28067N	PMogr16_77	89.492	28.067	0.022	5520	5390	5462	53	28	9	111	Mo Chhu
367	G089578E28030N	PMogr16_83	89.578	28.030	0.055	5296	5157	5224	57	25	3	278	Mo Chhu
368	G089603E28022N	PMogr16_91	89.603	28.022	1.203	5448	4987	5213	64	19	0	266	Mo Chhu
369	G089597E28014N	PMogr16_87	89.597	28.014	0.111	5426	5137	5295	56	24	4	290	Mo Chhu
370	G089556E28089N	PMogr16_101	89.556	28.089	3.812	6470	4316	5229	79	32	0	123	Mo Chhu
371	G089536E28087N	PMogr16_94	89.536	28.087	0.140	6520	6311	6427	65	26	0	130	Mo Chhu
372	G089646E28171N	PMogr16_109	89.646	28.171	0.178	5382	5261	5314	47	17	0	92	Mo Chhu
373	G089613E28021N	PMogr16_90	89.613	28.021	0.087	5337	5158	5253	53	23	1	129	Mo Chhu
374	G089751E28170N	PMogr16_113	89.751	28.170	7.905	6678	4419	5306	77	32	0	256	Mo Chhu
375	G089713E28171N	PMogr16_112	89.713	28.171	0.710	5661	4697	5194	73	35	2	284	Mo Chhu
376	G089750E28145N	PMogr16_114	89.750	28.145	0.982	5961	5108	5412	64	29	1	233	Mo Chhu

377	G089762E28152N	PMogr16_116	89.762	28.152	1.437	5995	4957	5604	68	28	0	131	Mo Chhu
378	G089774E28162N	PMogr16_118	89.774	28.162	0.333	6448	5248	5601	69	39	2	157	Mo Chhu
379	G089781E28167N	PMogr16_120	89.781	28.167	0.658	5888	5070	5468	73	31	1	136	Mo Chhu
380	G089782E28179N	PMogr16_121	89.782	28.179	3.361	6479	4817	5485	75	29	0	103	Mo Chhu
381	G089801E28192N	PMogr16_124	89.801	28.192	0.177	5579	5235	5363	64	27	3	107	Mo Chhu
382	G089795E28194N	PMogr16_123	89.795	28.194	0.184	5460	5248	5354	73	24	1	86	Mo Chhu
383	G089780E28195N	PMogr16_122	89.780	28.195	3.162	6155	4898	5473	68	23	0	129	Mo Chhu
384	G089796E28244N	PMogr16_125	89.796	28.244	0.347	6286	5661	6014	65	39	2	191	Mo Chhu
385	G089827E28229N	PMogr16_126	89.827	28.229	2.391	6019	5126	5613	73	20	0	231	Mo Chhu
386	G089821E28216N	PMogr16_127	89.821	28.216	0.024	5604	5522	5572	61	29	1	123	Mo Chhu
387	G089826E28213N	PMogr16_139	89.826	28.213	0.229	5477	5259	5338	58	16	1	83	Mo Chhu
388	G089836E28223N	PMogr16_131	89.836	28.223	0.194	5913	5496	5736	70	31	1	185	Mo Chhu
389	G089764E28145N	PMogr16_115	89.764	28.145	0.071	5456	5219	5339	69	36	5	120	Mo Chhu
390	G089768E28157N	PMogr16_117	89.768	28.157	0.247	5662	5317	5457	69	29	1	121	Mo Chhu
391	G089846E28225N	PMogr16_132	89.846	28.225	0.051	5722	5547	5630	57	31	4	192	Mo Chhu
392	G089829E28221N	PMogr16_130	89.829	28.221	0.101	5759	5612	5690	70	27	0	167	Mo Chhu
393	G089768E28170N	PMogr16_119	89.768	28.170	0.294	6706	6295	6538	69	34	1	163	Mo Chhu
394	G089823E28216N	PMogr16_128	89.823	28.216	0.025	5528	5435	5479	51	31	7	93	Mo Chhu
395	G089868E28038N	PMogr16_166	89.868	28.038	0.839	5550	4767	5031	66	21	0	242	Mo Chhu
396	G089863E28022N	PMogr16_167	89.863	28.022	0.154	5459	5198	5358	58	21	1	230	Mo Chhu
397	G089869E28025N	PMogr16_168	89.869	28.025	0.293	5615	5193	5382	52	19	0	190	Mo Chhu
398	G089876E28026N	PMogr16_169	89.876	28.026	0.577	5881	5137	5521	64	27	0	202	Mo Chhu
399	G089899E28004N	PMogr16_172	89.899	28.004	0.769	5658	5113	5366	64	18	0	240	Mo Chhu
400	G089889E28019N	PMogr16_170	89.889	28.019	1.382	5594	5213	5369	59	16	0	209	Mo Chhu

401	G089909E27993N	PMogr16_173	89.909	27.993	2.866	5592	5216	5414	67	14	0	238	Mo Chhu
402	G089905E27974N	PMogr16_174	89.905	27.974	0.839	5611	5137	5355	62	23	0	249	Mo Chhu
403	G089907E27959N	PMogr16_177	89.907	27.959	2.148	5523	5061	5228	65	18	0	234	Mo Chhu
404	G089895E27950N	PMogr16_178	89.895	27.950	0.033	5257	5151	5201	47	30	12	308	Mo Chhu
405	G089895E27949N	PMogr16_179	89.895	27.949	0.109	5384	5158	5259	50	23	1	231	Mo Chhu
406	G089896E27944N	PMogr16_180	89.896	27.944	0.027	5179	5093	5136	47	23	1	261	Mo Chhu
407	G089910E27971N	PMogr16_176	89.910	27.971	0.048	5575	5402	5478	59	30	1	180	Mo Chhu
408	G089896E28010N	PMogr16_171	89.896	28.010	0.465	5645	5219	5408	60	23	1	234	Mo Chhu
409	G089883E28202N	PMogr16_133	89.883	28.202	0.525	5851	5349	5589	70	25	1	256	Mo Chhu
410	G089888E28191N	PMogr16_135	89.888	28.191	0.426	6206	5380	5680	71	36	2	260	Mo Chhu
411	G089885E28177N	PMogr16_137	89.885	28.177	1.596	6288	5246	5630	79	25	0	271	Mo Chhu
412	G089881E28157N	PMogr16_139	89.881	28.157	0.894	5745	5210	5535	70	22	0	254	Mo Chhu
413	G089851E28142N	PMogr16_142	89.851	28.142	0.877	5772	5200	5471	74	24	1	195	Mo Chhu
414	G089831E28131N	PMogr16_144	89.831	28.131	2.703	6201	4730	5283	75	26	0	189	Mo Chhu
415	G089813E28124N	PMogr16_146	89.813	28.124	0.459	5253	4833	4996	65	20	0	274	Mo Chhu
416	G089821E28116N	PMogr16_147	89.821	28.116	0.260	6260	5542	5803	74	48	2	264	Mo Chhu
417	G089815E28098N	PMogr16_150	89.815	28.098	1.586	5961	5119	5465	77	26	0	257	Mo Chhu
418	G089814E28088N	PMogr16_154	89.814	28.088	0.237	5803	5057	5536	68	34	1	215	Mo Chhu
419	G089824E28086N	PMogr16_155	89.824	28.086	0.143	5428	5114	5301	64	28	3	212	Mo Chhu
420	G089826E28075N	PMogr16_157	89.826	28.075	0.181	5353	5165	5264	57	24	0	228	Mo Chhu
421	G089826E28097N	PMogr16_151	89.826	28.097	0.122	5729	5386	5553	63	34	1	125	Mo Chhu
422	G089841E28100N	PMogr16_158	89.841	28.100	10.076	6422	4623	5435	76	17	0	183	Mo Chhu
423	G089855E28074N	PMogr16_160	89.855	28.074	0.046	5381	5221	5302	56	35	0	261	Mo Chhu
424	G089857E28072N	PMogr16_161	89.857	28.072	0.282	5499	5023	5282	68	28	1	255	Mo Chhu

425	G089856E28066N	PMogr16_162	89.856	28.066	0.242	5549	4968	5314	75	35	1	266	Mo Chhu
426	G089858E28056N	PMogr16_164	89.858	28.056	0.525	5641	4972	5224	64	22	1	244	Mo Chhu
427	G089844E28047N	PMogr16_165	89.844	28.047	0.183	5308	5029	5109	61	24	1	281	Mo Chhu
428	G089857E28085N	PMogr16_159	89.857	28.085	1.566	5974	4974	5318	79	23	0	213	Mo Chhu
429	G089883E28166N	PMogr16_138	89.883	28.166	1.415	5936	5295	5546	70	21	0	254	Mo Chhu
430	G089879E28149N	PMogr16_140	89.879	28.149	0.512	5751	5301	5516	60	24	0	263	Mo Chhu
431	G089845E28132N	PMogr16_143	89.845	28.132	1.367	6060	5111	5427	78	26	0	191	Mo Chhu
432	G089814E28108N	PMogr16_149	89.814	28.108	0.768	6242	5252	5537	78	24	0	236	Mo Chhu
433	G089827E28081N	PMogr16_156	89.827	28.081	0.094	5387	5169	5324	62	29	1	200	Mo Chhu
434	G089823E28129N	PMogr16_145	89.823	28.129	0.349	5667	5045	5326	69	24	0	196	Mo Chhu
435	G089802E28110N	PMogr16_148	89.802	28.110	0.136	5423	4971	5116	72	32	1	167	Mo Chhu
436	G089853E28063N	PMogr16_163	89.853	28.063	0.067	5267	5114	5185	55	28	3	246	Mo Chhu
437	G089351E27862N	PMogr16_58	89.351	27.862	0.067	5505	5338	5412	67	35	2	159	Mo Chhu
438	G089367E27870N	PMogr16_60	89.367	27.870	0.086	6506	5920	6211	67	49	13	225	Mo Chhu
439	G089405E27891N	PMogr16_64	89.405	27.891	0.219	5388	5047	5199	63	29	4	97	Mo Chhu
440	G089482E28016N	PMogr16_68	89.482	28.016	0.100	5326	5099	5228	61	24	0	84	Mo Chhu
441	G089601E28146N	PMogr16_105	89.601	28.146	0.391	5767	4896	5273	68	33	1	130	Mo Chhu
442	G089868E28134N	PMogr16_141	89.868	28.134	8.811	6349	4584	5478	76	18	0	189	Mo Chhu
443	G089887E28185N	PMogr16_136	89.887	28.185	0.872	6364	5134	5588	76	31	1	271	Mo Chhu
444	G089882E28198N	PMogr16_134	89.882	28.198	0.396	5873	5275	5568	72	32	0	258	Mo Chhu
445	G089594E27742N	PMogr16_48	89.594	27.742	0.190	5360	5096	5193	62	24	1	122	Mo Chhu
446	G089839E27900N	PMogr16_182	89.839	27.900	0.022	5020	4980	5006	38	17	1	236	Mo Chhu
447	G089873E27948N	PMogr16_181	89.873	27.948	0.045	5257	5110	5175	51	27	5	259	Mo Chhu
448	G089890E27969N	PMogr16_175	89.890	27.969	0.056	5228	5124	5180	43	26	6	299	Mo Chhu

449	G089795E28076N	PMogr16_152	89.795	28.076	0.051	5285	5100	5199	50	28	6	284	Mo Chhu
450	G089798E28080N	PMogr16_153	89.798	28.080	0.071	5367	5210	5295	58	29	7	55	Mo Chhu
PAA CHHU SUB BASIN													
451	G089322E27835N	WPagr16_33	89.322	27.835	9.246	6701	4342	5217	83	31	0	173	Pa Chhu
452	G089251E27798N	WPagr16_20	89.251	27.798	0.394	6087	5183	5544	71	39	3	144	Pa Chhu
453	G089281E27796N	WPagr16_24	89.281	27.796	1.577	5936	5059	5465	72	27	0	211	Pa Chhu
454	G089274E27818N	WPagr16_28	89.274	27.818	1.030	7051	5916	6465	69	37	1	153	Pa Chhu
455	G089284E27816N	WPagr16_30	89.284	27.816	1.191	6459	4864	5543	76	39	1	116	Pa Chhu
456	G089293E27829N	WPagr16_32	89.293	27.829	2.644	6409	5005	5521	82	36	0	143	Pa Chhu
457	G089303E27810N	WPagr16_31	89.303	27.810	1.121	4799	4385	4528	69	18	0	154	Pa Chhu
458	G089238E27800N	WPagr16_19	89.238	27.800	0.141	5962	5615	5756	67	33	1	214	Pa Chhu
459	G089267E27807N	WPagr16_22	89.267	27.807	2.657	7201	4842	5789	72	35	1	177	Pa Chhu
460	G089288E27793N	WPagr16_25	89.288	27.793	0.645	5654	5144	5439	58	22	1	178	Pa Chhu
461	G089274E27800N	WPagr16_23	89.274	27.800	0.065	5380	5179	5258	62	27	1	208	Pa Chhu
462	G089295E27792N	WPagr16_26	89.295	27.792	0.376	5618	5199	5381	66	26	1	159	Pa Chhu
463	G089416E27673N	WPagr16_8	89.416	27.673	0.375	5616	5037	5308	73	33	1	225	Pa Chhu
464	G089420E27675N	WPagr16_9	89.420	27.675	0.079	5533	5348	5447	63	32	2	220	Pa Chhu
465	G089405E27667N	WPagr16_7	89.405	27.667	0.134	5248	5019	5102	69	27	4	191	Pa Chhu
466	G089405E27707N	WPagr16_11	89.405	27.707	0.192	5325	4996	5100	58	25	1	292	Pa Chhu
467	G089407E27713N	WPagr16_12	89.407	27.713	0.127	5348	5055	5196	52	25	3	277	Pa Chhu
468	G089409E27732N	WPagr16_14	89.409	27.732	0.195	5672	5375	5540	68	30	1	218	Pa Chhu
469	G089406E27724N	WPagr16_13	89.406	27.724	0.506	5600	5000	5276	63	28	1	271	Pa Chhu
470	G089343E27836N	WPagr16_34	89.343	27.836	1.153	6333	5225	5776	79	37	0	158	Pa Chhu
471	G089229E27784N	WPagr16_15	89.229	27.784	0.352	5784	5237	5491	71	33	1	243	Pa Chhu

472	G089249E27775N	WPagr16_17	89.249	27.775	0.026	5373	5187	5301	62	34	4	191	Pa Chhu
473	G089242E27789N	WPagr16_18	89.242	27.789	2.271	6042	4878	5462	69	23	0	139	Pa Chhu
474	G089243E27778N	WPagr16_16	89.243	27.778	0.097	5457	5164	5362	60	31	3	213	Pa Chhu
475	G089269E27827N	WPagr16_29	89.269	27.827	0.289	7317	6862	7077	80	43	2	181	Pa Chhu
476	G089420E27679N	WPagr16_10	89.420	27.679	0.226	5570	5001	5237	64	31	1	259	Pa Chhu
477	G089251E27804N	WPagr16_21	89.251	27.804	0.118	6238	5937	6109	71	47	5	156	Pa Chhu
478	G089356E27605N	WPagr16_5	89.356	27.605	0.298	5544	5016	5300	61	31	2	277	Pa Chhu
479	G089289E27802N	WPagr16_27	89.289	27.802	0.606	5795	5081	5427	72	31	1	99	Pa Chhu
480	G089360E27605N	WPagr16_6	89.360	27.605	0.065	5530	5206	5331	69	41	11	116	Pa Chhu
481	G089169E27577N	WPagr16_4	89.169	27.577	0.191	5394	4934	5187	61	34	0	260	Pa Chhu
PHO CHHU SUB BASIN													
482	G089920E27979N	PPhgr16_198	89.920	27.979	2.092	5660	5305	5461	66	14	0	156	Pho Chhu
483	G089914E27956N	PPhgr16_195	89.914	27.956	0.284	5406	5221	5322	48	16	1	195	Pho Chhu
484	G089939E27919N	PPhgr16_186	89.939	27.919	0.056	5146	5040	5098	48	25	4	289	Pho Chhu
485	G089944E27927N	PPhgr16_187	89.944	27.927	0.027	5174	5104	5137	55	25	4	261	Pho Chhu
486	G089945E27937N	PPhgr16_188	89.945	27.937	0.281	5311	5022	5133	66	19	0	259	Pho Chhu
487	G089940E27951N	PPhgr16_192	89.940	27.951	0.442	5463	5136	5290	61	24	0	247	Pho Chhu
488	G089922E27963N	PPhgr16_196	89.922	27.963	0.774	5507	5163	5344	57	14	0	168	Pho Chhu
489	G089956E27897N	PPhgr16_185	89.956	27.897	0.302	5243	5033	5136	55	19	0	265	Pho Chhu
490	G089945E27946N	PPhgr16_190	89.945	27.946	0.052	5280	5096	5193	59	28	5	66	Pho Chhu
491	G089944E27953N	PPhgr16_193	89.944	27.953	0.084	5481	5254	5359	49	25	2	194	Pho Chhu
492	G089937E27981N	PPhgr16_199	89.937	27.981	0.117	5409	5281	5355	54	22	1	190	Pho Chhu
493	G089939E27984N	PPhgr16_200	89.939	27.984	0.047	5232	5136	5182	40	17	1	61	Pho Chhu
494	G089942E27993N	PPhgr16_201	89.942	27.993	0.580	5389	5049	5232	60	15	0	93	Pho Chhu

495	G089929E27994N	PPhgr16_202	89.929	27.994	0.791	5645	5130	5322	65	23	0	164	Pho Chhu
496	G089919E28001N	PPhgr16_203	89.919	28.001	0.043	5302	5219	5275	39	17	1	92	Pho Chhu
497	G089911E28006N	PPhgr16_204	89.911	28.006	0.775	5651	5144	5383	56	16	0	99	Pho Chhu
498	G089890E28042N	PPhgr16_213	89.890	28.042	0.412	5535	5274	5395	74	21	1	120	Pho Chhu
499	G089902E28041N	PPhgr16_215	89.902	28.041	0.116	5383	5230	5321	53	25	2	174	Pho Chhu
500	G089898E28045N	PPhgr16_216	89.898	28.045	0.092	5117	5001	5046	48	13	0	154	Pho Chhu
501	G089890E28055N	PPhgr16_218	89.890	28.055	0.063	5232	5087	5158	62	27	1	279	Pho Chhu
502	G089880E28047N	PPhgr16_211	89.880	28.047	0.833	5810	4984	5293	76	25	0	217	Pho Chhu
503	G089882E28030N	PPhgr16_207	89.882	28.030	0.815	5910	5187	5554	68	27	0	110	Pho Chhu
504	G089928E27961N	PPhgr16_197	89.928	27.961	0.042	5234	5159	5204	40	18	1	142	Pho Chhu
505	G089907E28013N	PPhgr16_205	89.907	28.013	0.050	5265	5187	5221	49	18	1	88	Pho Chhu
506	G089891E28048N	PPhgr16_217	89.891	28.048	0.112	5577	5272	5451	74	36	1	116	Pho Chhu
507	G089950E27942N	PPhgr16_189	89.950	27.942	0.245	5209	4900	5067	65	19	0	153	Pho Chhu
508	G089941E27945N	PPhgr16_191	89.941	27.945	0.168	5391	5162	5293	53	22	1	232	Pho Chhu
509	G089878E28037N	PPhgr16_208	89.878	28.037	0.046	5878	5801	5823	62	16	0	189	Pho Chhu
510	G089884E28036N	PPhgr16_209	89.884	28.036	0.235	5912	5360	5657	69	32	4	133	Pho Chhu
511	G089940E27957N	PPhgr16_194	89.940	27.957	0.080	5255	5072	5173	55	24	1	163	Pho Chhu
512	G089900E28019N	PPhgr16_206	89.900	28.019	0.220	5435	5173	5301	67	20	1	122	Pho Chhu
513	G089884E28039N	PPhgr16_210	89.884	28.039	0.072	5849	5547	5714	65	36	2	120	Pho Chhu
514	G089897E28041N	PPhgr16_214	89.897	28.041	0.048	5312	5176	5242	49	27	2	233	Pho Chhu
515	G089867E28070N	PPhgr16_220	89.867	28.070	1.036	5464	4820	5221	75	18	0	112	Pho Chhu
516	G089876E28068N	PPhgr16_219	89.876	28.068	0.554	5308	5013	5151	62	20	0	141	Pho Chhu
517	G089863E28078N	PPhgr16_221	89.863	28.078	0.460	5427	5118	5262	66	23	1	85	Pho Chhu
518	G089864E28096N	PPhgr16_222	89.864	28.096	0.929	6162	4879	5577	76	33	1	159	Pho Chhu

519	G089872E28097N	PPhgr16_224	89.872	28.097	0.292	5851	5149	5421	69	34	2	174	Pho Chhu
520	G089878E28093N	PPhgr16_225	89.878	28.093	0.144	5386	5155	5271	56	28	1	192	Pho Chhu
521	G089879E28101N	PPhgr16_226	89.879	28.101	0.714	5876	4853	5267	74	30	1	117	Pho Chhu
522	G089879E28116N	PPhgr16_228	89.879	28.116	3.666	6245	4642	5275	74	24	0	106	Pho Chhu
523	G089893E28131N	PPhgr16_229	89.893	28.131	0.525	5567	5128	5328	72	25	0	113	Pho Chhu
524	G089890E28146N	PPhgr16_230	89.890	28.146	1.066	5724	5167	5448	66	17	0	131	Pho Chhu
525	G089895E28165N	PPhgr16_232	89.895	28.165	0.050	5534	5384	5475	61	28	3	108	Pho Chhu
526	G089921E28167N	PPhgr16_233	89.921	28.167	12.893	7085	4653	5688	79	26	0	221	Pho Chhu
527	G089917E28143N	PPhgr16_238	89.917	28.143	0.696	5755	5070	5332	70	32	1	278	Pho Chhu
528	G089917E28136N	PPhgr16_239	89.917	28.136	0.233	5515	4984	5244	61	29	1	240	Pho Chhu
529	G089926E28135N	PPhgr16_240	89.926	28.135	0.442	5537	5103	5347	61	26	0	200	Pho Chhu
530	G089926E28145N	PPhgr16_237	89.926	28.145	0.661	5886	5218	5471	69	27	0	120	Pho Chhu
531	G089929E28156N	PPhgr16_236	89.929	28.156	1.094	6364	5286	5699	67	35	1	137	Pho Chhu
532	G089938E28158N	PPhgr16_235	89.938	28.158	0.512	5658	5163	5387	63	29	2	158	Pho Chhu
533	G089949E28149N	PPhgr16_241	89.949	28.149	4.087	6247	4611	5245	77	26	0	212	Pho Chhu
534	G089964E28143N	PPhgr16_247	89.964	28.143	2.165	6272	4979	5397	72	23	0	184	Pho Chhu
535	G089975E28130N	PPhgr16_249	89.975	28.130	0.420	5357	5050	5198	65	29	0	265	Pho Chhu
536	G089929E28103N	PPhgr16_242	89.929	28.103	0.790	5751	4994	5291	76	30	1	260	Pho Chhu
537	G089938E28096N	PPhgr16_244	89.938	28.096	1.849	5792	5080	5374	69	18	0	173	Pho Chhu
538	G089945E28106N	PPhgr16_245	89.945	28.106	1.105	5762	5232	5393	68	18	0	98	Pho Chhu
539	G089965E28103N	PPhgr16_252	89.965	28.103	1.145	5736	5110	5437	63	25	0	243	Pho Chhu
540	G089970E28079N	PPhgr16_254	89.970	28.079	0.240	5619	5189	5347	69	26	1	278	Pho Chhu
541	G089972E28075N	PPhgr16_255	89.972	28.075	0.109	5645	5341	5490	58	29	4	201	Pho Chhu
542	G089971E28069N	PPhgr16_256	89.971	28.069	0.400	5422	5091	5205	71	19	0	260	Pho Chhu

543	G089976E28066N	PPhgr16_257	89.976	28.066	0.031	5403	5223	5316	65	37	11	216	Pho Chhu
544	G089981E28078N	PPhgr16_259	89.981	28.078	0.781	5636	5192	5412	64	20	1	101	Pho Chhu
545	G089980E28084N	PPhgr16_260	89.980	28.084	0.536	5596	5160	5367	63	23	1	79	Pho Chhu
546	G089978E28091N	PPhgr16_261	89.978	28.091	0.368	5629	5264	5443	66	26	0	100	Pho Chhu
547	G089978E28097N	PPhgr16_262	89.978	28.097	0.467	5599	5209	5386	61	23	1	81	Pho Chhu
548	G089979E28107N	PPhgr16_264	89.979	28.107	0.225	5379	5073	5178	56	21	0	106	Pho Chhu
549	G089982E28067N	PPhgr16_258	89.982	28.067	0.147	5158	5038	5081	48	14	0	93	Pho Chhu
550	G089982E28114N	PPhgr16_266	89.982	28.114	0.246	5383	5038	5215	63	31	1	59	Pho Chhu
551	G089979E28125N	PPhgr16_267	89.979	28.125	0.558	5418	5082	5249	64	28	1	106	Pho Chhu
552	G089979E28135N	PPhgr16_268	89.979	28.135	0.157	5311	5040	5177	63	27	0	105	Pho Chhu
553	G089975E28140N	PPhgr16_269	89.975	28.140	0.058	5487	5300	5380	53	30	11	112	Pho Chhu
554	G089974E28145N	PPhgr16_271	89.974	28.145	0.235	5501	5127	5325	70	30	1	83	Pho Chhu
555	G089970E28156N	PPhgr16_272	89.970	28.156	0.532	6006	5052	5327	75	35	2	84	Pho Chhu
556	G089880E28108N	PPhgr16_227	89.880	28.108	0.102	5618	5149	5412	62	37	2	121	Pho Chhu
557	G089968E28091N	PPhgr16_253	89.968	28.091	1.530	5667	5030	5379	66	23	0	253	Pho Chhu
558	G089928E28095N	PPhgr16_243	89.928	28.095	0.062	5356	5147	5244	52	30	5	253	Pho Chhu
559	G089975E28110N	PPhgr16_265	89.975	28.110	0.400	5619	5228	5445	70	26	0	109	Pho Chhu
560	G089973E28138N	PPhgr16_248	89.973	28.138	0.176	5483	5196	5346	62	26	1	202	Pho Chhu
561	G089969E28114N	PPhgr16_251	89.969	28.114	1.071	5748	4903	5312	71	35	0	271	Pho Chhu
562	G089946E28170N	PPhgr16_234	89.946	28.170	0.918	7118	6029	6717	74	41	1	157	Pho Chhu
563	G089887E28150N	PPhgr16_231	89.887	28.150	0.104	5576	5314	5406	52	22	1	84	Pho Chhu
564	G089976E28142N	PPhgr16_270	89.976	28.142	0.041	5393	5275	5329	55	34	15	83	Pho Chhu
565	G089973E28121N	PPhgr16_250	89.973	28.121	0.248	5377	4999	5177	73	38	13	293	Pho Chhu
566	G089954E28109N	PPhgr16_246	89.954	28.109	0.128	5400	5264	5336	55	25	1	202	Pho Chhu

567	G089886E28048N	PPhgr16_212	89.886	28.048	0.055	5768	5437	5582	78	45	4	244	Pho Chhu
568	G089867E28097N	PPhgr16_223	89.867	28.097	0.070	5734	5252	5485	69	41	5	171	Pho Chhu
569	G089975E28102N	PPhgr16_263	89.975	28.102	0.348	5658	5252	5438	64	29	1	83	Pho Chhu
570	G090152E28142N	PPhgr16_293	90.152	28.142	33.693	6632	4081	4911	87	22	0	172	Pho Chhu
571	G090041E28098N	PPhgr16_283	90.041	28.098	0.076	5210	5103	5152	56	17	0	151	Pho Chhu
572	G090048E28101N	PPhgr16_281	90.048	28.101	0.038	5461	5334	5392	61	34	12	140	Pho Chhu
573	G090045E28104N	PPhgr16_280	90.045	28.104	0.160	5360	5059	5215	73	30	1	250	Pho Chhu
574	G090045E28108N	PPhgr16_279	90.045	28.108	0.118	5289	5101	5196	63	30	1	256	Pho Chhu
575	G090076E28127N	PPhgr16_284	90.076	28.127	17.462	7035	4109	5092	88	29	0	165	Pho Chhu
576	G090107E28130N	PPhgr16_286	90.107	28.130	5.320	6885	4395	5526	88	37	0	183	Pho Chhu
577	G090119E28122N	PPhgr16_287	90.119	28.122	0.735	6041	4664	5518	76	36	0	238	Pho Chhu
578	G090124E28117N	PPhgr16_288	90.124	28.117	0.887	6220	4852	5573	78	41	1	187	Pho Chhu
579	G090122E28108N	PPhgr16_289	90.122	28.108	0.285	5474	5151	5302	74	29	0	185	Pho Chhu
580	G090128E28111N	PPhgr16_290	90.128	28.111	0.424	5638	5020	5343	65	31	1	191	Pho Chhu
581	G090089E27955N	PPhgr16_356	90.089	27.955	0.078	5275	5059	5182	60	28	2	277	Pho Chhu
582	G090088E27959N	PPhgr16_355	90.088	27.959	0.024	5272	5154	5218	50	26	9	275	Pho Chhu
583	G090135E28120N	PPhgr16_292	90.135	28.120	1.040	6192	4798	5430	78	39	1	108	Pho Chhu
584	G090193E28129N	PPhgr16_295	90.193	28.129	1.258	6435	4827	5554	80	39	0	218	Pho Chhu
585	G090181E28170N	PPhgr16_294	90.181	28.170	6.815	7034	6018	6532	86	25	0	190	Pho Chhu
586	G090245E28132N	PPhgr16_298	90.245	28.132	2.933	6230	4365	5176	75	28	0	182	Pho Chhu
587	G090278E28140N	PPhgr16_299	90.278	28.140	9.698	6666	4440	5585	85	24	0	186	Pho Chhu
588	G090305E28114N	PPhgr16_301	90.305	28.114	1.703	5609	4665	5132	72	23	0	208	Pho Chhu
589	G090326E28112N	PPhgr16_302	90.326	28.112	4.728	5924	4510	5257	81	21	0	173	Pho Chhu
590	G090345E28098N	PPhgr16_303	90.345	28.098	0.274	5567	5220	5385	76	18	0	182	Pho Chhu

591	G090351E28083N	PPhgr16_304	90.351	28.083	7.058	6422	4698	5324	78	27	0	245	Pho Chhu
592	G090356E28064N	PPhgr16_305	90.356	28.064	2.797	6306	4996	5582	71	19	0	231	Pho Chhu
593	G090342E28054N	PPhgr16_306	90.342	28.054	0.653	5397	5136	5285	52	20	0	243	Pho Chhu
594	G090329E28052N	PPhgr16_307	90.329	28.052	0.733	5534	5088	5290	78	20	0	111	Pho Chhu
595	G090318E28050N	PPhgr16_308	90.318	28.050	0.657	5520	5235	5349	61	19	0	258	Pho Chhu
596	G090301E27984N	PPhgr16_321	90.301	27.984	1.375	5782	5343	5522	62	15	0	145	Pho Chhu
597	G090275E27983N	PPhgr16_322	90.275	27.983	3.704	5657	5150	5372	64	16	0	234	Pho Chhu
598	G090256E27986N	PPhgr16_326	90.256	27.986	0.332	5628	5321	5464	60	25	1	85	Pho Chhu
599	G090253E27995N	PPhgr16_328	90.253	27.995	0.112	5572	5365	5464	62	23	1	96	Pho Chhu
600	G090313E28024N	PPhgr16_310	90.313	28.024	8.755	5835	5353	5545	76	12	0	190	Pho Chhu
601	G090289E28017N	PPhgr16_314	90.289	28.017	0.699	5684	5336	5500	67	16	0	246	Pho Chhu
602	G090298E28008N	PPhgr16_311	90.298	28.008	0.531	5786	5431	5565	69	19	1	160	Pho Chhu
603	G090281E28025N	PPhgr16_315	90.281	28.025	0.440	5687	5238	5500	67	22	0	248	Pho Chhu
604	G090280E28032N	PPhgr16_316	90.280	28.032	0.504	5673	5326	5492	57	18	0	260	Pho Chhu
605	G090281E28042N	PPhgr16_317	90.281	28.042	1.514	5562	5182	5376	62	19	0	231	Pho Chhu
606	G090092E27962N	PPhgr16_354	90.092	27.962	0.033	5368	5255	5304	66	30	5	91	Pho Chhu
607	G090096E27965N	PPhgr16_353	90.096	27.965	0.284	5428	5187	5327	70	20	0	139	Pho Chhu
608	G090107E27968N	PPhgr16_352	90.107	27.968	0.622	5486	4971	5204	64	22	0	105	Pho Chhu
609	G090103E27974N	PPhgr16_351	90.103	27.974	0.059	5478	5316	5395	59	25	1	117	Pho Chhu
610	G090110E27978N	PPhgr16_349	90.110	27.978	0.649	5454	5164	5326	66	18	0	160	Pho Chhu
611	G090119E27974N	PPhgr16_348	90.119	27.974	0.504	5484	5112	5281	69	19	0	204	Pho Chhu
612	G090124E27967N	PPhgr16_347	90.124	27.967	0.052	5284	5108	5183	72	24	1	215	Pho Chhu
613	G090132E27967N	PPhgr16_346	90.132	27.967	0.029	5452	5289	5376	64	34	7	118	Pho Chhu
614	G090130E27973N	PPhgr16_345	90.130	27.973	0.526	5503	5082	5314	74	25	1	88	Pho Chhu

615	G090122E27982N	PPhgr16_344	90.122	27.982	1.101	5590	5162	5426	70	22	0	80	Pho Chhu
616	G090116E27988N	PPhgr16_343	90.116	27.988	0.617	5685	5162	5385	64	24	0	124	Pho Chhu
617	G090125E27999N	PPhgr16_342	90.125	27.999	0.158	5433	5233	5347	66	26	2	116	Pho Chhu
618	G090146E28019N	PPhgr16_339	90.146	28.019	0.346	5523	5263	5401	64	23	1	169	Pho Chhu
619	G090135E28015N	PPhgr16_341	90.135	28.015	0.884	5532	5182	5364	72	18	0	163	Pho Chhu
620	G090148E28023N	PPhgr16_338	90.148	28.023	0.223	5428	5112	5257	73	26	1	219	Pho Chhu
621	G090158E28024N	PPhgr16_337	90.158	28.024	0.301	5630	4999	5307	79	30	3	253	Pho Chhu
622	G090167E28025N	PPhgr16_335	90.167	28.025	0.307	5577	5306	5441	74	23	1	134	Pho Chhu
623	G090176E28012N	PPhgr16_334	90.176	28.012	0.173	5422	5198	5300	58	26	2	285	Pho Chhu
624	G090202E28029N	PPhgr16_333	90.202	28.029	0.226	5392	5184	5289	61	27	1	261	Pho Chhu
625	G090221E28021N	PPhgr16_332	90.221	28.021	0.170	5499	5300	5412	55	18	1	184	Pho Chhu
626	G090243E28005N	PPhgr16_331	90.243	28.005	0.829	5485	5162	5300	57	20	0	271	Pho Chhu
627	G090250E27990N	PPhgr16_327	90.250	27.990	0.508	5615	5272	5450	68	24	0	236	Pho Chhu
628	G090244E27997N	PPhgr16_330	90.244	27.997	0.964	5637	5179	5424	66	17	1	256	Pho Chhu
629	G090253E27984N	PPhgr16_325	90.253	27.984	0.142	5623	5278	5486	66	29	0	238	Pho Chhu
630	G090245E27976N	PPhgr16_324	90.245	27.976	0.956	5467	5087	5284	56	20	0	243	Pho Chhu
631	G090252E27978N	PPhgr16_323	90.252	27.978	0.088	5557	5258	5437	64	37	17	301	Pho Chhu
632	G090267E27965N	PPhgr16_357	90.267	27.965	1.763	5740	5205	5429	63	20	0	247	Pho Chhu
633	G090264E27952N	PPhgr16_358	90.264	27.952	0.629	5584	5192	5391	57	19	0	261	Pho Chhu
634	G090263E27942N	PPhgr16_359	90.263	27.942	1.265	5510	5175	5340	60	16	0	260	Pho Chhu
635	G090261E27934N	PPhgr16_360	90.261	27.934	0.368	5577	5261	5422	56	19	0	242	Pho Chhu
636	G090276E27927N	PPhgr16_361	90.276	27.927	4.431	5750	5136	5427	76	14	0	216	Pho Chhu
637	G090251E27912N	PPhgr16_362	90.251	27.912	0.062	5416	5250	5334	59	26	3	314	Pho Chhu
638	G090241E27909N	PPhgr16_366	90.241	27.909	1.748	5569	5145	5296	64	18	0	170	Pho Chhu

639	G090226E27920N	PPhgr16_379	90.226	27.920	1.992	5515	5158	5362	59	12	0	226	Pho Chhu
640	G090221E27910N	PPhgr16_378	90.221	27.910	1.031	5584	4929	5267	64	20	1	256	Pho Chhu
641	G090256E27907N	PPhgr16_363	90.256	27.907	0.279	5568	5225	5423	61	27	0	75	Pho Chhu
642	G090293E28007N	PPhgr16_312	90.293	28.007	0.103	5695	5449	5579	65	25	1	197	Pho Chhu
643	G090028E28124N	PPhgr16_275	90.028	28.124	0.052	5403	5235	5319	65	31	3	219	Pho Chhu
644	G090031E28124N	PPhgr16_276	90.031	28.124	0.092	5502	5270	5372	64	34	3	161	Pho Chhu
645	G090300E28138N	PPhgr16_300	90.300	28.138	2.359	6409	5690	6150	86	24	0	179	Pho Chhu
646	G090286E28010N	PPhgr16_313	90.286	28.010	0.471	5630	5278	5435	58	19	0	277	Pho Chhu
647	G090324E28041N	PPhgr16_309	90.324	28.041	1.142	5836	5373	5534	81	17	0	255	Pho Chhu
648	G090252E27999N	PPhgr16_329	90.252	27.999	0.056	5579	5425	5499	57	37	11	63	Pho Chhu
649	G090227E27927N	PPhgr16_380	90.227	27.927	0.145	5509	5147	5364	59	25	3	265	Pho Chhu
650	G090218E27929N	PPhgr16_381	90.218	27.929	0.290	5365	5165	5288	50	20	1	257	Pho Chhu
651	G090133E28110N	PPhgr16_291	90.133	28.110	0.100	5587	5256	5446	70	44	2	168	Pho Chhu
652	G090203E28120N	PPhgr16_296	90.203	28.120	0.195	5441	5135	5251	76	34	1	108	Pho Chhu
653	G090289E28042N	PPhgr16_318	90.289	28.042	0.039	5528	5374	5450	60	31	4	68	Pho Chhu
654	G090046E28100N	PPhgr16_282	90.046	28.100	0.038	5414	5297	5353	57	30	3	142	Pho Chhu
655	G090142E28023N	PPhgr16_340	90.142	28.023	0.043	5487	5373	5419	61	25	2	191	Pho Chhu
656	G090291E28051N	PPhgr16_319	90.291	28.051	0.047	5422	5216	5314	65	36	4	242	Pho Chhu
657	G090214E27902N	PPhgr16_376	90.214	27.902	0.104	5408	5140	5248	55	25	1	247	Pho Chhu
658	G090211E27867N	PPhgr16_372	90.211	27.867	0.240	5317	5095	5192	58	23	1	229	Pho Chhu
659	G090227E27880N	PPhgr16_370	90.227	27.880	0.140	5202	5065	5119	52	15	1	286	Pho Chhu
660	G090235E27879N	PPhgr16_371	90.235	27.879	0.141	5288	5159	5230	52	18	0	181	Pho Chhu
661	G090234E27900N	PPhgr16_367	90.234	27.900	0.580	5519	5221	5377	66	21	0	134	Pho Chhu
662	G090223E27900N	PPhgr16_377	90.223	27.900	1.196	5613	5090	5354	74	22	0	232	Pho Chhu

663	G090206E27896N	PPhgr16_374	90.206	27.896	0.110	5276	5096	5171	43	18	0	234	Pho Chhu
664	G090249E27903N	PPhgr16_365	90.249	27.903	0.298	5460	5179	5327	57	19	0	156	Pho Chhu
665	G090256E27900N	PPhgr16_364	90.256	27.900	0.045	5312	5255	5279	39	17	2	209	Pho Chhu
666	G090262E27838N	PPhgr16_382	90.262	27.838	0.769	5393	5005	5198	59	19	0	271	Pho Chhu
667	G090252E27837N	PPhgr16_383	90.252	27.837	0.033	5237	5122	5181	53	24	1	90	Pho Chhu
668	G090250E27835N	PPhgr16_384	90.250	27.835	0.138	5261	5073	5169	47	19	1	271	Pho Chhu
669	G090244E27832N	PPhgr16_385	90.244	27.832	0.059	5159	5047	5101	57	25	1	215	Pho Chhu
670	G090241E27828N	PPhgr16_386	90.241	27.828	0.026	5164	5078	5110	59	24	3	295	Pho Chhu
671	G090223E27887N	PPhgr16_369	90.223	27.887	0.038	5355	5194	5273	49	24	5	241	Pho Chhu
672	G090226E27889N	PPhgr16_368	90.226	27.889	0.089	5469	5216	5368	53	28	3	234	Pho Chhu
673	G090206E27866N	PPhgr16_373	90.206	27.866	0.093	5281	5109	5195	61	24	3	252	Pho Chhu
674	G089997E28145N	PPhgr16_273	89.997	28.145	28.922	7200	4376	5223	82	26	0	186	Pho Chhu
675	G090054E28124N	PPhgr16_278	90.054	28.124	0.173	5816	5336	5607	74	45	4	97	Pho Chhu
676	G090090E28137N	PPhgr16_285	90.090	28.137	0.560	6854	4920	5759	88	54	1	242	Pho Chhu
677	G090219E28132N	PPhgr16_297	90.219	28.132	9.236	6874	4307	5411	88	25	0	158	Pho Chhu
678	G090107E27986N	PPhgr16_350	90.107	27.986	0.115	5340	5168	5249	49	20	1	257	Pho Chhu
679	G090164E28031N	PPhgr16_336	90.164	28.031	0.098	5342	5119	5210	69	34	3	199	Pho Chhu
680	G090041E28125N	PPhgr16_277	90.041	28.125	2.566	6231	4672	5341	78	36	0	203	Pho Chhu
681	G090018E28137N	PPhgr16_274	90.018	28.137	0.928	6616	5067	5578	78	38	1	228	Pho Chhu
682	G089837E27904N	PPhgr16_184	89.837	27.904	0.027	5070	4983	5027	39	23	3	277	Pho Chhu
683	G089841E27906N	PPhgr16_183	89.841	27.906	0.057	5266	4991	5127	74	40	5	109	Pho Chhu
684	G090211E27898N	PPhgr16_375	90.211	27.898	0.088	5258	4988	5108	52	26	7	279	Pho Chhu
685	G090218E27811N	PPhgr16_388	90.218	27.811	0.104	5140	4930	5025	68	32	3	260	Pho Chhu
686	G090237E27825N	PPhgr16_387	90.237	27.825	0.051	5163	5044	5096	58	26	5	283	Pho Chhu

687	G090267E28049N	PPhgr16_320	90.267	28.049	0.029	5361	5239	5304	51	24	2	282	Pho Chhu
THIM CHHU SUB BASIN													
688	G089426E27677N	WThgr16_38	89.426	27.677	0.024	5555	5339	5461	62	37	6	78	Thim Chhu
689	G089413E27714N	WThgr16_36	89.413	27.714	0.647	5325	5063	5167	56	15	1	66	Thim Chhu
690	G089421E27728N	WThgr16_35	89.421	27.728	1.371	5607	5108	5271	61	13	0	100	Thim Chhu
691	G089530E27749N	WThgr16_41	89.530	27.749	0.184	5418	5145	5286	59	28	1	249	Thim Chhu
692	G089535E27758N	WThgr16_42	89.535	27.758	0.175	5317	5138	5222	45	14	0	71	Thim Chhu
693	G089427E27670N	WThgr16_39	89.427	27.670	0.830	5581	4937	5259	74	25	0	89	Thim Chhu
694	G089412E27699N	WThgr16_37	89.412	27.699	0.564	5314	5068	5179	69	18	0	83	Thim Chhu
695	G089560E27787N	WThgr16_44	89.560	27.787	0.232	5704	5407	5563	82	40	1	161	Thim Chhu
696	G089555E27787N	WThgr16_43	89.555	27.787	0.173	5662	5294	5499	62	31	3	184	Thim Chhu
697	G089567E27787N	WThgr16_45	89.567	27.787	0.108	5613	5445	5529	77	33	1	204	Thim Chhu
698	G089575E27786N	WThgr16_46	89.575	27.786	0.268	5777	5484	5651	73	33	1	186	Thim Chhu
699	G089575E27782N	WThgr16_47	89.575	27.782	0.103	5492	5161	5338	72	42	3	229	Thim Chhu
700	G089481E27770N	WThgr16_40	89.481	27.770	0.043	5349	5205	5298	51	27	2	271	Thim Chhu

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