FINAL REPORT – Glacier expedition in the Langtang Valley, Central Nepalese Himalaya

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Research Assistant: Ms. Manisha Buda Magar, alpinist and climber
Mountain Guide: Mr. Tula Magar, a lead mountain guide from Himalayan Research Expedition (HRE)

Content: This field campaign was conducted from 11- 29 November 2025 in the Langtang Valley, Central Nepal as a part of my PhD project which aims to quantify the controls on, influences, and impacts of glacier disconnection and fragmentation on ice masses in the Himalaya. Fieldwork and field data are key components of my PhD project as they will enable me to: i) ground-truth and validate remote sensing-based inventories of structural, glaciological, and geomorphological features, as well as monitor glacial changes ii) collect in-situ data (climatic variables and melt runoff) and glacier parameters (e.g. snow, firn, and ice density; melt and radiation factors) that are crucial for parameterizing, running, and validating the glacier surface energy mass balance (SEMB) model. The validated structural, glaciological, and geomorphological mapping datasets and the glacier surface-energy-mass balance model informed by field data are key steps for identifying the occurrence and drivers of glacier fragmentation and disconnection and for assessing their impact on glacier mass balance and ice flow dynamics. Langtang Valley has been selected due to its established role as a key site for glacier research in Nepal, its relatively easy access to multiple glaciers, and the prevalence of glaciers exhibiting clear signs of fragmentation and disconnection.

1. Aims and objectives of the work, briefly setting these in the wider context of relevant knowledge of the subject.

The major objectives of the fieldwork were:

- To conduct the second phase of detailed dGPS and drone surveys of the glaciers that have undergone disconnection and fragmentation (Lirung, Yala, and Langshisha, identified from satellite imagery mapping and field survey conducted in November 2024).
- To collect in-situ data including climatic variables, melt runoff, and glacier parameters (e.g. snow, firn, and ice density, melt and

radiation factors, snow water equivalent), which are important inputs to parameterize and simulate the glacier SEMB model.

- To install stake networks on the glaciers and ice-cliffs to measure the melt rates, acumulation, and glacier surface velocity and use these measurements for validating the glacier SEMB model and comparing with satellite derived glacier velocity.
- Install low-cost time lapse cameras and radiation sensors on the glacier to monitor real time and continuous changes of ice cliffs, exposed bed rocks, and changes in radiation regimes of glaciers and utilize these data to assess their contributions to total glacial wastage.
- Perform glacier-wide SEMB modelling informed by high resolution DEM and field datasets to quantify the impacts of glacier disconnection and fragmentation on glacier mass balance and ice-flow dynamics.

2. Summarise how well things went, what worked, and what failed. Explain the extent to which you were able to make useful observations or collect sufficient data to address the aims.

The fieldwork was largely successful, with most primary objectives achieved. UAV surveys of Lirung Glacier were completed at both the beginning and end of the fieldwork period. This provides comprehensive repeat coverage of the ice cliff that will help in generating DEM and useful in computing icecliff backwasting. Ice cliff melt data were collected over 2–5 days at both Yala and Lirung Glaciers, and snow depth and density measurements were obtained from Yala Glacier. These data that will be valuable for parameterising and validating the surface energy and mass balance model.

However, a few objectives could not be fully completed. UAV surveys of Yala and Langshisha Glaciers were not possible due to persistently cold and windy conditions over 2–3 days. Continuous monitoring of the terminus ice cliff at Lirung Glacier was also unfeasible, as the laser scanner required for this purpose was unavailable at the university during the fieldwork period. An extensive survey of Yala Glacier's accumulation zone could not be completed due to reduced team capacity — one team member required evacuation following a severe illness, later diagnosed as appendicitis, which significantly constrained available human resources during a critical phase of the fieldwork.

Despite these setbacks, the data collected are sufficient to address the core research aims, and the incomplete objectives have been identified for follow-up in future fieldwork seasons.

3. A map of the area visited showing your travel route and location of the main sites of sampling, measurements or observations. We suggest also including a table listing the geographic coordinates of these field sites, with an indication of how much and the types of data recorded per site.

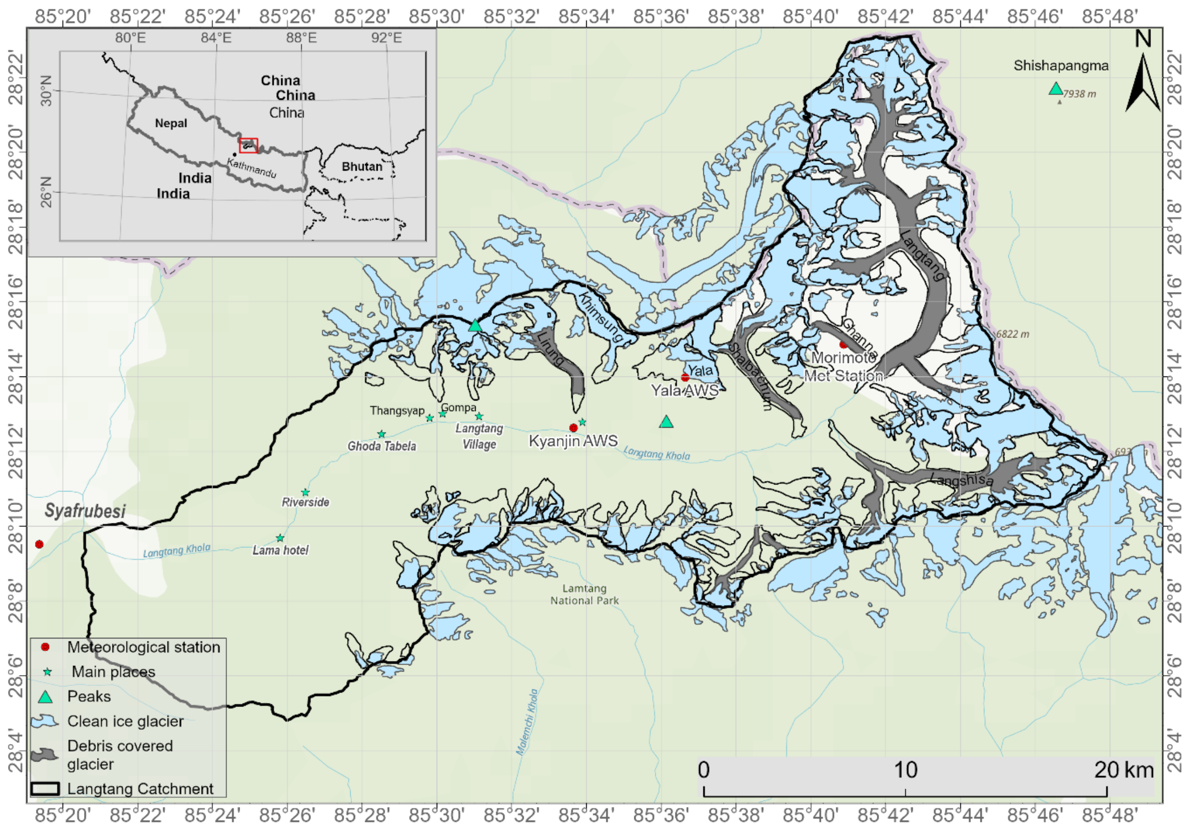


Figure 1. Map of the Langtang Catchment, central Nepal Himalaya, showing the distribution of clean-ice (light blue) and debris-covered (grey) glaciers, major settlements, meteorological stations (red circles), and prominent peaks (green triangles). The catchment boundary is delineated by a bold black line. Key glaciers including Lirung, Langtang, Langshisha, and Yala are labelled, alongside major settlements such as Kyanjin, Langtang Village, and Syafrubesi along the Langtang Khola valley.

Table1. The details of the geographic locations and data collected

Glacier	Latitude	Longitude	Altitude	Glacier type	Data collected	Remarks
Yala	28.236	85.618	5338	Clean ice	UAV survey, ice cliff melt	Ice cliff melt data for 2 days
Lirung	28.252	85.547	4341	Debris-covered	UAV survey, ice cliff melt	UAV survey completed, melt data of 5 days
Ghanna	28.256	85.672	4908	Debris-covered	-	-

Langtang	28.293	85.711	4932	Debris-covered	-	-
Shalbachum	28.246	85.634	4621	Debris-covered	-	
Langshisha	28.188	85.742	4877	Debris-covered	UAV survey conducted in Nov 2024	UAV survey was not possible this year because of the unfavourable weather conditions

4. Field photographs of the phenomena investigated, including any of interesting observations or samples that might be of interest.

Photo1. Team ready for Lirung Glacier survey

Photo2. Navigating snowy terrain to Yala Glacier

Photo 3. Stake installation at one of the ice cliffs on Yala Glacier at 5250 m asl

Photo 4. dGPS survey at Lirung Glacier ~4000 m asl

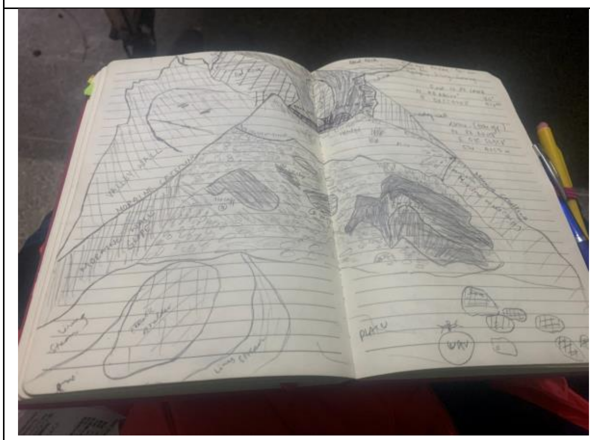


Photo 5. Taking notes of some important features of glacier observed during the survey

Photo 6. Drone survey of the terminus ice-cliff of Lirung Glacier ~4100 m asl

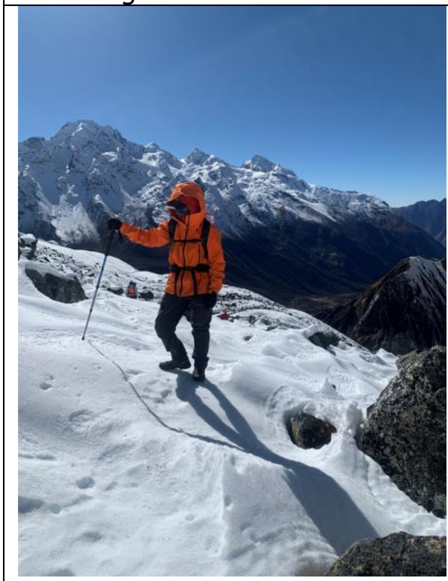
 Photo 7. stake installation at the ice-cliff of Lirung Glacier	 Photo 8. Taking notes during a rest time
 Photo 9. Traversing Yala Glacier	 Photo 10. Setting up drone at Lirung Glacier

Photo 11. Research assistant (Manisha) and mountain guide (Tula) helping me bring equipment and stakes to Lirung Glacier.

Photo 12. Research assistant (Manisha) and mountain guide (Tula) installing stakes at one of the ice cliff sections.

Photo 13. Measuring the height of debris boulder at Lirung Glacier

Photo 14. Sharing a dinning tent with colleagues from ICIMOD at Yala basecamp ~5100 m asl

Photo 15. Stake installation and noting GPS points with handheld GPS at Yala Glacier's ice cliff and

Photo 16. Checking Timelapse camera installed at the terminus moraine of Lirung Glacier

Photo 17. Photo at automatic weather station (AWS) at Yala Basecamp after checking the conditions and retrieving data from it.

Photo 18. Measuring snow depth at Yala Glacier's accumulation area ~5400 m asl

Photo 19. Camp at Yala Lower Base camp ~4900 m asl

Photo 20. Nice and clean snow pit to measure snow profile, depth, and density

Photo 21. Team heading back to Kyangjin Gompa after completing work at Yala Glacier

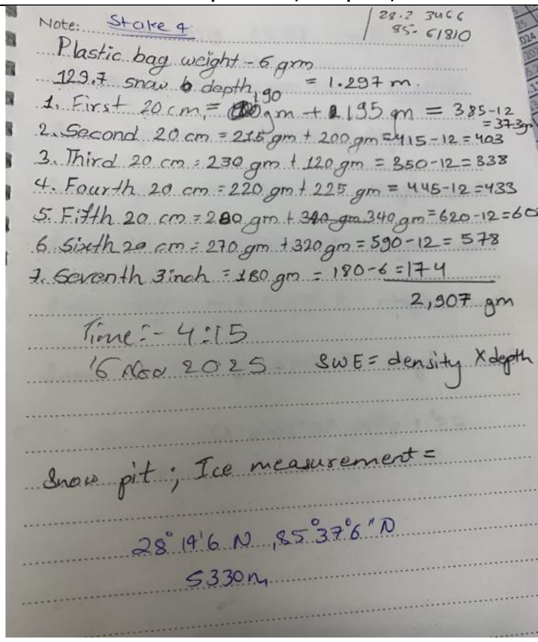


Photo 22. Some notes of snow depth and density measurements

 Photo 23. An aerial view of Kyangjin Gompa (~3900 m asl), a high-altitude settlement that serves as the gateway to the upper Langtang Valley.	 Photo 24. A major development in the Langtang Valley ~20-megawatt hydropower plant already in the final stage of completion which will be connected to the national gridlines.

5. Provide a summary of the findings and conclusions with sufficient level of information (graphs, tables, photos) to support the conclusions made. If already reported or published elsewhere, feel free to repeat or refer to this, providing bibliographic information and include an electronic copy with this report.

The field data collected during this campaign is currently under processing and analysis. These data and results will form one of my PhD chapters which will be published in peer reviewed journal upon completion.

Furthermore, specific geomorphological datasets derived from this year and last year glacio-geomorphological surveys have been analysed and made a section in manuscript 'Glacier changes in the Langtang Catchment from LIA to 2023 CE' is currently in the peer-review and revision stage with a Global and Planetary Changes Journal. As soon as this work is formally published, the digital object identifier (DOI) will be promptly provided to the MEF for their records.

In addition, some preliminary research findings from our initial analysis are:

1. High-Resolution Topographic Modelling and digital elevation model (DEM) of terminus ice cliff of Lirung glacier from the UAV drone images from this year survey. The raw imagery was processed using licensed Agisoft Metashape software, employing a Structure from Motion (SfM) photogrammetric workflow.

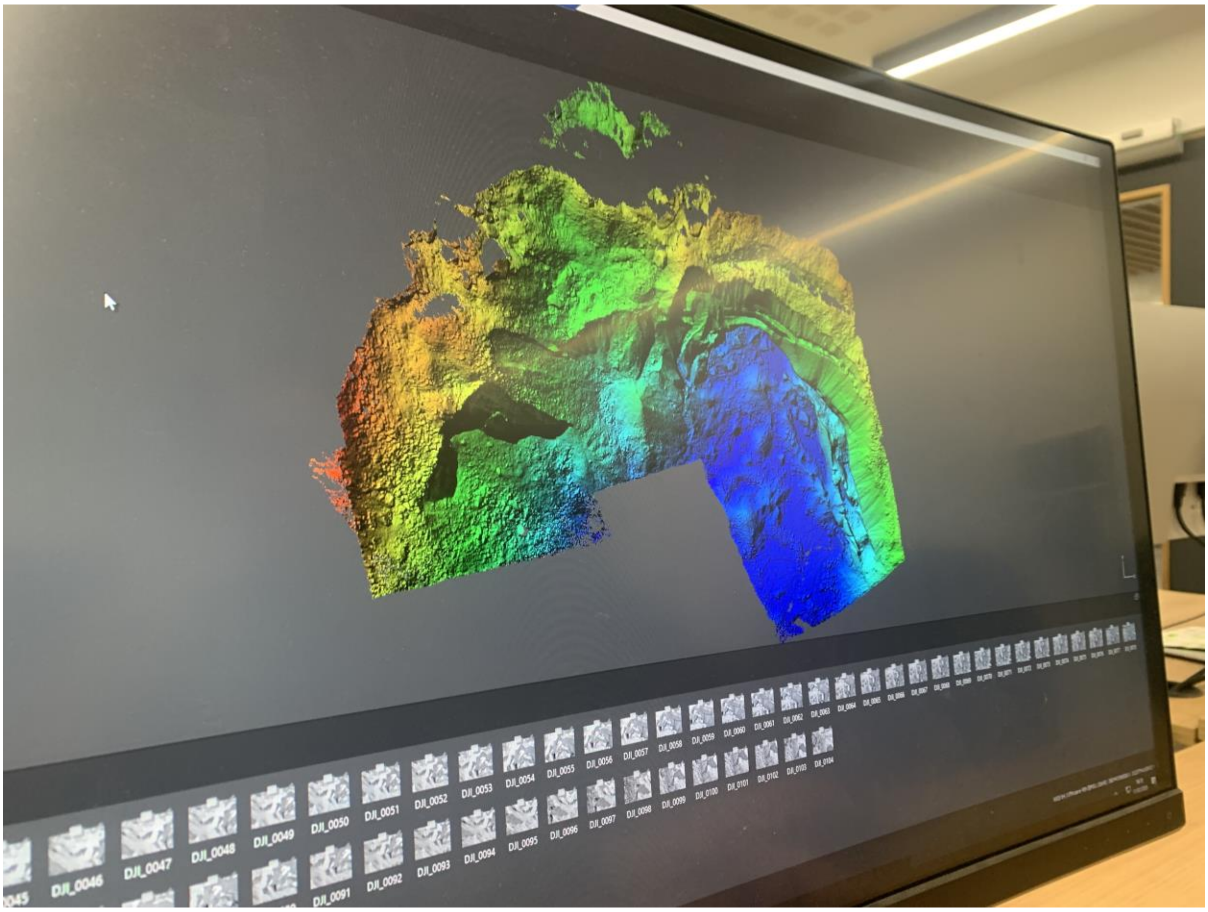


Figure 2. Processing of drone footages in structure from motion (SFM) workflow in Agisoft software to generate high resolution digital elevation model (DEM) of Terminus ice cliff of Lirung Glacier. This DEM will later be utilized to compute ice cliff surface energy balance.

2. Processing of snow depth, density, and snow water equivalent (SWE) and glacier mass balance of Yala Glacier: the preliminary results of snow depth, density and snow water equivalent (SWE) are presented in Table 2.

Site	Latitude (°)	Longitude (°)	Altitude (m)	Average depth (m)	Average density (kg m^{-3})	Average SWE (mm w.e)
Stake 3	28.234	85.617	5295	1.297	213	277.17
Stake 4	28.235	85.616	5325	1.5	270	405
Stake 5	28.236	85.620	5371	1.13	255	288.15
Stake 6	28.235	85.621	5400	1.12	216	241.92
Stake 7	28.234	85.623	5460	1.56	240	374.4
Stake 8	28.234	85.624	5482	1.6	215	344

The snow depth and density data will be used for surface energy balance (SEB) model calibration and validation, and the SWE data will be used for calculating annual mass balance at Yala Glacier.

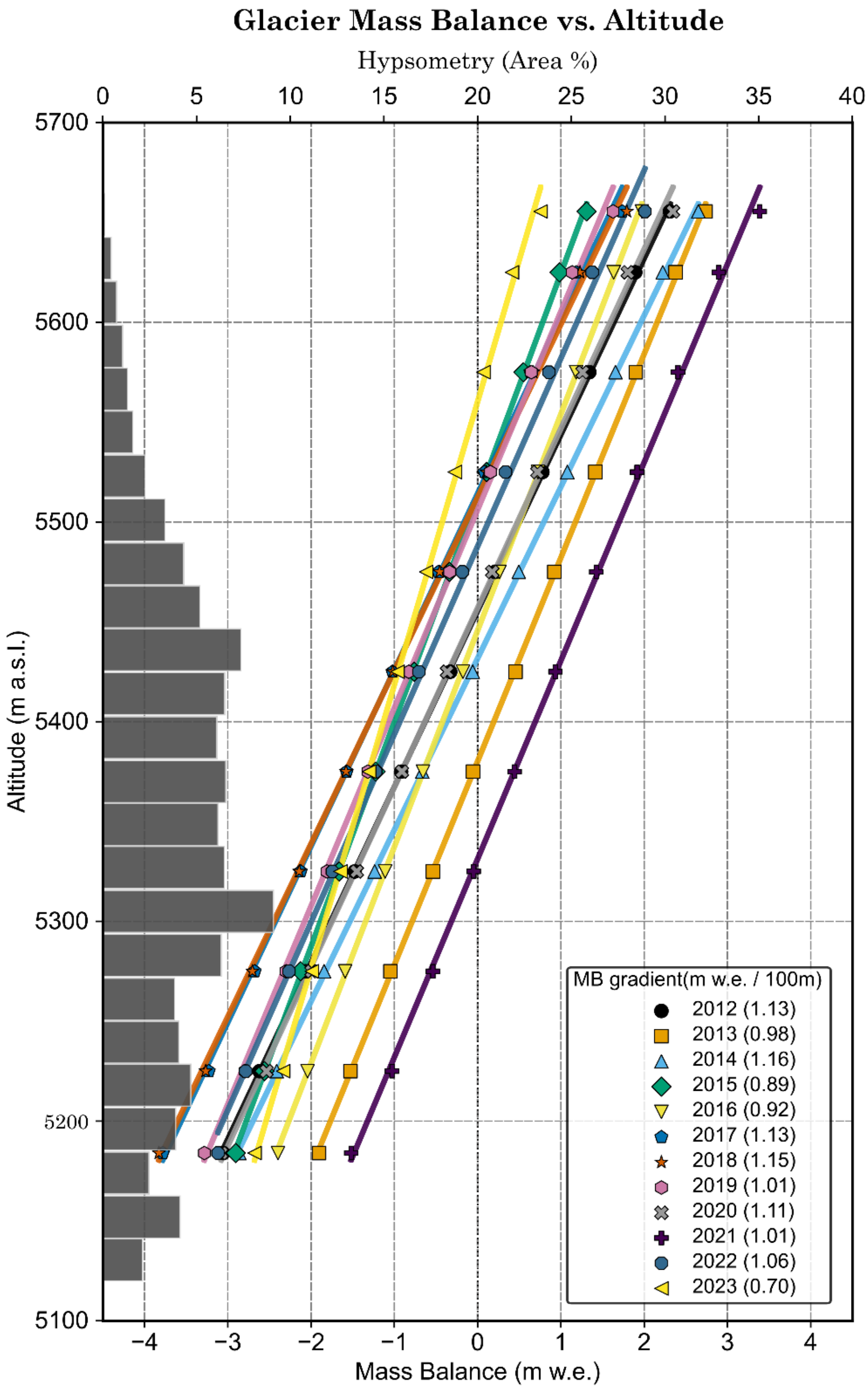


Figure 3. Annual mass balance from 2012 to 2023 at Yala glacier based on the traditional glaciological method using stakes and snow pit measurements.

3. Processing of meteorological datasets from automatic weather stations in the Langtang valley.

I am still processing the raw meteorological data retrieved from a few meteorological stations in the Langtang valley. The meteorological data will form an input forcing to run the point and distributed surface energy balance model for Yala and Lirung Glaciers.

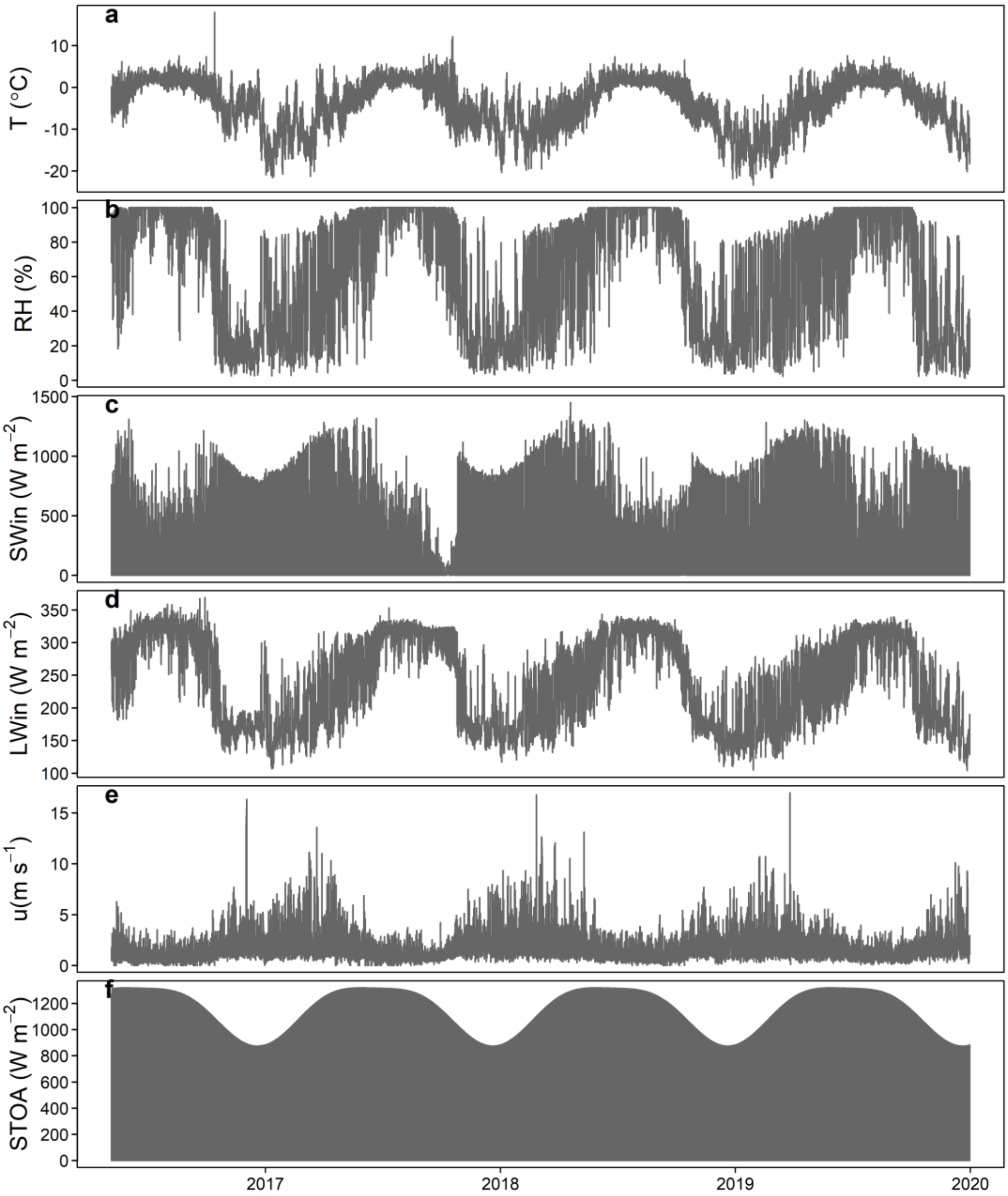


Figure 4. Different meteorological components measured by the automatic weather station at Yala-on-glacier site at ~5350 m asl from May 2016 to November 2019. These data will be analysed properly, check for any gaps and errors before utilizing for the SEB calculation at point scale and glacier wide.

6. If the research has not yet been completed, provide a timeline and plan of when it is likely to be completed, and specify who is responsible for this.

The research is currently in progress, with a projected completion date of September 2027. As this work constitutes my doctoral dissertation, I am the lead investigator responsible for the project’s execution and timely delivery.

7. If publications are still pending, tell us of your plan for publications (i.e. which journals and when), and provide copies when they become available.
A manuscript titled 'Glacier changes in the Langtang Catchment from LIA (~1815 CE) to 2023 CE' is currently under peer review with *Global and Planetary Change Journal*. Concurrently, a second paper integrating field-derived data to calibrate and validate glaciological models is in preparation and will be submitted to *Journal of Glaciology in near future*. Upon publication, DOIs and full-text copies of both works will be provided to the MEF by the lead author.

8. Notes on access or other issues of interest to future visitors.
This report is available to anyone who finds the information relevant. For further inquiries or detailed discussion regarding the fieldwork and data, please feel free to contact me directly.

9. Details of any injury or illness to expedition members and/or porters.
No injuries or misfortunes occurred within our team during the expedition. However, a colleague from ICIMOD was rescued from the Yala basecamp due to a medical emergency, later confirmed to be appendicitis.

10. Details of waste disposal.
To maintain environmental integrity throughout the expedition, we strictly adhered to the regulations set by the Department of National Parks and Wildlife Conservation (DNPWC) of the Government of Nepal. All waste generated during our camping at Yala Basecamp was transported to Kyangjin for disposal at designated facilities, while trashes produced during trekking was secured in personal backpacks until it could be deposited in authorized bins. Under our direction, the trekking agency employed leak-proof containers for the collection of all food and human waste, which were then securely transported to Kyangjin for proper disposal. We prioritized resource efficiency and minimal impact by installing only essential equipment. Furthermore, we mitigated ecological disturbance by strictly following established trails to protect vegetation and soil, avoiding wildlife habitats, and ensuring that no chemical contaminants were introduced into the glacier or local water systems.

11. Elaborate on the summary, the journey and interesting discoveries or events, the team dynamics in achieving or not the original plan, weather,

and anything else that made the journey and the expedition memorable both for yourselves, but what might help those in the future seeking other objectives in the area.

Overall, this field expedition was a success. Despite the challenges posed by heavy snow accumulation following Cyclone Montha in late October, which delayed our fieldwork by a few days, we achieved the majority of our objectives. We successfully collected several days of melt data from two ice cliffs and completed comprehensive measurements of snow depth, density, and snow water equivalent (SWE) at every stake location on the Yala Glacier. While persistent high winds precluded the planned UAV survey on Yala Glacier, the expertise of my research assistant and mountain guide ensured that all other tasks were completed efficiently. The fieldwork at Lirung Glacier was successful, I was able to conduct UAV survey twice (one on 14th November before heading to the Yala Glacier and the other on 20th November, after coming back from the Yala Glacier), install stakes at ice cliff and collected 5 days' worth of ice melt data. A significant highlight of the trip was the opportunity for knowledge exchange; I engaged our local team in discussions regarding glaciological monitoring and the critical long-term impacts of climate change on Himalayan water resources. These in-situ datasets now provide a robust baseline for my upcoming chapters on energy-mass balance modelling.

Beyond the data collection, my observations along the valley revealed a rapidly changing landscape. The frequency of snow and rock avalanches has increased significantly, and I encountered numerous fresh landslides throughout the route. These conditions made me aware that mountain environments no longer offer risk-free zones, for scientists and trekkers alike, every decision carry weight. Even with comprehensive rescue and evacuation insurance, the logistical and financial costs of accidents are rising, so taking extreme caution and being vigilant is extremely important.

Establishing strong collaborations with local institutions is a strategic advantage that significantly enhances the efficiency and success of high-altitude research. These partnerships streamline the bureaucratic process, particularly when navigating the complexities of securing research and fieldwork permits from national organizations. Beyond administrative support, such alliances allow for the optimization of resources and budgets through the sharing of specialized equipment, which often eliminates the logistical burden of transporting heavy gear internationally.

Furthermore, the indigenous expertise and site-specific knowledge held by local partners are invaluable. Their deep understanding of the local terrain, weather patterns, and community dynamics ensures that expeditions run smoothly and safely. By integrating local insights with academic rigor, researchers can more effectively navigate logistical hurdles and foster positive relationships with the communities residing in the study area.

12. A calculation of the carbon footprint of the expedition. Provide a summary of any carbon offsetting you undertook, and how you addressed any cultural impact during the expedition.

The expedition involved flying from London to Kathmandu, Nepal and taking local transport train (within the UK), buses and jeep to get to Syafrubesi. Approximately the expedition produced about ~4,480 kg CO_2e, calculated based on ISO 14064-1- A global standard for quantifying and reporting GHG emissions and removals at the organizational level.

12. A summary of expedition accounts, travel, accommodation etc, itemising wages of porters or mule men.

The summary of expedition accounts, travel, accommodation are shown in Table 3.

SN	***Items***	***No of item/ Pax***	***No of Days/ Times***	***Per/Rate (NPR)***	***Total (NRs.)***	***Total cost (GBP)***	***Remarks***
A.	**Trekking Cost**						
1	Food & Accommodation: (BLD, Tea, Coffee, snacks/ boild water and lodge) Tea House	2	10	11000	220,000.00	1260	Food as per lodge menu (For me and a research assistant)
2	Food & Accommodation: (BLD, Tea, Coffee, snacks/ boiled water and lodge) Camping	2	5	12500	125,000.00	715	Camping food & tent sleep
3	Professional Guide	1	15	4000	60,000.00	350	Registered 1 guide is mandatory
4	Porters	2	15	2500	75,000.00	430	field assistants
5	Food & lodge for field staffs	3	10	1000	30,000.00	170	Guide/Porter in Teahouse days
					510,000.00	**2550**	
B.	**Transportation**						
1	Kathmandu to Shyaphrubesi or ahead	1	2	25000	50,000.00	285	Cost shared with ICIMOD colleagues
					50,000.00		
C.	**Permits**						
1	Langtang National Park Entree Permit	1	1	3500	-	-	Foreigner only

2	TIMS	1	1	2500	-	-	Foreigner only
3	Research Permit	1	1	0	21000	150	Department of National Park and Wildlife conservation Office, for drone and research permit (no Vat for this)
D.	**Additional Cost**						
1	Kathmandu Purchase	1	1	0	-		If you need anything
3	Staff tips	9	1	0	30000	175	Given as per the rates/no vat for this
4	Research assistant fee	1	15	5000	**75000**	430	No vat for this one
	Total of A,B,C, D				**560,000.00**		
	VAT (13%)				632800	416	13% VAT is mandatory
	Total cost					**4380**	

Regarding the total expenditures, a grant of £2,000 from the MEF was utilized to cover approximately 50% of the operational costs detailed above. The remaining balance, including international airfare and supplemental field expenses, was funded through a combination of my OnePlanet DTP research fieldwork grant and a supplementary grant from the Quaternary Research Association (QRA).

Timing: The actual expedition took place from 11-29 November 2025. I arrived early in Kathmandu ~22nd October 2025 for fieldwork arrangements and planning and preparation. The itinerary of the fieldwork is given in the Table 4.

Date	**Destination**	**Travel /Sleep**	**Sleeping Altitude**	**Task**	**Fieldwork days**	**Number of days**
20/10/2025	Newcatle-London-Kathmandu(KTM)	Travel				
21/10/2025	KTM	Travel				
22-25/10/2025	KTM	Home	1500 m	Celebrate Tihar with family		
26/10/2025	KTM	Home	1500 m	Visit KU to gather equiment and field gear/ meeting with research assistant		
27/10/2025	KTM	Home	1500 m	Visiti KU to gather field equiopment and meet people		
28/10/2025	KTM	Home	1500 m	Renew research permit at DNPWC		

29/10/2025	KTM	Home	1500 m	Meet with Walter's team		
30-31/10/2025	KTM	Home	1500 m	Test and organize gear and equipment/ collect research permits		
1/11/2025-10/11/2025	Kathmandu/ KU/ICIMOD	Home	1500 m	Fieldwork preparation and other work.		
11/11/2025	KTM to Syafrubesi	Syafru besi	1400 m	Travelling (5-6 hours on a Jeep)/ organization	1	
12/11/2025	Syapfrubesi to Lama Hotel	Trek/G uestho use	2500 m	7-8 hours trek (task, gear Organization/ observation Langtang River System, gather bamboo stakes)	2	
13/11/2025	Lama Hotel to Lantang	Trek/G uestho use	3500 m	6-7 hours trek (organization/ observation and make notes)/ get bamboo stakes	3	
14/11/2025	Langtang to Kyangjing	Trek/G uestho use	3860 m	3-4 hours trek (organization, accilimitize, visit to Kyangjing AWS station, sort out the bamboo stakes, test equiment/ meeting with Gyalbu Sherpa for porters and arranging logistics during camping at Yala (Hotel Hollyland)	4	
15/11/2025	Kyangjing to Lirung Glacier	Trek/G uestho use	3860 m	1 hour trek (glacio-geomorphological Survey GPS, drone, install bamboo stakes (ice cliff and on debris)	5	
16/11/2025	Kyangjing to Lirung Glacier	Trek/G uestho use	3860 m	1 hour trek (glacio-geomorphological Survey GPS, drone, install bamboo stakes (ice cliff and on debris)	6	
17/11/2025	Kyangjing to Lirung Glacier	Trek/G uestho use	3860 m	1 hour trek (icecliff monitoring), log measurement (hourly)	7	
18/11/2025	Kyangjing to Lirung Glacier	Trek/G uestho use	3860 m	1 hour trek (debris monitoring), log measurement (hourly)	8	
19/11/2025	Kyangjing to Lirung Glacier	Trek/G uestho use	3860 m	1 hour trek (icecliff monitoring), log measurement (hourly)	9	
20/11/2025	Kyangjing to Lirung Glacier	Trek/G uestho use	3860 m	1 hour trek (debris monitoring), log measurement (hourly)	10	
21/11/2025	Kyangjing to Yala BC	Fieldow ork/Ca mp	5100 m	4-5 hours trek (sort and organize, dGPS Survey)	11	
22/11/2025 to 16/ 25/2025	Yala Glacier	Fieldow ork/Ca mp	5100 m	ice cliff glacier survey, install bamboo stakes on ice cliffs and on ablation zone and log measurements/ carry drone survey	12-16	
26/11/2017	Yala Glacier to Kyangjin	Trek/ Guesth ouse	3860 m	3 hours trek down to Kyangjing (Organize and field gear, equipment, field notes),	17	
27/11/2017	Lirung Glacier	Trek/ Guesth ouse	3860 m	Visit Lirung Glacier and collect final data from the stakes	18	
28/11/2025	Kyangjing to Rimche	Trek/ Guesth ouse	2500 m	8 hours trek	19	

29/11/2025	Rimche to Syapfrubesi	Bus/jeep/ Hotel	1500 m	5-6 hours trek (sort equipment and gear)	20	
30/11/2025	Syapfrubesi to Kathmandu	Home	1300 m	5-6 hours by jeep	21	
01/12/2025 to 04/12/2025	Kathmandu	Home		sort equipment and handover to respective organizations/ Work from home/ visit KU/ TU/DHM/ICIMOD	22-24	
05/12/2025	Newcastle	Travel		Back to Newcastle		
				Total days away from Newcastle	**11+30 +4**	**45**
				Total number of days in the field	**21**	
				celebration of festival and spend time with family	**10**	
				Travel days	**5**	
				Meeting/organizing/sorting/ research permit	**9**	

Acknowledgement: A huge thank you to MEF, OnePlanet DTP, QRA for providing funds to support my fieldwork.

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