# Drones to study Himalayan glaciers

*Drone pilots and field visit team going towards the glacier*


*Orthophotomap of  a section of the Ponkar Glacier*

| OVERVIEW | |
|---|---|
| **Flying Labs** | Nepal Flying Labs |
| **Geographic area** | Bhimthan, Manang, Nepal |
| **Date** | November 2019 |
| **Sector program** | EcoRobotics |
| **Main SDG** | Goal 13: Climate Action<br>Goal 15: Life on Land |

| SCOPE | |
|---|---|
| **Project stakeholders** | Aberystwyth University, Kathmandu University, Tribhuvan University, Sikkim University |
| **Beneficiaries** | Team of researchers from the above mentioned academic institutions |
| **Challenge** | Glaciers in the Hindu Kush Himalayas (HKH) serve as a major source of water in the region's rivers. They also provide clear climate change indicators and are essential to understand future water availability for downstream communities. Sadly, the glaciers in the Hindu Kush Himalaya Region are melting as a result of climate change, thus it is important to study their rate of melt. However, surveying glaciers from the ground is not only very difficult, but also highly dangerous. |
| **Scope** | Nepal Flying Labs teamed up with researchers to work on glacier monitoring using drones. Obtaining high resolution surface models of the glaciers from drone-acquired images would allow to accurately calculate the elevation of glacier surfaces. The same data acquisition and mapping work, if done over multiple times over different periods of time, would help to understand the nature and the amount of change in the glacier volume. |
| **Outcome** | The team obtained high-resolution images to further study the glacier volume by comparing it with the previously captured data. The data is used to figure out the rate of change of ice volume compared to previous years.<br><br>The project team experienced flying a drone at such high altitudes, which caused a significant reduction in flight endurance, difficulty for pilots in physically reaching the planned take-off points, and broader instability issues due to strong winds in the late morning - often requiring the team to start as early as 5 am. These issues significantly limited the coverage area for the done platform, resulting in a three days long survey. |

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| **Impact** | The success of the 2019 Ponkar expedition showed the potential for drones in the mapping of high-altitude glaciers. The collected data will allow calculating the rate of melt of these glaciers over a period of time. |
| **Next steps** | The research team will continue collecting data on a regular basis and summarize the findings in a research publication. The research team will map the area again as per the need and scope of the project.<br><br>Nepal Flying Labs would like to introduce drones into more of these types of projects to more accurately map the glaciers and to better understand the effect climate change is having on them. |

| **COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT** | |
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| **Consent for data acquisition** | The project team acquired permissions to fly drones over the glacier area from the district administration office. Since there were no communities nearby, we only consulted with the local government officials to acquire the permissions. |
| **Activities to engage with the community** | Not Applicable |
| **Community groups engaged with** | Not Applicable |
| **Community attendance** | Not Applicable |
| **Community feedback** | Not Applicable |
| **Stakeholder support** | The team provided drone technical support by successfully operating the drone in an extremely cold environment and producing the data outputs such as raw data and orthophoto. |

| **DATA ACQUISITION** | |
|---|---|
| **Size of area** | 4 sq km (400 ha) |
| **Drone** | DJI Phantom 4 Pro |
| **Sensor(s)** | Phantom RGB camera |
| **Flight plan software** | Pix4Dcapture |
| **Flight height** | 120 m above ground level |
| **GSD (Accuracy)** | 5.38 cm/pixel |
| **Number of images acquired** | 1110 |
| **Number of flights** | 5 |
| **Time invested in data acquisition** | 2 days |
| **Georeferencing** | Yes (onboard GPS) |

| DATA PROCESSING & ANALYSIS | |
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| **Processing software** | Pix4Dreact |
| **Processing time** | 150 minutes |
| **Data products** | Raw Images, orthophoto |
| **Analysis tools** | N/A |
| **Analysis outputs** | N/A |
| **Final outputs shared with stakeholders** | Raw data along with orthophoto |
| **Data sharing** | SD card as well as Google Drive |