IITB-Monash Research Academy

An Indian-Australian research partnership

Indian Institute of Technology Bombay | MONASH University

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Project Title: **Modelling Glacier Stored Volume in Eastern Himalayas using Remote sensing Datasets**

Project Number **IMURA0351(a)**

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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(*Feel free to nominate more than one. For more information, see www.iitbmonash.org)*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. **Water**
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Define the problem

Estimation and measurement of glacier depth and volume is an essential parameter to understand impact of climate change. This can influence environmental, economic and political issues in the Himalayan and surrounding region. Depth of Himalayan glaciers and its spatial distribution is important to understand hydrological cycle and also to assess evolution of Himalayan landscape. This can also help in assessing potential of sources of disasters.

Different techniques have been used to estimate glacier thickness and volume. In the Himalaya, hardly any

measurement is made using Geophysical methods. Therefore, the estimates based upon approach called Volume Area Scaling are extensively used (Chen and Ohmura, 1990; Bahr et al., 1997). Where, volume is estimated using surface area and empirical constants. However, different authors have given different empirical constants (Cuffey and Paterson, 2010; Chen and Ohmura, 1990; Chaohai and Sharma, 1988; Bahr, 1997, Bahr et al., 1997; and Arendt et al., 2006), causing large variation in estimate of glacier stored water. These methods suggests total glacier stored water in the Indian Himalaya is 3600 to 4400 Gt (Kulkarni and Karyakarte 2014). However, these estimates give only amount of glacier stored water and methods cannot be used to estimate spatial distribution of glacier depth. Spatial distribution is important to assess changes in glacial extent due to climate change also to map bottom topography. Bottom topography is an important variable to assess formation of moraine dammed lakes and possible flash flood.
Considering these drawbacks, it is planned to use surface velocity based approaches for estimation of glacier stored water and map bottom topography using optical, SAR datasets.

Project aims

Define the aims of the project

- Development of a model to estimate spatial distribution of glacier depth and volume in Eastern Himalayas.
- Observations and validation of glacier velocity and depth using GPS and GPR respectively in selected study glaciers.
- To assess glacier stored water in Eastern Himalayas using Optical, SAR, and GRACE datasets.
- To assess the future glacier stored water using inputs from various climate models.

Expected outcomes

Highlight the expected outcomes of the project

1. Estimation of present glacier stored water volume in the study area with less uncertainty band.
2. Basin and sub-basin wise estimates of water availability in the selected glaciers of Eastern Himalayas.
3. Future volume estimation of glacier stored water using climate model outputs.
4. One of the outcomes of the project will be to better understand the impact of climate change on glacier ice volume.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

One of the major outcomes would be quantification of glacier stored water. Changes in glacier volume are important for questions linked to sea-level rise, water resource management, and tourism industry. With the ongoing climate warming, the retreat of mountain glaciers is a major concern. Outcomes of the project would certainly give a reliable estimate of the current state of glacier stored water in Himalayas. The results would help in formulating mitigation and adaptation strategies for effective usage of melt water resources and protecting the livelihoods of people depending on the glacier fed rivers etc.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

Academic Qualifications:

Masters in Engineering/Technology with specialization in any of the following areas: Remote sensing/Geo-informatics

Minimum Skills Required: Good knowledge in statistics, excellent programming skills in FORTRAN / C /C++/ Matlab.

Desirable: previous experience of working in glacier related problems