

## Field Training Course in Glaciology: For Promoting Basic and Application Oriented Techniques – Tripti Jayal, National Institute of Hydrology, Roorkee, (E: [triptijayal@gmail.com](mailto:triptijayal@gmail.com))

Glaciers are not only tourist attractions in mountainous regions, but also a natural resource and people across the world rely on glacial melt for their water for part of the year. It is imperative to say that in late summer a significant part of the river flow comes from melting of glaciers as many rivers coursing through India, China and other parts of the Asian continent are fed primarily by the snowmelt. Residents of Bolivia and La Paz in South America, rely on glacial melting from a nearby ice cap to meet their water requirements during significant dry spells at times.

The changing climatic scenario, in particular global warming, across the world has raised a major concern over the impact of melting of glaciers and subsequent rise in sea level. The Himalayan region has both strategic as well as climatic importance. It has become a focus of research interest in the field of glacier dynamics and its impact on hydrology of the highly-populated watersheds downstream. In order to fulfill the objective, a systematic and regular monitoring of the glaciers is needed. This would not only fulfill the scientific purpose but would also improve the knowledge about the importance of water resources to the society.

For carrying out scientific studies of the glaciers, proper knowledge and training is required. Very few organizations in India are engaged in training programs on glaciers. Here DST is playing a major role by funding organizations like Jawaharlal Nehru University, New Delhi (Indo-Swiss Training Program 1<sup>st</sup>/2<sup>nd</sup> with level 1 and 2) and Devicha Center of Climate Change, ISC Bangalore (Climate change and Remote Sensing), but major work is being done by Geological Survey of India (GSI). It is the pioneer in developing and implementing new concepts and theories intended to develop expertise in the field of glaciology. Since the beginning (4<sup>th</sup> January, 1974) of Glaciology division at Lucknow, GSI has established strong knowledge base in the various aspects of the glacier studies. The GSI, with the help of its glowing past experience and available expertise, has successfully organized scientifically-designed training programs that no other Indian university has done in the field of glaciology.

The first training course conducted by the Geological Survey of India was in 1993 in collaboration with the Department of Science and Technology (DST). The Seventh and Eighth course in 2012 and 2014, respectively, were conducted in collaboration with Science and Engineering Research Board (SERB), a statutory body established in 2008 under DST, Government of India. In continuation, ninth training course (8th August- 9th September 2016) was designed for trainees to impart training in fundamental aspects on how and where to work in glaciers through theoretical and field aspects. Till now, 131 participants including officers, students and scientists have been trained during these courses.

All seventeen trainees this year were from different universities, academic and research institutes and GSI. The inaugural function was

on 8th September 2016 where Dr. A. Ganju, Director, SASE, V.K. Raina (retired Director, GSI), Dr. S.P. Shukla (GSI), Shri Bhriugu Shankar (GSI), Shri G.C. Kandpal (GSI) and some other faculty members of GSI were present. The training programme covered lectures and practical. The lecture consisted of systematic studies of glaciated region of the Indian Himalaya covering glacio-hydrology, glacial dynamics, meteorology, glacial micro-meteorology and suspended sediment loads in head-water regions. Main emphasis was on field demonstration together with hands-on training on the various techniques and related exercises for understanding the behavioral pattern of glaciers, different aspect of snowfall, hydrology of glacier fed rivers and glacier environment of the headwater. It was a multidisciplinary approach for glaciological studies. The lectures were conducted at the Chandigarh, Manali, Chhatru and Hamtah Glacier base camp and were delivered by various eminent scientists and instructing officers from SASE Chandigarh and Manali, NIH Roorkee, IMD Chandigarh, GSI (Lucknow, Chandigarh and Faridabad) and Atal Bihari Vajpayee Institute of Mountaineering, Manali.

Field demonstration sessions were also conducted for collecting the samples and installation of automatic weather stations. In Chhatru base camp, a traverse was conducted along the Chandra valley and Chandra lake with glimpse of various glaciers under the supervision of GSI officers. Communicative sessions with fitness lectures and high-altitude trekking were conducted at Hamtah glacier base camp, which helped the students to discuss various problems associated with high-altitude terrain. Hands-on training for data processing was taught on total station equipment used in modern surveying. The equipment enabled measurement of angle and distance as well as coordinates and helps recording absolute location of the object. Non-destructive technique of the ground penetrating radar (GPR), which assesses ice thickness, bedrock topography, hidden crevasses, study of glacial channels, mapping internal structure of ice sheets and glaciers, was also shown. Besides this, OSL dating techniques, discharge measurement techniques, collection of sample for suspended sediment load computation and chemical analysis, stake networking, computation of mass balance and snout monitoring were also taught on the Hamtah glacier. The data was collected by the participants under the guidance of the experts. The best and memorable moment of training was trek along Hamtah glacial valley to reach the accumulation zone of the glacier.

The positive feedback from the trainees indicated that training is beneficial for the creation of necessary expertise and competent manpower for undertaking basic and application-oriented research work for people working in different organizations. It helps in the process of acquiring the essential skills required to do work in a particular field. Thus, there is a need to promote such kind of training programs.