South Lhonak Expedition 2016: A technical Report

Background

It was in April 2012, when DST&CC, Sikkim team first visited the South Lhonak Lakefor *Rekhi* (general survey) of the glacial lakes in the Lhonak valley. Team surveyed the moraine dammed lake and observed the outlet conditions, took photographs and returned back, since DST &CC was monitoring the lakes from times series satellite data. In the meantime, scientists from the NRSC Hyderabad studied the lake through satellite data and reported that South Lhonak Lake is highly vulnerable for GLOF event, though his finding suggested ground observation.DST&CC, Sikkim requested the Department of Science and Technology Government of India to take up the matter and they constituted Working group for the study of South Lhonak Lake. Working Group approved the studies of bathymetry and resistivity of the moraines for further scientific intervention. With the support of DST, Govt of India, DST&CC Sikkim went for another scientific expedition in August 2014 to carry out bathymetric studies and electrical resistivity measurement of moraines damming the south Lhonak Lake. The team successfully carried out bathymetric studies and calculated the volume of water stored at the lake. In addition, team also went for resistivity survey of moraines and found that presence of dead Ice and permafrost beneath the moraine.

After the analysis of data and series of meetings with Working group constituted for South Lhonak lake, some short term and long term interventions for mitigations were suggested and recommended by the Working group, where siphoning and early warning system was recommended at short term interventions.

It was with this background, with support of Land Revenue and Disaster Management Department and CDAC- Pune, a multi departmental expedition to South Lhonak Lake carried out this time (September 2016) most importantly for siphoning of lake and to install Glacier Lake monitoring system in the South Lhonak Lake. The expertise for the Siphoning has been engaged by LR&DM Department, Sikkim from SECMOL, Ladakh. Other line departmental members from were also the part of this expedition for their sectoral studies.

Team members of Expedition (2016)

1. **Siphoning expert: SECMOL, Ladakh**
   Dr. SonamWangchuk, Consultant
   Mr. StanzinNorbu, Asst. to Consultant
   Mr. SuryanarayanBalasubramaniyam, Asst. to Consultant
   Mr. NamgyalTashi, Asst. to Consultant

2. **Glacier Lake Monitoring System (Lake Sensor) from DST &CC, Sikkim**
   Mr. N.P. Sharma, Asst. Scientific Officer, Remote Sensing
   Mr. R.K. Sharma, Scientist B, Climate Change Cell
   Mr. Pranay Pradhan, Scientist B, Climate Change Cell
   Mr. BandanGajmeer, Junior Research Fellow, Alpine Dynamics

Mr. SundeepChettri, ResearchAssistant, Climate Change Cell

3. **Land Revenue and Disaster Management Department**
   Mr. Pemba Norbu Sherpa, District Project Officer (West)

4. **Water Resources and River Development Department**
   Mr. Kamal Gurung, Divisional Engineer
   Mr. HisseyBhutia, Assistant Engineer.

5. **Mines Minerals and Geology Department**
   Mr. Tekendra Sharma, Asst. Geologist
   Mr. Passang Sherpa, Asst. Geologist

6. **Forests , Environment and Wildlife Management Department**
   Ms. Karma Choden, ACF (Wildlife, North)
   Mr. SonamGyatsoLepcha, Forest Guard
   Mr. ZigmeBhutia, Forest Guard
   Mr. B. TsheringLachenpa, Field staff

First Siphoning of South Lhonak Lake

After the scientific interventions, Sikkim State Climate Change Cell together with the support of Disaster and land Revenue Department, Government of Sikkim and expert guidance from Dr. SonamWangchuk, SECMOL, Ladakh, initiated the first mitigation works for GLOF in September 2016 at South Lhonak Lake. Siphoning of lake was done by using High Density Polyethylene (HDPE) quick clamp pipes during the expedition. The diameter of the pipe was 8 inches. A total of 140 pipes were used for the siphoning of lake for siphoning of waterfrom three sets of pipelines. The team first measured the discharge of lake (say discharge after the peak melting season) by area velocity method. The approximate discharge measured near the outlet was about 4.5 m^3/s(160 cusec). The discharge from single pipeline is measured approximately 50 litres/second which ultimately gives a total of 150 -180 lit/s in three sets of pipelines. It is expected that lake would be lowered by about 2 meters at the end of winter season. This is the first of its kind, that HDPE pipes were used for siphoning the glacial lake in India and first approach towards the siphoning of such glacial lake in Indian Himalayan region.

The photos showing the siphoning of South Lhonak Lake for lowering the water level on September 2016

Updating the Bathymetric studies

Previously in 2014, the DST team studied the volume of the lake by ultrasonic depth sounder and estimated volume was about 53 million m^3. At the middle of the lake, it was expected that more depth could be there as the depth sounder crossed it threshold of 80 meters.

During this expedition, the team also calculated the actual depth at the middle of the lake using manual probe made up of rope and measuring tape. The depth was estimated

to about*130 meter* at the centre of the lake. This results would help us in updating the bathymetric volume of South lake.

Updating the Bathymetric survey and measuring the Water Depth in the lake on September 2016

Installation of Lake Water monitoring system

As a part of project with Centre for Development and Advanced Computing (CDAC), Pune, the Department of Science and Technology, Sikkim has installed a Lake monitoring and information System (water level Sensor) at South Lhonak lake. The sensor gives the water level of the lake and also monitored the lake level when there is sudden fluctuation in water level. The sensor is developed by CDAC Trivandrum. The sensor provide the data to the CDAC-Pune and mobile information system is in process so that any alert message can be given at the local level. The system itself is in experimental phase. The same sensor has also been installed Kupup Lake, North Sikkim this year.

Installation of Lake Water monitoring systemat South Lhonak Lake on September 2016

The team concluded the expedition on 17thSeptember 2016.