Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

ACC31-P01 Room:Poster Time:April 29 14:00-15:15

Identifyig the ice thickness of five perennial snow patches in the Tateyama Mountains based on GPR soundings

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We carried out ground penetrating radar (GPR) soundings in the Kuranosuke, the Hamaguri-yuki, the Tsurugisawa, the Chojiro and the Ikenotan-migimata perennial snow patches in the Tateyama Mountains, the northern Japanese Alps since 2012. The Kuranosuke and the Ikenotan-migimata perennial snow patches had large ice masses (>30 m in thickness). We had measured the surface flows of both ice masses since 2011. The maximum surface flows of the Ikenotan-migimata and the Kuranosuke perennial snow patches were about 2 m a^{-1} and 0.14 m a^{-1}, respectively. Thus, we regard the both snow patches as active glaciers.

The Hamaguri-yuki, the Tsurugisawa and the Chojiro perennial snow patch had thin ice masses (<20 m in thickness). It is possible that these ice masses are not flowing at the present time. Thus, we guess that these snow patches are glacierets rather than active glaciers.

Keywords: glacier, perennial snow patch, Mt. Tateyama, Mt. Tsurugi, GPR

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ACC31-P02 Room:Poster Time:April 29 14:00-15:15

Studies on internal structure of active glacier in the Tateyama Mountains

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In 2013, we carried out 20 m depth boring in the Sannomado Glacier (2000 m above sea level), in the Tateyama Mountains, the northern Japanese Alps. The 20 m core was analyzed paying attention to the structure of firn and ice.The following observations were carried out;

(i) stratigraphic observation of snow layer and glacier ice.
(ii) measurement of density profi1e.
(iii) measurement of grain shape and profile of grain size.
(iv) observation of elongation of air bubbles.

The internal structure of the Sannomado Glacier was characterized by obvious boundary between firn and ice. At the depth of 5m, there was a distinct dirt layer formed in the last autumn. Above this dirt layer, firn transformed into ice abruptly and the density curve showed a discontinuity to 850kg/m^3. The temperature of the snow and ice measured in the borehole was 0 ℃ throughout the layer. Spouting water was found in the borehole, indicating an aquifer in the glacier. From these results, such a rapid transformation process from snow to ice in this glacier will be discussed.

The grain size gradually increased with depth and elongation of air bubbles was shown below 15m which suggests internal flow of the glacier.

Keywords: glacier, perennial snow patch, Mt. Tateyama, Mt. Tsurugi, boring

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Contribution ratio of glacier discharge to the river water in Mongolian Altai

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The discharge from glaciers is an important theme for arid regions like Mongolia. The water from glaciers are accounted for the important water resources in Mongolia where little water is supplied from precipitation. It is to be revealed that how much water is available from the glaciers. In this study, we estimate how much water is available in the present states and in the future by analyzing water chemistry and water quantity.

We have measured the discharge, water temperature, electric conductivity (EC), pH, dD, d18O of the river at the beginning, middle and end of the melt season of the glacier. The contribution rate of the melt water to the river water were estimated by the two methods; A) discharge and EC, B) glacier melt rate.

The contribution rate was estimated to be 20-50 % of the flow. The future change of the contribution rate was estimated by method B with the temperature warming rate in the future estimated by the climate models in Mongolia. The results show that the river water is supposed to be increasing in next some decades and decreasing in next century. The snow melt water to the river is also need to be taken into account.

Keywords: glacier, glacier discharge, temperature warming, water resources, Mongolia, climate change

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Comparison of surrounding land features on the glacier terminal areas in the Himalayas derived from DEM

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Radiation field on the surface of mountain glaciers is reported to be controlled by the surrounding land features and does not distribute uniformly. Net radiation, which is obtained as a result of radiation budget, has been reported as an important factor to melt the ice surface of glaciers in the Himalayas by the previous studies. On the other hand, the lower areas of many glaciers in the south area of Himalayas are covered with debris that has variety of thermal properties, which corresponds to the one of the factor to cause the spatial variety of ice melt rates fields. Considering the surrounding land form features in the radiation field is probably required for estimating thermal properties on the debris-covered glaciers accurately. However, in-situ observation of those phenomena cannot be conducted mainly due to the difficulties of accessibility to the Himalayas. Thus, application of satellite remote sensing techniques is a powerful tool as an alternate method.

This study focuses on the Lunana region, Bhutan, which corresponds to the target area where in-situ observation has been carried out since 2002, as a case study to estimate the influence of surrounding land features around the lower glacier areas on their radiation field. I calculated a distribution of azimuth and zenith angles from each target point (pixel) on the lower glacier areas to each direction to the skylines with an approximate method to derive surrounding land feature; the value 1 corresponds to the full sky view and it decreases to 0 with the decrease of openness. My first result, which was derived from 8 directions for each pixel with the limit of about 4.5 km far from the point as a line of sight, shows it ranges from 0.7 to 0.9 regarding the three glaciers; Thorthormi, Lugge and Lugge Ⅱ.

Because these values depend on the method to move the line of sight on the DEM, in other words, the method for processing the raster image as well as the accuracy of both elevations and horizontal positions, I would also like to present the other experimental results that were calculated with some different conditions to discuss the influence of the surrounding land form on the radiation field in the Himalayas.

Keywords: Digital Elevation Model (DEM), image processing, glacier melt rate, radiation budget, mountain glaciers, Himalayas

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Glacier lake and glacier lake outburst floods in Tien Shan and Ladakh Range

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As a result of recent glacier melting, present glacier lakes develop rapidly at glacier fronts in Tien Shan Mountains, Central Asia and Ladakh Range, Indian Himalayas. Although glacier lakes in the Tien Shan and Ladakh Range are small, compared to those in the eastern Himalayas (Bhutan and eastern Nepal), several GLOFs in the past have caused fatalities and serious damage to infrastructure and crops. With recent changes in the development of glacier lakes in these mountain regions, floods are becoming an increasing threat to local residents. However, the current status of glacier lakes is poorly characterized in this region. In this study, we researched glacier lakes in the Tien Shan Mountains and Ladakh Range using high-resolution ALOS/PRISM-AVNIR-2 images taken in 2007-2010. In addition, we report the characteristic of glacier lake and glacier lake outburst floods (GLOFs) in Tien Shan, using investigation of the appearance of glacier lake and GLOFs in the past.

We examined about 1600 glacier lakes ($>$0.001 km^2) in the Tien Shan. Although glacier lakes are distributed throughout the Tien Shan Mountains, regional differences in their number and size are large. Larger glacier lakes are found in the Teskey and Ili-Kungoy regions, whereas most small glacier lakes occupy other mountain ranges (4000-5000 m asl), such as the Pskem, Talas, and Kyrgyz Ala-Too ranges. In seven mountainous regions, many present-day glacier lakes have appeared since the 1980s. Glaciers in these mountain regions are most glacier shrinkage area in Tien Shan over the 30 years, and these glacier lakes appeared after glacier shrinkage area. We report our results in detail in JpGU meeting.

Keywords: glacier lake, glacier lake outburst floods, small-size glacier lake region, Tien Shan, Ladakh Range

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Chemical Composition on the surface in the Urumqi No.1 glacier, Tien Shan, China

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Various chemical solutes are deposited in snow and ice on glaciers. Such solutes are usually washed out of glaciers during melting season. However, concentration and composition on snow and ice during melting season are little known. The solutes are important to understand microbes living on the glacier surface since chemical conditions affect their growth. In this study, we analyzed chemical compositions of ice surface in the melting season on Urumqi glacier No.1, Tien Shan Mountains in central Asia. Results showed that calcium ion was dominanted more than 60% in all of the area on the glacier. This indicates that the chemical composition on the melting glacial surface is greatly affected by dust from desert in this region. Total concentration of nigrogen solutes (ammonium) was highest in the middle part of the glacier. Measurements of chlorophyll a concentration revealed that it was also maximal in the middle of the glacier. The altitudinal variation of solutes may affect the algal community and biomass on the glacier.

Keywords: chemical composition, glacier