主論文の要約

論 文 題 目　Contribution of glacier meltwater to river runoff in Western Mongolia
（西モンゴルの河川流量に対する氷河融解水の寄与）
氏　　名　KHALZAN Purevdagva

Mongolia, characterized by limited water resources, relies significantly on glaciers, which contribute to over 10% of the country's water sources, with more than 70% of the surface water supply in the western region. The Hovd river basin, as the largest river system in western Mongolia, hosts 96% of the country's glaciers. This study comprises two primary components. The first part focuses on the glacier mass balance of four Mongolian glaciers, while the second part involves modeling the impact of glacier meltwater on the Khovd, Zavkhan rivers, and the Uvs Lake basin in Western Mongolia. The objective of the second part is to simulate the flow of these rivers, evaluate disparities between observations and simulations, and estimate the quantity and dynamics of runoff resulting from glacier melt. The glacier mass balance study aims to assess both in situ observed and modeled mass balances for four specific glaciers located in the Mongolian Altai Mountains.

In this study focuses on assessing the glacier mass balances of four distinct glaciers in the Mongolian Altai Mountains, each with its unique characteristics and geographical features. The Potanin Glacier, situated on the Tavan Bogd Mountain, stands as the largest in Mongolia, originating from the country's highest peak and converging with the Alexander glacier to form the Tsagaan river. The Turgen Glacier, located in the Turgen Mountains near the Russian border, flows from south to north, covering a considerable distance. The Sutai Glacier, extending along the border between Khovd and Govi-Altai provinces, encompasses a significant area, flowing from the summit of Sutai Mountain. Lastly, the Tsambagarav Glacier, situated in the Tsambagarav Mountains, adds to the diverse glacier landscapes in the region. The detailed characterization of these glaciers sets the foundation for the subsequent analysis of their mass balances, providing valuable insights into the dynamics of glacial systems in the Mongolian Altai Mountains.

Mass balance stakes and automatic weather stations (AWS) were placed on each glacier to measure mass balances and meteorological elements. The meteorological data from ERA-5 was adjusted using observational data to calibrate parameters, specifically for precipitation. Subsequently, the calibrated meteorological data was utilized in an energy and mass balance model to estimate observed mass balances obtained from the stake measurements. Calibrated ERA-5 data and adjusted precipitation parameters were employed to fill spatial

and temporal gaps in the stake network and AWS measurements. Subsequently, the mass balance model was utilized to calculate both the mass balance profile and the overall glacier-wide mass balance. The calibrated annual precipitation value (Pcal) for the Turgen glacier has experienced a slight increase, reaching 860 mm, attributed to the precipitation gradient. Likewise, precipitation values for other glaciers have also seen slight increments, falling within the range of 190 to 640 mm. We proceeded to reconstruct the long-term mass balances over the period 1980–2018, spanning from -760 to -160 mm w.e. These reconstructions accounted for various climatic conditions, with annual precipitation varying between 190 and 860 mm. Additionally, we calculated the mass-balance sensitivities in response to variations in temperature and precipitation. In summary, the mass accumulation on Potanin and Turgen glaciers is 1.6-2.0 times higher during precipitation ranging between 620–860 mm in mountainous regions, whereas in the arid environments of Sutai and Tsambagarav, annual precipitation in the range of 190-250 mm results in significantly more substantial mass accumulation, reaching 3.2-4.2 times higher.

Within the scope of this study, the SIBUC model was employed to simulate the runoff at 34 hydrological stations distributed across the Khovd River, Uvs Lake, and Zavkhan River basins in Western Mongolia. In the framework of modelling for glacier meltwater effect on Khvovd, Zavkhan rivers and Uvs lake basin of Western Mongolia study aimed the runoff of 34 hydrological posts which are located in the Hovd River, Uvs Lake and the Zavkhan River basins was modeled using the SIBUC model. The purpose of the modeling was to simulate the flow of these rivers and assess the errors between observations and simulates and estimate the amount and dynamics of runoff from glacier melt. The purpose of the modeling was to assess the errors in modeling the flow of these rivers and to detect the volume and dynamics of runoff from glacial melt. The evaluated the indexes which was MAE=4.72, RMSE=7.71 and NSE=0.2 respectively. Also estimated the p-value which is 0.0003 that result is indicates a statistically significant. Then, estimated the correlation coefficient between the model runoff and actual measurements that, average r2=0.4 of all 34 hydrological posts. Annual total runoff of these 34 hydrological posts was 5862 m3/s and its 759 m3/s or 12% of the total runoff is from glacier melt. And excluding glacier melting contribution, the annual total runoff is estimated 2746 m3/s or 47 % of the total runoff. That this is not equivalent to difference between simulated discharge and simulated glacier meltwater because precipitation and land processes over the terrain where glacier exists are taken into account. Also, three periods were selected that dry, wet and normal and total river runoff and glacier melt water runoff were compared. From This comparison, concluded the amount of glacier meltwater runoff in the total runoff is strongly depended on annual precipitation.