Geophysical Research Abstracts
Vol. 15, EGU2013-3807, 2013
EGU General Assembly 2013

Applicability of a mass balance model for the debris-covered Khumbu Glacier in the Nepal Himalaya

Akiko Sakai (1), Takayuki Nuimura (2), and Koji Fujita (2)

(1) Nagoya University, Graduate School of Environmental Studies, Japan (shakai@nagoya-u.jp), (2) Nagoya University, Graduate School of Environmental Studies, Japan

Debris-covered glaciers are widely distributed in the Himalayas. Ice melt process beneath debris-mantle is complicated because of insulation/acceleration effects depending on debris thickness and spatially heterogeneous distribution of debris. A mass balance model for debris-covered glacier has been established by considering thermal resistance, which is an integrated index of thickness and thermal conductivity, and the model has been evaluated with point measurements of debris thickness and ice melt by stake method on a southeastern Tibetan glacier. However, applicability of this model to other glaciers under different climates and with different condition of debris coveris not evaluated so far.

Mass balance of debris-covered area the Khumbu Glacier in the Nepal Himalaya was calculated using the thermal resistance model. Distribution of thermal resistance was calculated from those of surface temperature and albedo of ASTER data, and meteorological data observed by the Pyramid station nearby the glacier,.

In order to evaluate the thermal resistance model, we alternatively calculated mass balance of debris-covered area of the Khumu Glacier from elevation change obtained by remotely sensed multi-temporal digital elevation models and a continuity-equation of ice flow. Considering the continuity-equation of ice flow, a longitudinal mass balance profile was calculated as a difference between elevation changes and emergence velocity. Elevation change, surface flow velocity and ice thickness of the glacier were based on previous studies.

Result shows that the two longitudinal profiles of mass balance based on the different methods correspond well in the middle part of debris-covered area, where thickness of debris is rather thinner. However, large discrepancy is found near the terminus, where thick debris layer seems to prevent ice melt. Then, we must calibrate the result of the mass balance model, when we apply to relatively thick debris glacier area.