Remotely sensed global distribution of debris thermal resistance on glaciers

*Orie Sasaki[1], Yukiko Hirabayashi[2], Shinjiro Kanae[1]

1. Tokyo Institute of Technology, 2. The University of Tokyo

Supraglacial debris is commonly found in high relief mountains and affects glacier melting rate by altering surface reflectivity and conductive heat flux. Several researches therefore developed local glacier models that reflect debris effects. However, there is no global glacier model that includes debris effects in glacier melting process due to limited information about spatial distribution and thermal properties of debris. Here, we present a global distribution data of debris thermal resistance to account for debris effects in global glacier models. We calculated thermal resistance of debris layer at 90m horizontal resolution on a global scale by utilizing ASTER and CERES satellite products in conjunction with meteorological data, excluding Greenland and Antarctica. Result indicated that 16.8% of total glacier area was covered by supraglacial debris, and regional differences are apparent from region to region. When we classified debris into thin debris and thick debris, it was found that thick debris-covered area was larger than thin debris-covered area, with the exception of Svalbard and Scandinavia. Moreover, we assess the possible uncertainties and limitation of our methodology. Although the uncertainties is relatively high, our estimation provides a necessary basis to calculate the debris effects on glaciers on a global scale, which may refine future predictions of glacier meltwater and its contribution to regional water availability and global sea-level change.

Keywords: debris-covered glacier, thermal resistance

