Features of energy balance for snowmelt during rain-on-snow events in central Japan

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It has been known that various kinds of hazards such as floods, landslides, avalanches can occur during rain-on-snow (ROS) events due to large quantity of melt- and rainwater supplied to the snowpack and the ground. Some previous studies have discussed the features of snowmelt during ROS events based on field observations, however, the temporal and the spatial variations of snowmelt during ROS events still have been poorly understood. For example, Marks *et al*. (1998) showed that larger heat source for melting was supplied to the snowpack during ROS events than non-ROS periods in the Central Cascade Mountains in Oregon, USA, whereas Kojima *et al*. (1973) reported the result showing less heat supply to the snowpack during ROS events in Moshiri basin in Hokkaido, Japan. In this study, we analyzed meteorological data of Oshirakawa, Niigata Prefecture (360 m a.s.l.) from the melt season (from March 1 to the day when snowpack was disappeared) of 2012 to that of 2015 in order to clarify the difference in the features of surface energy balance between ROS events (daily rainfall > 10 mm) and non-ROS periods (the days without rainfall) and their temporal variations. In addition, we also analyzed the meteorological data at Osado Mountains (800 m a.s.l.) in Niigata Prefecture and at Mt. Ontakesan (2195 m a.s.l.) in Nagano prefecture during the melt season of 2015 to discuss the difference in surface energy balance during ROS events between a low-altitude basin and high-altitude mountains.
The result of the observations in Oshirakawa showed that, in average of the four years, less heat source for snowmelt was supplied during ROS events than non-ROS periods due to less shortwave radiation balance. However, the heat source for snowmelt during ROS events showed substantial difference by year as a result of the changes in albedo and air temperature corresponding to the time of occurrence of ROS events. In the high-altitude mountains, larger heat source for snowmelt was supplied during ROS events than in the basin mainly due to larger turbulent heat fluxes resulting from stronger winds. Thus, we can conclude that there is higher risk of snowmelt-induced hazards in high-altitude mountains due to greater water supply into the the snowpack and the ground.

Keywords: rain-on-snow event, snowmelt, energy balance

