Japan Geoscience Union Meeting 2012
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AHW28-P03 Room:Convention Hall Time:May 20 17:00-18:00

Monitoring rockwall erosion and soil transport in an alpine area, Southern Japanese Alps

MATSUOKA, Norikazu[1*], NISHII, Ryoko[1], IKEDA, Atsushi[1]

[1]University of Tsukuba

Purpose and methodology

Monitoring of rockwall dynamics is undertaken in the Mt. Ainodake area, Southern Japanese Alps, in an attempt to determine contemporary rates of erosion, amount of debris production and transport and to analyze their controlling factors. In August 2010 a new monitoring site was established on the Aresawa rock-slide scarp, where observations highlight climatic conditions (e.g. freeze-thaw process, snowmelt and heavy rain) and bedrock conditions (e.g. rock joints, rock mass strength and micro-topography). The new monitoring system is combined with foregoing monitoring campaigns on (1) pre-failure movement of the Aresawa headscarp area (Nishii & Matsuoka 2010), (2) soil movement associated with freeze-thaw action on the mountain-top slope (Matsuoka 1998, 2005) and (3) meteorological conditions (e.g. air temperature, precipitation and wind direction and speed), towards comprehensive evaluation of high-mountain geodynamics and sediment budget.

The following methods permit visual, quantitative and continuous observations of the dynamics of the rockwalls, where Matsuoka (1990, 2001) conducted preceding measurements.

- Photo-evaluation of shattered area on painted rockface
- Manual collection of fallen debris from painted rockface
- Automatic recording of rock-joint opening and rock temperatures (at 1, 10, 40 cm depth)
- Visual observation of rockface and foot slope with interval camera (daily) and terrestrial LiDAR (annually).

Continuous data have so far been acquired from August 2010 and October 2011 (see Figure) unless some interruption resulted from consumption of battery and extraordinary operation of the interval camera. The camera displayed limited snow cover on the rockface even in mid-winter, which was supported by large diurnal amplitudes of rock surface temperature. As a result, the rockface frequently experienced diurnal freeze-thaw cycles from September to May, with seasonal frost penetration to a few meters.

Results and discussion

A comparison between shattered bedrock, trapped debris, visual images and meteorological records showed that significant rockfalls and foot slope erosion occurred (1) during the night of 7-8 July, 2011 (precipitation ca. 30 mm) and (2) between 1 and 4 September 2011 when a large typhoon (precipitation 700 mm in total) crossed central Japan (see Figure). In addition, small, but continuous debris production seem to have dominated on the rockface during freeze-thaw and snowmelt periods. In normal years rockfalls prevail in freeze-thaw and snow-melt periods (Matsuoka 1990, Matsuoka & Sakai 1999), whereas the 2010-2011 period encountered an extraordinary and highly active debris production, partly responding to a heavy rain event.

References

Matsuoka 1990. Earth Surf Process Landf 15, 73-90.
Matsuoka 1998. Permafrost Periglac Process 9, 397-409.
Matsuoka 2001. Earth Surf Process Landf 26, 601-614.
Matsuoka 2005. Earth Surf Process Landf 30, 41-58.
Matsuoka & Sakai 1999. Geomorphology 28, 309-328.
Nishii & Matsuoka 2010. Eng Geol 115, 49-57.

Figure: A. Rockwall retreat based on trapped debris. B. Rockwall temperature at surface and 40 cm depth. C. Daily precipitation. D. Snow condition at noon on 4 Dec 2011.

Keywords: rockfall, rock weathering, freeze-thaw, periglacial, monitoring, Japanse Alps

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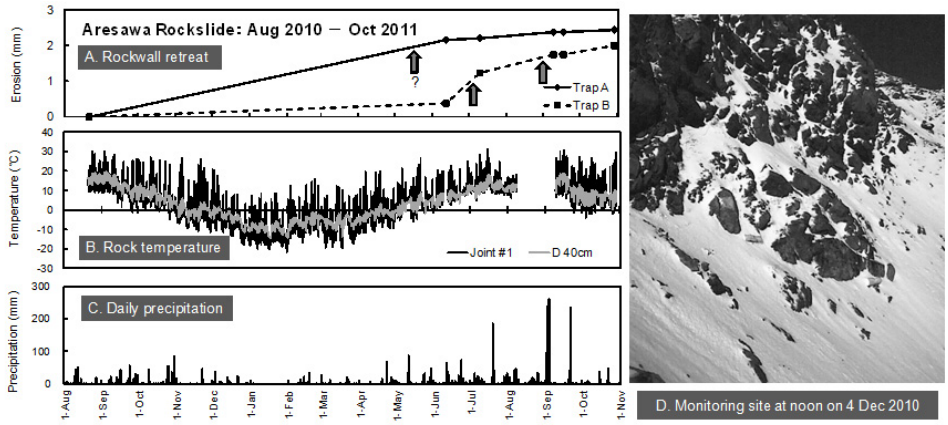

D. Monitoring site at noon on 4 Dec 2010