Wave of avalanche disasters in response to colonization: a century of statistics from the world's deadliest avalanche-prone islands

Evgeny A. Podolskiy[1,*], Kaoru Izumi[2], Vladimir E. Suchkov[3], Nicolas Eckert[1]
[1] IRSTEA (UR ETGR), St.-Martin-d'Heres, France
[2] Research Institute for Natural Hazards and Disaster Recovery, Niigata University, Niigata, Japan
[3] Avalanche Safety Service, "Roza Hutor" Ski Resort, Sochi, Russia

ABSTRACT: The record of avalanche disasters on Sakhalin and the Kuril Islands was always incomplete due to the historical divide of the region between Japan and Russia. In this study we combine and analyze all available relevant information from Japanese and Russian archive sources in order to reconstruct a continuous centurial record of snow avalanche catastrophes in the region from 1910 to 2010. Despite the relatively small scale of the majority of disastrous avalanches in the area, with a total vertical drop less that 200 m, the evidence documented in this paper places Sakhalin and the Kuril Islands among the most avalanche affected areas of the world. In total, 756 fatalities and more than 238 injuries occurred in 275 accidents during 100 years (two thirds of the fatalities and accidents were among Japanese). For example, this death toll is higher than that of Canada, New Zealand or Iceland. The pattern of the fatality rate was found to decrease over time due to social factors and is different from any other considered region due to the lack of any recreationist deaths. Even if the present fatality rate is lower than that of, for example, Iceland or the USA in recent years, the islands' per capita avalanche causality rate is among the highest in the world. Finally, a shock wave of avalanche disasters in response to intense colonization of the islands could be shown. Although this demonstrated 'wave' could be considered a local issue of the past, many presently developing countries may face similar impacts.

KEYWORDS: avalanche, fatalities, disaster, statistics, Sakhalin, Kuril Islands.

INTRODUCTION

In this study we attempt to reconstruct a full centurial record of snow avalanche disasters on Sakhalin and the Kuril Islands, Russia, between 1910 and 2010. The recent history of this region at the far east of Eurasia was shattered into two distinct eras: (i) from 1905 to 1945 the Kuril Islands and half of Sakhalin were controlled by Japan, and (ii) after 1945 the whole territory became a part of USSR / Russia. This corresponded to a complete lack of any knowledge possessed by Soviet / Russian scholars about any avalanche catastrophes experienced by the previous Japanese population (Suchkov, 2012). In order to fill this gap, through a trilateral collaborative effort, we recovered and integrated all available records for reconstructing a full history of the catastrophic encounters of the islands' inhabitants with snow avalanches.

DATA AND METHODS

Analysed records about historical avalanche accidents, including their physical and societal descriptions, were found and collected from archives of old Japanese newspapers (Karafuto-nichinichi-shinbun, Otaru-shinbun and Hokkaido-Times), diaries and self-published memoirs (e.g. Nakamachi, 1991), and from multiple previous Russian language scientific publications (e.g. Kazakova and Lobkina, 2007; Suchkov, 2012, and etc.). For additional analysis of factors contributing to the high number of accidents we also obtained meteorological records made at old Japanese stations from Monthly Reports of the Meteorological Observatory of Japan (for the period of 1913–1940).

RESULTS

Overall, for the period between 1910 and 2010 we could identify 275 avalanche accidents, at least 238 injuries, and 756 fatalities (Fig. 1; more than half of the accidents and deaths were among Japanese and probably Koreans). Meaning that for the first time the region could be recognized as having one of the world's highest avalanche causality rates, and that, probably with the exception of Honshu Island (Japan), it presents the world's deadliest avalanche-prone islands.

Four other important points found were: (i) a possible strong impact of large scale deforestation (due to logging, fires and tree diseases) in the vicinity of roads and settlements on intensified avalanche activity (Fig. 2); (ii) the colonization of the islands and increasing

Corresponding author address: E. A. Podolskiy, IRSTEA (UR ETGR), 2 rue de la Papeterie, BP 76, 38402, St.-Martin-d'Heres cedex, France; tel: +33(0)4-7676-2758; fax: +33(0)4-7651-3803; email: evgeniy.podolskiy@gmail.com

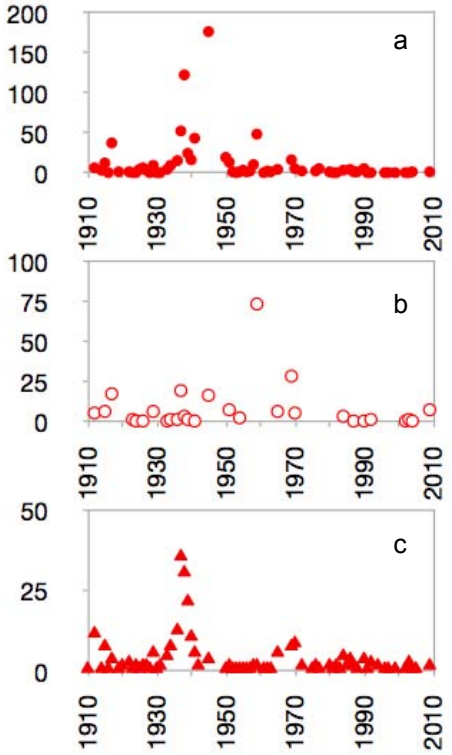

Figure 1. Annual number of a) fatalities, b) injuries, and c) accidents (1910-2010).

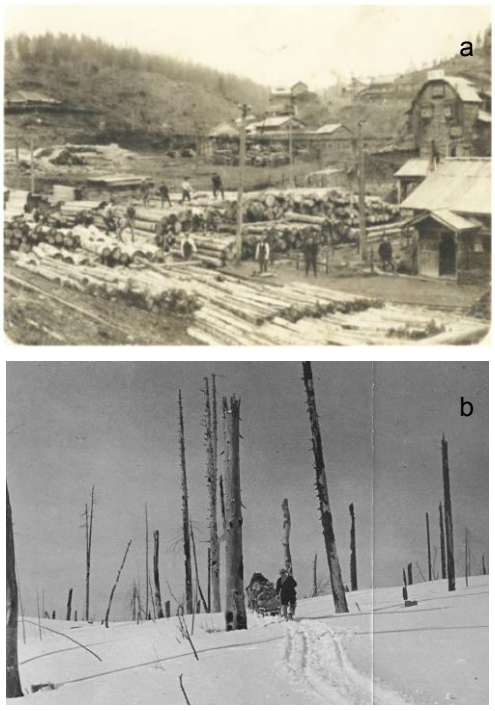

Figure 2. a) Example of a logging village at Sakhalin Island (1940s; photograph is a courtesy of National Archives of Korea, Republic of Korea). Note bald slopes near the settlement; with 300-500 mm of winter precipitation even such slopes may become potentially dangerous. For example, in one occasion an avalanche from a 10 m slope killed 23 Japanese soldiers (Shumshu Island, 1/3/1945; Nakamachi, 1991). b) Example of poor forest conditions due to fires and pine wilt near Poronaisk (photograph is a courtesy of Kokusho Kanko-kai, Inc., Tokyo, Japan).

population as the main drivers of high fatality rates; (iii) a striking similarity between many locations of 'Japanese' and 'Russian' disasters (Fig. 3); and, finally, (iv) almost a complete lack of recreational deaths, which now present the main risk group in developed countries.

DISCUSSION

Comparison of the annual fatality and injury rates (Fig. 1a&b) with overall population growth on the islands (not shown) suggested that an intensive colonization was the main cause of high exposure of inhabitants to avalanches. A higher rate of winter precipitation during the 1930s could also play a role as a potential contributor to the high number of accidents (Fig. 1c).

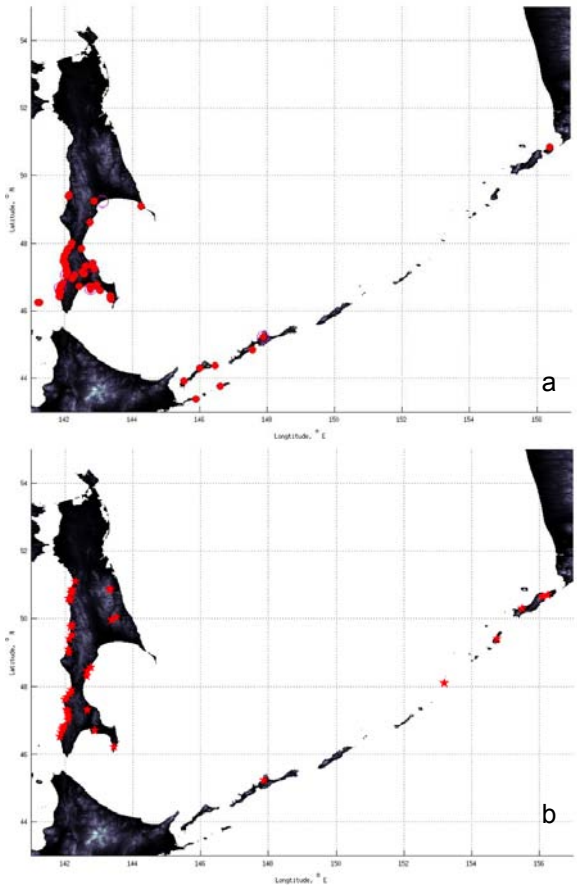

Figure 3. Locations of fatal avalanche disasters: a) Japanese era (1910-1945) (violet circles indicate old Japanese meteorological stations); b) Soviet / Russian era (1928-2010).

The total number of fatalities in the region is higher than all recorded fatalities in the history of Canada, New Zealand or Iceland, and higher than the non-recreational fatalities in France for the same period of time. Thus this little known region falls into the category of the territories with the largest per capita losses due to snow avalanches, like Switzerland, Austria, Iceland or Norway (Irwin and Owens, 2004).

CONCLUDING REMARKS

It is our hope that awareness about previously unknown avalanche disasters of the Japanese era (Fig. 3a) and their further analysis will be valuable for risk mitigation and will lead to a safer life on the islands.

Note that the full version of this study, which includes a comprehensive review of the physical properties of the typical avalanches of the region, archival photography and in-depth statistical analysis and descriptions of catastrophic events and their relationship to population and meteorological factors, may be found in Podolskiy et al. (submitted). We present the work here at the ISSW'13 for facilitating discussions and wider dissemination of the results.

ACKNOWLEDGMENTS

The authors would like to thank S. Matoba, E. A. Hardwick, Y. Ito, T. Nakamura and Y. Seo for help and discussions. The research leading to these results was possible because of funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme (FP7/2007-2013) under REA grant agreement #298672 (FP7-PEOPLE-2011-IIF, "TRIME"). K.I. acknowledges financial support partially from Grant-in-Aid for Scientific Research of Japanese Society for the Promotion of Science for a possibility to collect archival materials which made this study possible.

REFERENCES

Irwin, D. and I. Owens. 2004. A history of avalanche accidents in Aotearoa, New Zealand. Proc. Internat. Snow Sci. Workshop (ISSW-2004), Jackson Hole, 484–491.

Kazakova, E. N., and V. A. Lobkina. 2007. Avalanche disasters of Sakhalin oblast'. Data of Glaciological Studies, 103: 184−188. (In Russian).

Monthly Reports of the Meteorological Observatory of Japan. The Central Meteorological Observatory, Tokyo, Japan. [for 1913−1940 may be accessed at http://kindai.ndl.go.jp/search]. (In Japanese).

Nakamachi, J. (Ed.). 1991. Northern defense party, the 1st Artillery of the 91st Division (Kita no sakimori dai 91 shidan dai 1 houheitai), privately printed, Japan. (In Japanese)

Podolskiy, E. A., K., Izumi, V. E. Suchkov, and N. Eckert, (submitted). Physical and societal statistics for a century of snow avalanche hazards at Sakhalin and the Kuril Islands (1910 – 2010). Submitted to Journal of Glaciology.

Suchkov, V. E. 2012. Role of snow drift in redistribution of snow cover and formation of snow patches, glaciers and avalanches on Sakhalin and the Kuril Islands. Ph.D. Thesis, RosHydroMet, Nalchik, Russia, 164 pp. (In Russian).