

20 YEARS OF AVALANCHE INCIDENTS IN SLOVAKIA - COMPREHENSIVE OVERVIEW OF AVALANCHE INCIDENTS IN SLOVAKIA

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ABSTRACT: Avalanche prevention center in Slovakia is national avalanche warning service responsible for data collection on avalanche incidents. The center belongs to Mountain rescue service and it cooperates with medical air services to gather as much as possible data when avalanche incidents happen. 63 people died in avalanche accidents in Slovakia in last 20 years, even more people were injured. The aim of the preliminary study is to provide an overview over spatial distribution of avalanche incidents within Slovak mountain range. The study analyses the data stored in the incidents database of Avalanche prevention center and air medical service. Furthermore, it will investigate and collect data on cause of death among avalanche fatalities in Slovakia.

KEYWORDS: Avalanche incidents, avalanche fatalities, avalanche victims, Slovakia.

1. INTRODUCTION

Avalanches in Slovakia claim 3 fatalities per year in average. The avalanche activity is located within the main five mountain areas: Vysoké Tatry, Západné Tatry, Nízke Tatry Malá and Veľká Fatra. Despite some of the outlying incidents most of the avalanche incidents logically occurs in these five avalanche regions. Data on incidents are collected by the Avalanche prevention center, which operates under the Mountain rescue service. The aim of the study is to summarize incidents which happened in the period of 1998 – 2018 and provide basic overview on spatial and statistical distribution of the incidents. This preliminary study will be enhanced in the future including data from Polish side of the Tatra Mountains with aim to investigate cause of death in the Western Carpathians.

2. DATA COLLECTION

Data on avalanche incidents are being collected after all of the incidents where mountain rescue teams are involved additionally there is effort to collect and include all avalanche incidents. Also the ones which ended luckily and no professional rescue were necessary. The studied area is rather small compared to the Alps and other mountain ranges therefore it is assumed the bias is rather low. Still we are aware the data in the avalanche incidents database are biased and skewed towards more serious incidents. Addi-

tionally the data from coroner's office, and helicopter rescue company are collected, which will be investigated in the future.

3. AVALANCHE INCIDENTS

In the last twenty years (1998 – 2018) 169 people were injured from these 37,2 % (nf = 63) died. In average a bit more than three persons die in avalanche annually (3,1/yr) (Figure 1).

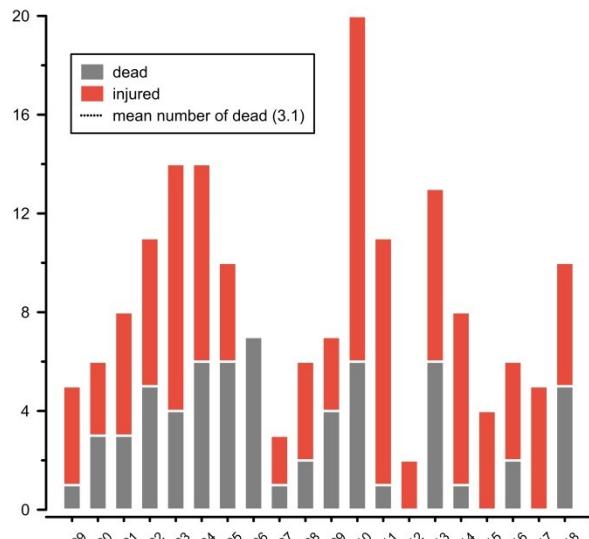


Figure 1: Number of people injured and killed by avalanche in the period of 1998 – 2018. In total 218 incidents were recorded with 169 people injured from which 63 died.

The most avalanche prone mountain range is Vysoké Tatry (113 avalanche incidents) followed by Nízke Tatry (45) and Západné Tatry (40). These ranges have typical alpine terrain with several thousand of avalanche slopes. Avalanche incidents are spatially distributed according to number of winter visitors. Many of the

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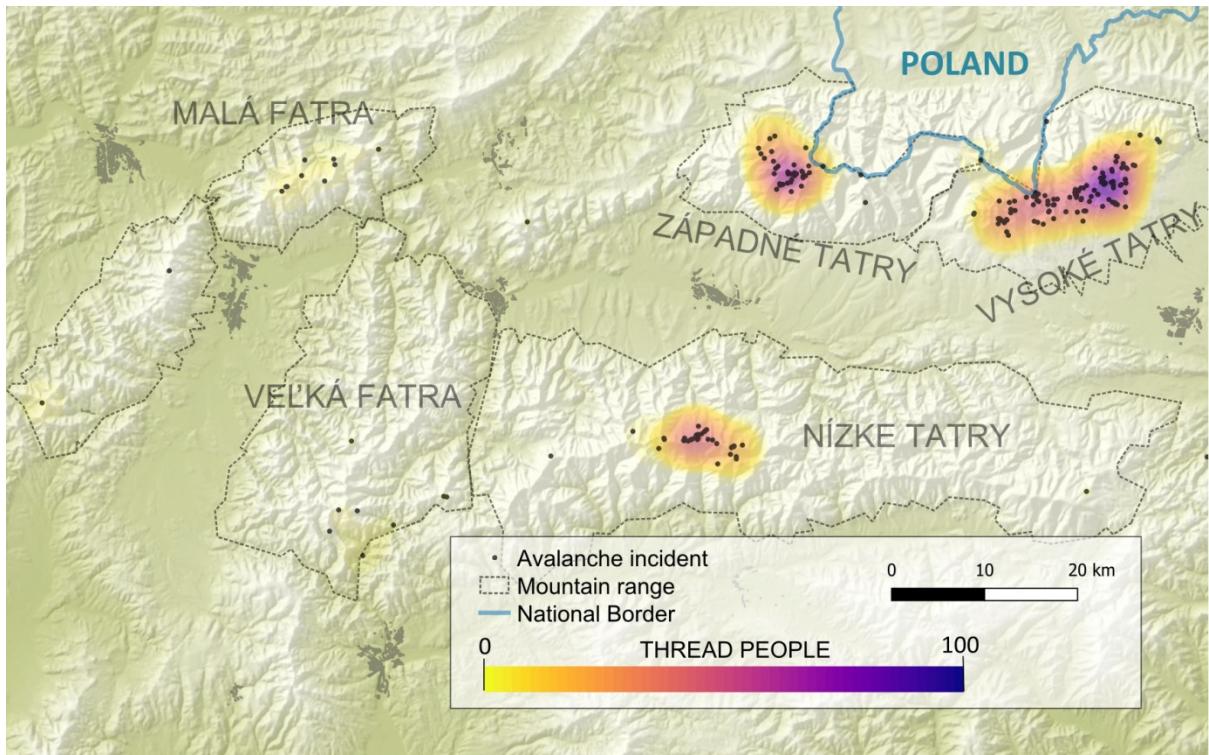


Figure 2: Heatmap of avalanche incidents within Slovakia in the period of 1998 – 2018.

incidents occur in same valleys and places annually and the follow the winter activity. For the last two decades with onset of ski centers, more and more incidents occur in close proximity of the ski centers. Very few incidents have been recorded in Malá (12) and Veľká (8) Fatra. This might be partially caused by decreased snow precipitation, and increased annual temperatures. In such a regions combination with lower altitudes and climate change might cause the disappearance of avalanche in the future. See figure 2 for the spatial distribution of incidents.

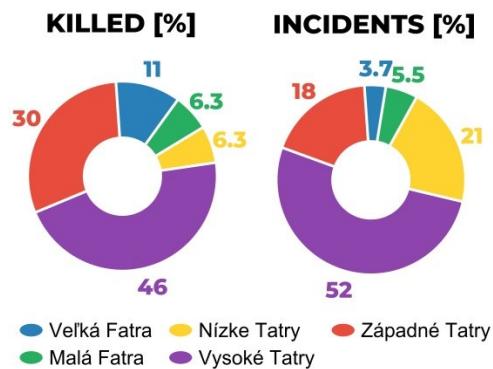


Figure 3: Rate of each Mountain range on fatalities and incidents

3.1 Avalanche fatalities

In the last two decades (1998 – 2018) 198 avalanches claimed lives of 63 people. Most of them died in Vysoké Tatry where 113 avalanches took

lives of 29 people. In Západné Tatry 40 incidents resulted in 19 deaths. Nízke Tatry with 45 avalanches and only 4 fatalities are overtaken by Malá Fatra with only 12 incidents and 4 fatalities.

Veľká Fatra has high fatality rate with only 8 incidents resulting in 7 fatalities. High fatality rate is in Západné Tatry where 18% (40) of all incidents (218) occurred, with 19 deaths, which is 30% of all recorded fatalities (63). Even worse rate is in Veľka Fatra, where only 3.7% of all incidents occurred, claiming 11% of all fatalities. See figure 3 for the rest of mountain ranges.

With respect to activity ski – touring claims most of the lives (24) (followed by climbing – mountaineering (20) and winter hiking (11). For the full list see figure 4. These results are quite similar to Alps (Valt et al., 2009; Harvey et al., 2002). In the past climbing – mountaineering was the activity with most fatalities, but in recent years, with onset of ski-touring and ski-mountaineering, there is slight shift of fatalities into these ski categories.

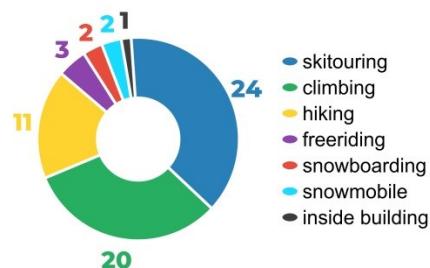


Figure 4: Fatalities according to activity.

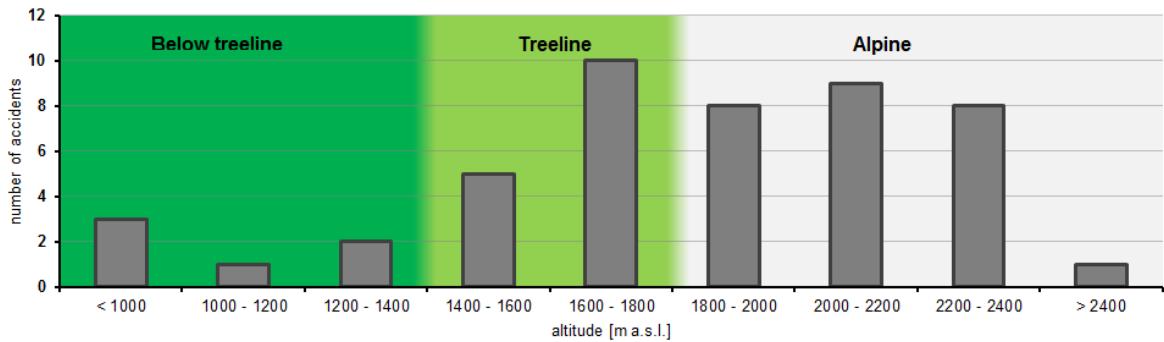


Figure 5. Fatal avalanche incidents by the altitude of triggering.

Concerning the altitude zones more than a half of the fatal incidents (27 out of 47) occurred in alpine terrain. This fact is natural as many of avalanche prone slopes are located in higher elevations. But this is valid only until certain level of 2400 m a. s. l. as only one fatal incident happened above that altitude. Above that altitude, there are only slopes with very small release areas.

In case of slope angle, all fatal avalanches were triggered in steeper terrain than 30° (figure 6). Most common angle was between $36 - 40^\circ$. These results are not surprising and are in accordance with other studies (e.g. Schweizer and Lütschg, 2001; Schweizer and Techel, 2017) from Swiss Alps.

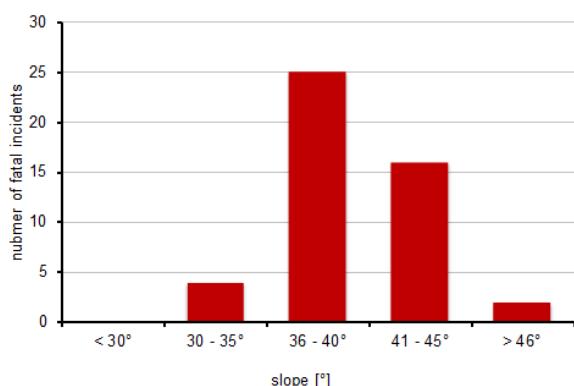


Figure 6. Fatal avalanche incidents by slope angle of triggering zone

The most frequent aspect was found to be northeast (25%) followed by southwest (19%), north, east, southeast, southwest (10%) and least fatal avalanches were triggered on northwest slopes (2%) (Figure 7). That is quite different to results from Alps, because in Alps, the whole north sector (NE, N, NW) is dominant. In our case, just the northeast appeared to be more frequent. North and northwest are significantly less frequent than in Alps. There are two possible reasons. Firstly, this study deals with just incidents located in Slovakia and northern part of Tatry mountains is located in Poland. Second

reason is climatic. Most prevailing wind direction in Slovakia is northwest and snow is often blown to leeward southern side of the mountains and causes danger snow formations.

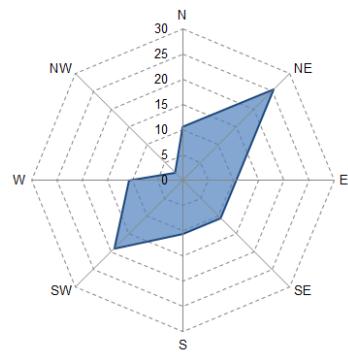


Figure 7. Fatal avalanche incidents by aspect of triggering zone

4. CONCLUSION

These preliminary study attempted to collect and analyze the data from last two decades of avalanche incidents occurred within the Slovak mountain ranges. In the future more detailed study will follow up with goal to investigate the cause of death among avalanche victims in Western Carpathians.

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