Snow avalanches a natural phenomenon typical for snowy winter mountains consist of snow and sometimes of other material (debris, rocks, truncated trees and soil). On first sight they seem to be harmless mass of snow sliding down on a slope. But not they can be disastrous. Despite the snow avalanches event lasts for couple of seconds, they can take human lives, and destroy infrastructure. Until they occur in far and remote places they are not concern. The avalanche run-out has been always an issue. How far avalanches can travel? Is there avalanche activity out there? How large is the avalanche hazard on certain places? Will the avalanche airbag will influence the probability of not being critically buried by an avalanche. These are the question the thesis attempt to solve with the use of GIS, remote sensing and statistical analysis. The aim of the thesis was to find reasonable answers to these questions. The effectiveness of avalanche airbags was first tested by pilot study when the artificial avalanche was triggered and motion of the dummies with different types was recorded. Additional estimation of impact forces, speed and final position of dummies was investigated and modelled (publication 6). The mechanism behind the avalanche airbags – inverse segregation was proofed to work in field test, but how is it with real avalanche incidents and the effectiveness of airbags in real life situations? To examine this question a retrospective study of avalanche airbags was done. Statistical analysis revealed that the real effectiveness of avalanche airbag is lower than previously reported (publication 1). It was found out (publication 2 and 3) the statistical approach to avalanche modelling has its limitations and thus it is relatively easy to implement it within GIS environment, in future it will be replaced by more complex numerical simulations (publication 5, 7, 8). Simulations coupled with GIS represent very powerful tool, which should not be overestimated, still it is a simulation. Resolution of input digital elevation model and setting correct friction parameters are key factors for getting reasonable outputs. Avalanche activity is valuable feedback for avalanche forecasting. As most of the mountain areas have very limited access, remote sensing can provide overview from above and map large areas in reasonable time and effort (publication 4). The thesis provides further insight into avalanche monitoring using GIS, remote sensing and run-out simulation. Despite that the outputs are in experimental testing, there is aim to make them operational in avalanche forecasting and hazard zoning.