A DYNAMIC APPROACH TO EVALUATE THE DENSE AND POWDER SNOW AVALANCHE MODEL SAMOS-AT

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INTRODUCTION

The powder snow avalanche model SamosAT is in practical use since the end of 2007 in the Forest Technical Service for Avalanche and Torrent Control. In the practical and scientific application of the tool many experiences were made so far. As a result of the recent findings a recalculation of 20 well documented avalanches to calibrate a new suspension model for the powder layer was done by Joerg et al., 2010. This study was mainly focused on the avalanche runout behaviour and in some cases on avalanche pressure and deposition depth. The actual study brings the evaluation of the avalanche velocities into focus. This paper gives information about the project to evaluate the avalanche model SamosAT and the approach to analyse the avalanche dynamics especially of the front velocity within the avalanche track. The public road administrations in Vorarlberg and in Styria operate pulsed Doppler radar measurements to monitor the avalanche events. These data from the Technical University in Graz (Schreiber et al., 2011) provide information of avalanche velocities. The goal of the actual study is to compare the measured avalanches with the calculated results in the SamosAT model. The study of the Grimming avalanche showed that the measured velocity corresponds in general well with the calculation with the exception of the middle part of the track. As expected the additional snow entrainment plays a decisive role in the recalculation of the avalanche velocity (see Fig. 2).

A SHORT MODEL DESCRIPTION OF SAMOS-AT

The SamosAT friction law in the actual setting can be described as an extended Voellmy (1955) calculation with a variable μ and ξ considering the shallow water approach. The bed friction angle $\tan\delta$ still plays the decisive role in the calculation of the maximum avalanche runout. In the avalanche runout calculation the bed friction angle will be increased at lower avalanche velocities in order to stop smaller avalanches more realistically and to prevent lateral spreading of avalanches at very low flow heights (under 0,5 m depending on the setting). The SamosAT friction law provides a suitable runout behaviour in comparison to the reference avalanche data.

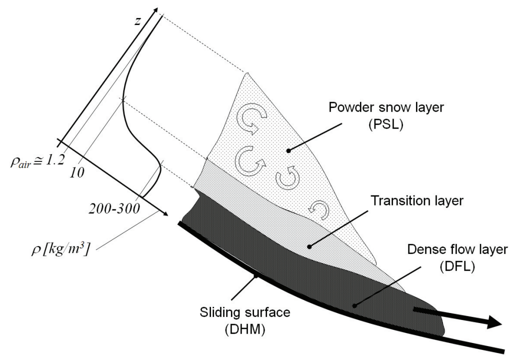

Fig. 1 Vertical layer-structure of a dry snow avalanche as assumed in the SamosAT model (Sampl et al., 2007)

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The calculation of the powder snow avalanche in the newly released model is performed on an AVL-Swift platform. The basic formulas have been adapted to the SamosAT model. Additionally a real two phase calculation model of ice particles and air has been integrated to obtain a more realistic simulation of the aerosol. Besides the gain of mass particles, this method allows for a supplementary deposition of snow particles along the avalanche path. Consequently, snow particles can rise and drop within the aerosol especially at strong surface bends. In the meantime a new more stable quadratic calculation mesh with a higher resolution of 15x15m was developed to calculate the 3D powder flow layer. The new suspension model calculates in general higher avalanche velocities, which is in better agreement to the dynamic avalanche data (Gauer 2009).

COMPARISON OF AVALANCHE VELOCITIES WITH SAMOSAT

First comparisons of surveyed avalanches with the avalanche model SamosAT were done by Sailer et. al. (2002), which displayed a general agreement with the Samos99 model. More recently Gauer (2009) analysed the avalanche velocities of SamosAT with the result that the simulated velocities are lower than avalanche measurements in Vallee de la Sionne. A study at the Centre for Snow and Avalanches (SSL) showed that the avalanche velocities of SamosAT are within the range of the measured avalanche velocities as shown at Grimming. A comparison of SamosAT with the Elba+ model was done in Fig 2.

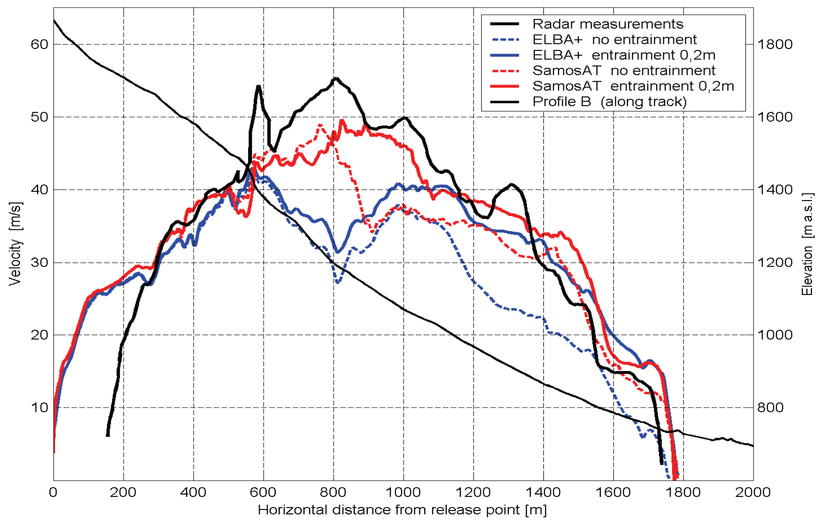

Fig. 2 Comparison of radar measurement (Grimming) with the simulation velocities (Elba+, SamosAT)

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