PENZENLÄHNER AVALANCHE - CALCULATION OF MAXIMUM RUN-OUT OF SNOW AVALANCHES. PRESENTATION OF THE RESULTS FROM THE NORWEGIAN WORKING GROUP

Berechnung der maximalen Auslauflänge der Penzenlähner Lawine Präsentation der norwegischen Arbeitsgruppe

by/von

U. DOMAAS

Abstract:

In order to find a probable run-out of extreme snow avalanches in the area east of Hungerburg of the Penzenlähnerlawine, we have used three different methods to calculate runout in the same manner as in Norway. The models are calibrated for Norwegian conditions, and the results must be used with care.

The avalanche path itself is rather large compared to much of the Norwegian avalanches, with a vertical height of about 1.500 m. The known travel distance along the path is around 3.100 m measured from the top of the release zone. The path itself is gentle with no abrupt changes in inclination. This will provide snow avalanches with long runouts.

Prior to the field trip we did some preliminary runout calculations, and this showed us that the avalanche could travel far, maybe as far as the river Inn. During the field trip we saw that earth mounds had been built in the avalanche path. Therefore, we moved our beta-point to this position, and this, of course, changed the results.

Zusammenfassung:

Um eine annehmbare, extreme Ausl[illegible]e für die Penzenlehnerlawine zu finden, werden drei verschiedene Berechnungs[illegible]n angewandt, wie sie in Norwegen verwendet werden. Diese Modelle sind für norwegische Randbedingungen kalkuliert, daher sind die Ergebnisse mit großer Sorgfältigkeit zu interpretieren. Zur lawinendynamischen Beurteilung der vorgegebenen Lawinen wurden das PCM-Modell, das NIS-Modell und das Empirical Modell herangezogen. Für die Berechnung mit Hilfe des NIS-Modelles erfolgte die Justierung des Modelles auf norwegische Verhältnisse, um zu sehen, wie weit eine „Norwegische Lawine“ in einem ähnlichen Gelände auslaufen würde.

PCM-MODEL

We have been using this model mostly to calculate the avalanche front speed after knowing the runout to backcalculate the avalanche speed along the track. In this investigation we used a normal set of μ and χ (eller ψ?) values ($\mu = 0.15$, $\chi = 500$). On Fig. 1 we see that this result corresponds with the maximum known runout for this avalanche.

NIS-MODEL

The results from this model are relative to the snowheight in the release area. We have adjusted the model to the Norwegian conditions, and the results show thereby how far a Norwegian avalanche would travel in similar terrain. Another difficulty is that the Penzenlahnerlawine is larger than most avalanche tracks we consider, and this may also add to the differences in runout prediction. We do not use the NIS-model to calculate runout-distance alone because it is sensitive to the parameter chosen. We have used a parameter set that corresponds with long runcuts, and the result is presented on the map in Fig. 4. The runout results show that the avalanche can travel almost as far as the start of the Penzenbahn at Hungerburg. The corresponding velocity profile is shown on Fig. 2.

EMPIRICAL MODEL

When using the empirical model developed for Norwegian avalanches, we have to take into consideration the differences in the climate. Austria has a continental climate and Norway has a marine climate. This will create some differences, and our first thought is that we would have to calibrate our model to use it properly in Austria. This is not the case in this investigation, and we have used the model with this limitation. The result from the model is shown in Fig. 3. The figure shows five comparable avalanche paths, and the Penzenlahnlawine in the same figure. It is obvious that the Austrian avalanche is larger than most of the Norwegian avalanches. Fortunately one of the avalanches is comparable in size, and in our climate it is possible for an avalanche to travel as far as shown on Fig. 4. This means that the avalanche would reach as far down the mountainside as 25 to 50 m above the uppermost buildings at Eckenried.

In this calculation we have not taken into account the large and old forested area between the earlier avalanche runout and the town. This forest will provide some resistance to the avalanche movement, and we also believe that this effect will be reinforced by the gently inclined terrain.

The calculated results and our experience tells us that the avalanche will most probably stop on the shoulder around 800 m above sea level and not reach the houses at Eckenried. The reason for this is the earth mounds built in the avalanche track.

Author´s address/
Adresse des Autors:

U. DOMAAS
Geotechnical Institute, P.O.Box 3930 Ullevaal Hageby
N-0806 Oslo, Norway/Norwegen

Fig. 1

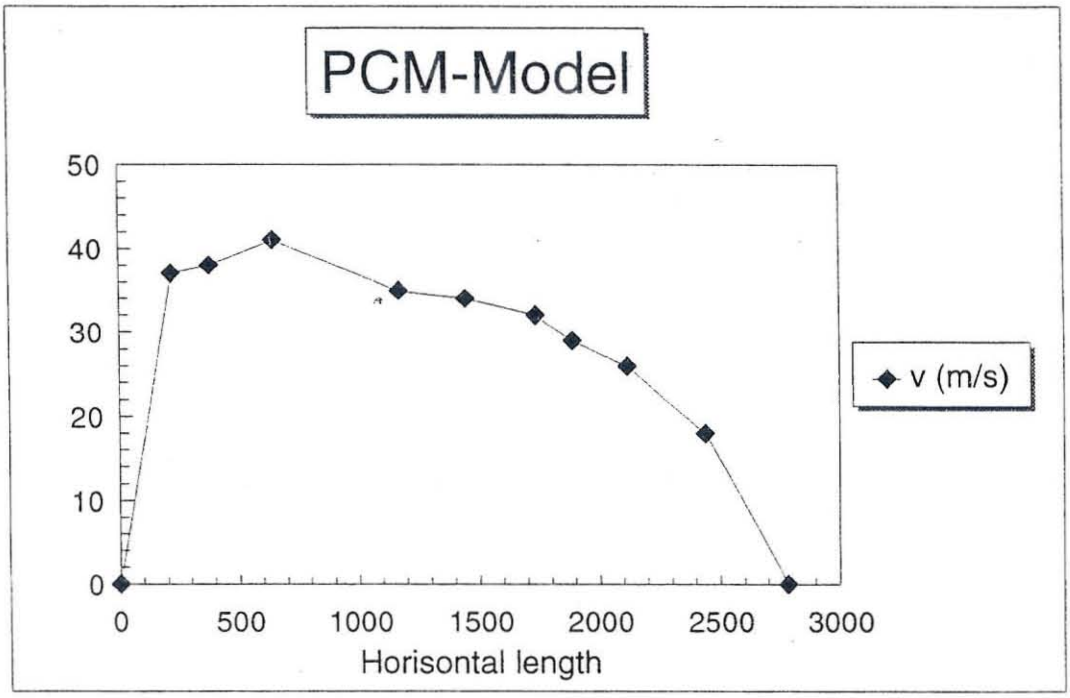

Fig. 2

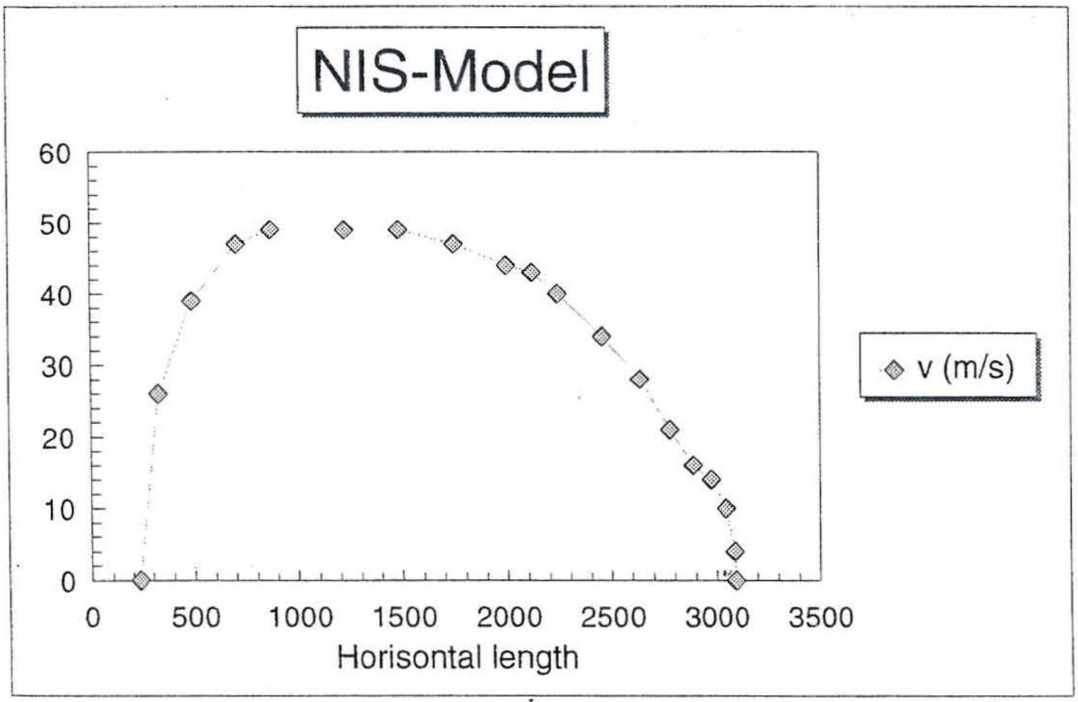
NIS-Model
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
3500
Horisontal length
v (m/s)

Fig. 3

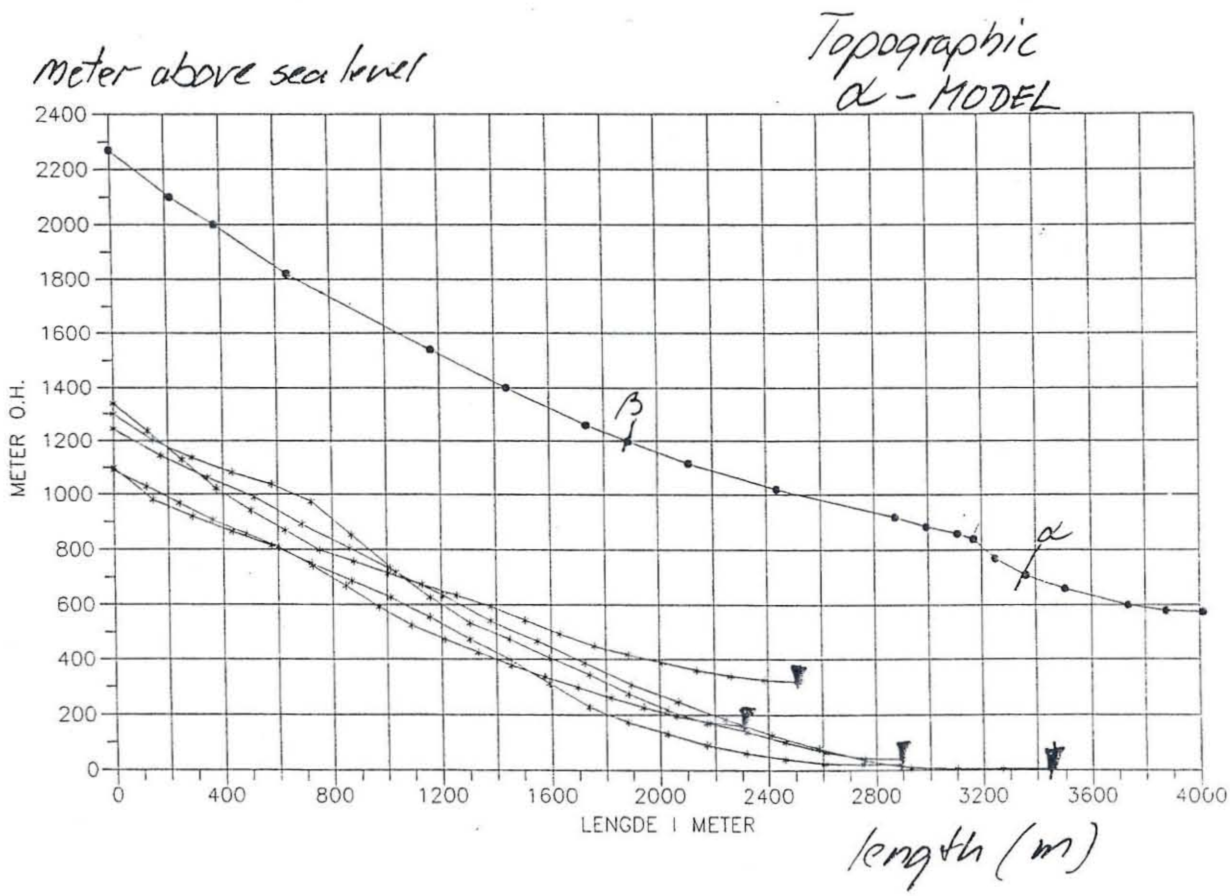
meter above sea level
Topographic α - MODEL
METER O.H.
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
LENGDE I METER
length (m)
β
α

Fig. 4