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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Avalanche Impact Pressures on Structures with Upstream Pile-Up/Accumulation Zones of Compacted Snow" *by* Perry Bartelt et al.

Anonymous Referee #4

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General comments I appreciate to read this paper that search to explain why large impact occurs even at low avalanche velocities.

However, as yet proposed by Peter Gauer and Thierry Faug, the theory proposed is very similar to what can be found in the Chapter 11 of "The design of avalanche protection dams", without a citation and without an explanation of the originality of this new work. I think that at least the explanation given in the Bartelt's answer (26 September 2018) should be introduced in the paper.

I would have expected a validation with more data collected in the field, or at least less simplification (in many cases the hypothesis h Ω=h φ is done, a rectangular dead zone

is proposed. . .).

In addition I would have appreciated a more detail where new equations are introduced.

Specific comments:

-Page 2 line 27: "kinetic energy" : do you mean "flux of kinetic energy"?

-Page 2 line 27: The additional assumption that the width of the flow is larger than the obstacle width should be underlined.

-Page 2 line 30: why in Eq. (3) dKφ/dt=0.5·dMφ/dt·Vφ2+ Mφ·vφ·dvφ/dt the term Mφ·vφ·dvφ/dt is omitted?

- Page 2 Figure 1. For a more understandable figure the z-axis could be added (In this way it is more clear where x=0 is). In addition since Eq. (12) is based on the presence of a slope angle the x-axis could be inclined. Hence Δd$\Xi\rightarrow\Omega$(t) could be represented in the figure.

-Page 4 line 4: what do you mean with "stationary"? I think that it is not in the sense of dS Ω /dt=0.

-Page 4 line 5: "remains smaller": this is an assumption

-Page 4 line 12: it is not clear to me from where this equation come from, in particular the value 1/2. In addition SΩ is written without the dot (in discordance with Eq.(6)?

-Page 4 line 17: it is not clear to me from where this equation come from.

-Page 5 Figure 2: it is not clear to me in which way the Froude number (for me Fr=u/(gh)0.5) is related to the density.

- Page 5 line 11: Do you mean that the "friction component" is the total pΩ or only $\mu\Omega$g z ?

-Page 6 Figure 3: the picture is not so clear. The x-axis drawn in vertical is difficult to interpreted: I suggest to turn the Side View picture.

- Page 6: Eq. 13 should be better explained

- Page 7 lines 25-26: “approximately twice” is in discordance with “between 3 and 5”

-Page 7 lines 27-32: what’s the Ω value?

-Page 8 Figure 4, on the right: I don’t understand why the value with $\Omega < \varphi$ is plotted (For instance φ=480 kg/m3 and φ=400 kg/m3 . In this way we would have a decompression!)

-Page 8 line 4: seen the Figure maybe it is better to use pT(t)«pΞ(t)

-Page 9 line 12: It is for this reasons that no data of Ω are available?

-Page 9 lines 13: why the name “RAMMS” is not explicited?

-Page 10 Figure 6 on the right: what do you mean with “Total pressure?” please explicit (for istance pΞ+ pΞ)

-Page 10 Figure 7: the shadow doesn’t allow to well see the picture

-Page 11 line 8: How much is high the bridge? This information can help the reader to understand better the problem.

-Page 11 lines 13 -14: “Calculated. . . 50 kPa)” is a repetition of “excess of the standard pressure formula (50 kPa)” at line 12

-Page 12 line 10: why do you continue to underline the specific case of h Ω=h φ?

- Page 13 line 4: it is not clear to me in which way the Froude number (for me Fr=u/(gh)0.5) is related to the density.

-Page 13 lines 8-10: it would be nice to see what happen at the density simulated by RAMMS, if a wall is inserted directly as a DTM modification. The model is able to describe the snow compaction or numerical instabilities occurs?

- Page 13 lines 25-26: Why do you say that it is not possible to experimentally measure

the pile-up in a test site? I think that at least characteristics as the final SΩ, the final density Ω can be easily measured.

-Page 13 line 27: A(hΩ,$\mu\Omega$) is not explained

- It is not clear to me why you talk about pile-up but you suppose h Ω=h φ. In addition the results are compared with the standard equation p=v2 used in Switzerland where a hstau=v2/(2gλ) is considered too. If this to heights corresponds at two different processes it could be explained.

- The reference “The design of avalanche protection dams” should be cited

Typing errors:

- Pag.1 line 21: “process: When” -> “process: when”

- Pag.2 line 7: “importance: The” -> “importance: the”

- -Page 8 Figure 4 caption: “givne”-> “given”

- Page 7 line 30: “coeffieciens -> “coefficients”

- Page 8 line 14: “model: To” -> “model: to”

- Page 9 caption Figure 5: “Vφ(0)=25 m/s” -> “Vφ(0)=26 m/s”

- Page 11 line 7: “caclculated” -> “calculated”

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