Response to H. J. Laimer comments (1st Referee)

The authors would like to thank the first referee for his attentive lecture of the manuscript and his valuable comments and constructive suggestions.

We are waiting for the second referee comments before giving the revised text.

Referee comments

The topic of the paper is definitely important for researchers in the field of applied earth science and construction or traffic engineers: small events are underrepresented in natural hazard research for several reasons but cause ever greater economic losses. The authors are trying to make the scientific community aware of the need to deal with the problem.

Therefore they collected online reports on natural hazard events affecting transportation networks in Switzerland. This approach could certainly be criticised for different reasons as data integrity or completeness, but the authors of course are aware of these problems. I think it is nearly the only way to get fast access to nationwide event data, particularly since infrastructure operators often have reservations against publishing their data.

The declared objective of the authors is to help decision makers to minimise the impact of natural hazards (l. 83 – 85). I therefore recommend offering some suggestions for ways in which infrastructure operators could be assisted in order to better illustrate the benefit of the new database.
Answer: Our main suggestion (added in the paragraph at the end of the conclusion):
Since the risk reduction on a track is difficult because of it is too expensive to add protective measures on the all track section as small events can occurred almost everywhere, we must reflect in terms of traffic accessibility at a local scale. Robustness of the network must be increased by maintaining or creating alternatives tracks in order to avoid as possible traffic restriction and indirect damages. Direct damage resulting from small events are not huge but their indirect damages can be important and expensive for a region. To maintain, to improve or to create emergency accesses like forest tracks in case of road closure can avoid isolating villages.

The factors of influence mentioned in the results chapter are not new, however, the paper provides essential statistical proofs!

I see only chapter 4.3.3 - Time of day and hourly distribution rather critically, because the time of event notification very frequently does not match with the real event time.

Answer: We agree that the time of event from the medias articles must not be considered as the strict truth. However, we believe that they correspond more and less to the reality, particularly for time of event occurring during the day because time of event from police services are generally trusty, train drivers must generally note on their book the time of a track restriction, event occurring on road with a certain among of traffic has different witnesses as well as event occurring on street in a urban area. Time of events occurring during the night or on track with little traffic (forest road) effectively match rarely with the real event time. We added a sentence to mention this fact at the end of paragraph 4.3.3..

The reason for the high proportion of landslides on rail tracks can not only be found in bad embankment construction (l. 342 – l. 343). Railways have higher exposure to landslides than other line structures because of their grade limitations. Rail tracks require a balanced gradient ratio, therefore they must be run along the valley sides over far distances. This requires long and steep cutslopes.

Answer: Thank you for this important and correct input. We have added text about this at the end of paragraph 4.4.1..

There is a separate chapter 4.5.5 - Deviation length for roads. What about alternative routes for trains? Are there any informations on this issue? I suppose it is very difficult to get appropriate data.

Answer: We have estimated the deviation length for railways but as they are less pertinent as deviation length on roads and that we had to reduce the manuscript length, we do not keep the dedicated paragraph in the last version of the manuscript. We see three different ways to estimate deviation length of train closures: 1) To compute the deviation distance on train track between the two stations on both sides of the closure (= no replacement buses service); 2) To evaluate the deviation distance on road track between the two stations on both sides of the closure (= replacement buses); 3) To compute the real deviation distance during a event (on road with bus or on railway if no replacement service). We have evaluated the distance on train track (solution 1 above). The average distance of the 27 computed deviations was estimated at 65 km. For 72 events on railways, it was not possible to have a deviation by train. In a general way, we believe that the increase of the travel duration in case of railway closures is more relevant for passengers than the distance of deviation itself. We have added some sentences about this problematic at the end of chapter 4.5.5.

I can hardly believe that highways are proportionally more vulnerable than other roads (l. 364 – 365). Is it not rather the case that small events on minor roads (e. g. nonpublic forest roads) are underrepresented in the database? The discussion chapter 5. 2. 1 contains a detailed outline of this problem (in particular l. 580 – 581).

Answer: Yes, events on non-public roads are underestimated in the database and we tried to discuss this in the chapter 5.2.1.

The authors dare to the extremely sensitive subject of damage costs. It is difficult to get reliable data for direct costs, for indirect costs this is an almost impossible task. Costs per square meter (small event 100 m2 , middle event 200 m2 , large event 300 m2) might seem unusual to infrastructure operators, but it could be a good approach to gain a nationwide overview.

Answer: Yes, direct costs are difficult to estimate (and indirect costs are effectively almost impossible to be estimated). Even different services (police, road service / railway company, communes, canton, Confederation, etc.) do not really know how much and for what they have paid to fix the track closure. Our proposition of costs per square meter is unperfect but it is simply and based on our experience of affected area superficies and based on the costs experience of a civil engineer. We tried to discuss those cost uncertainties and large cost variability according the event location in the chapter 5.3.

The figures are readable and helpful, a clear graphic visualization of the results.

The relevant articles and sources were quoted conscientiously.

-syntax and grammar-

consistent thousands separators (e.g. 5.000) *Answer: Space for thousands separators added.*

l. 24 . . .the database is imperfect because of. *Answer: Rewritten with :" the database is imperfect because of the way it was built".*

l. 48 . . .than for. . . *Answer: Rewritten with: " than large".*

l. 55, l. 58, l. 974 . . .Tchögl 2006, Tschögl et al. 2006 *Answer: Replaced and rewritten with: "Tchögl et al. 2006".*

l. 269 . . .bad weather events *Answer: "Meteorological" has been deleted.*

l. 297-6 . . .and by the. . . *Answer: Replaced with "by the fact that...".*

l. 297 . . . precipitation. . .falls as snow *Answer: Rewritten with "precipitations in mountains fall as snow".*

l. 304 . . .to occur. . . *Answer: Rewritten with "They occur".*

l. 316 . . . 6 pm? *Answer:18 pm was replaced with 6 pm.*

l. 343 . . .earthy. . . unsuitable fill material *Answer: Rewritten with "soil embankments or unsuitable fill material".*

l. 425. . . missing punctuation *Answer: Dot added.*

l. 440 – l. 442 and l. 534 – l.537 show a repeated text passage. *Answer: Exactly! L. 533 to 539 were now deleted.*

l. 456. . .event mass? *Answer: Replaced with "the material that fell".*

l. 464. . .before impacting. . . *Answer: Rewritten with "before impacting a fallen*

l. 539. . .debris flows *Answer: Sentence now deleted.*

l. 603. . .over the years *Answer: Rewritten with "over the years".*

l. 612. . .represents a certain *Answer: "S" added.*

l. 618. . .an impact. . . *Answer: Rewritten with "an impact".*

l. 631. . .word repetitions *Answer: Rewritten with "that can not be compared.".*

l. 669. . .without sufficient knowledge of natural hazards *Answer: Rewritten with "without sufficient knowledge".*

l. 693. . .have such an event database *Answer: Rewritten with "no interest to have such an event database".*

l. 695. . .Even if. . . *Answer: Rewritten with "Even if".*

l. 702. . .depends on. . . *Answer: Rewritten with "it depends on"*

l. 744. . .railway tracks *Answer: Rewritten with "railway tracks".*