Reply to referee R. Holle (referee #2)

We thank R. Holle for his constructive comments. Below we give detailed replies and briefly outline the changes we intend to make in the manuscript.

General comments

One of the general results is that younger males tend to be the most frequent victims of all types of natural disasters. It is mentioned that work scenarios are the dominant issue, but it is also stated that young males tend to be more risk-takers (line 559). It is apparent from other lightning studies that risk taking is more likely to be the dominant issue in the United States, at least.

This is an interesting point. We will scan the available US studies on lightning fatalities in order to consider this point in section 5.4 by adding a sentence and appropriate references.

Another comment is that many databases of natural hazards start the threshold at ten people affected per event. Instead, many phenomena, including lightning, impact one person at a time. The large number of such single-fatality incidents can exceed the total of ten-plus events. This causes an under-appreciation of several natural hazards in many reporting hazard systems. In fact, such limits affect policy as to what is being warned for the public. This is not an easy issue to resolve, but rightly is identified on line 635 in the paper.

Thank you for bringing this up. We will add a sentence at the end of the first paragraph of section 5.7 (at line 637) stating that additionally to the underestimation of total fatalities, this problem also leads to under-appreciation of natural hazard processes with a high percentage of single-fatality events.

Specific comments

1. Confusing comments near end: Line 211 states that the lightning total "includes all people who died after being struck by lightning." Tables 1, 2, and 3 show 164 lightning fatalities. However, on page 21, the first paragraph of the Conclusions states that some lightning deaths were not included in the previous data summary. Am I reading this wrong, or has a group been excluded from the preceding results? Do the data presented earlier in the paper not include those in connection with high-risk sports and other situations (line 718)? If so, what is the real number of lightning fatalities Switzerland, or is this an extra comment that doesn't affect the earlier numbers?

As stated in Chapter 3.4 (lines 220-228) we omitted natural hazard fatalities where people willingly exposed themselves to a considerable danger, for example, we omitted loss of life due to high-risk sports (e.g. canoeing and river surfing performed deliberately during floods) and other outdoor activities in potentially dangerous environments, such as canyoning, mountaineering and rock climbing (which take place off of official hiking trails). We also excluded popular snow sport fatalities outside of ski resorts, such as freeriding and alpine touring, that have been described elsewhere.
In the case of the process type lightning, this means that we did not include mountaineers or rock climbers struck by lightning for several reasons, including the fact that it is typically very difficult to determine the cause of death in such cases. Based on recent information of the Swiss Alpine Club, approximately six climbers/mountaineers died from 2000 to 2013 after having been struck from lightning. Prior data is not available.

2. Add global summary of fatality rates: Several lightning fatality studies are referenced starting with line 84. The following summary of national lightning fatality rates was not in the current version of the manuscript since it is quite recent: Holle, R.L., 2016: A summary of recent national-scale lightning fatality studies. Weather, Climate, and Society, 8, 35-42.

We will add a reference to this new publication (i) in the list of US studies on lightning fatalities and (ii) at the end of the same paragraph in a new sentence emphasizing on the global summary for 23 countries on six continents.

3. Add reference to India fatality study: The manuscript on lines 660 and 665 references a study by Singh and Singh, who found an average of only 159 fatalities per year within India. There has been an additional study by Illiyas et al. who found 1,755 fatalities per year. The latter seems more likely in this very populous country. The reference is: Illiyas, F.T. K. Mohan, S.K. Mani, and A.P. Pradeepkumar, 2014: Lightning risk in India: Challenges in disaster compensation. Economic & Political Weekly, XLIX, 23-27.

Thank you for providing this alternative reference regarding lightning fatalities in India. Interestingly, the study of Singh and Singh (2015) was published after the contribution of Illiyas et al. (2014). However, the latter publication is not cited in Sing and Singh (2015). Also, the two studies use two different data sources. While Singh and Singh (2015) extracted information from a database on disastrous weather events of the India Meteorological Department, Illiyas et al. (2014) apply three different data sources: the Bureau of Indian Standards data set, data from the Disaster Update Bulletins of the Nat. Inst. of Disaster Management, and data from the National Crime Records Bureau.
The difference in fatality data from the two studies is very large (approximately one order of magnitude) and leaves us a bit confused. The fact that the slightly newer study by Singh and Singh (2015) was published in an indexed Journal (Meteorol. Appl. Of the Royal Meteorological Society) somehow supports it. In contrast, Illiyas et al (2014) was published in an non-indexed periodical. But then again, Illiyas et al. (2014) clearly state that lightning-associated fatalities have received little attention in India, leading to under-reporting of incidents and lower media coverage.
For us it is very difficult to decide which of the two investigations better describes the occurrence of lightning fatalities in India. However, the remark of referee R. Holle makes sense to us and the higher indication of lightning deaths by Illiyas et al. (2014) seems more likely. Especially when the data is compared to data from other, similarly developed countries (cf. e.g. Table 3 in Singh and Singh). We will thus add the reference of Illiyas et al. (2014) to our text and slightly adapt our statement in section 5.7.

4. Effect of buildings: Page 15, line 515 states that the reduction in lightning fatalities is partially due to building and structures attracting lightning. Cloud-to-ground lightning interception by large structures is relatively rare. Instead, it is recommended that the reason is due to more people spending more time inside lightning-safe structures compared with decades ago.

This phrase originates from Derek Elsom (2001). He used this argument to explain the decrease in lightning fatalities. With the expansion of urban areas there are more buildings and other structures which can attract lightning. This means that the probability that the lightning strikes the taller building or structure nearby is higher than that it strikes a person nearby. The comment brought up by referee #2 is also very valuable and will be included and emphasized in the manuscript.

Technical corrections

Line 103: The word lightning has an extra e.
Corrected.

Line 283: Figure 5 referenced here would be easier to read if a log scale were used, since most entries have small numbers.
We agree with referee R. Holle and will adapt Figure 5 (this point was also raised by referee #1).

Line 729: The word lightning is missing the first n.
Corrected.