Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-302-RC2, 2020

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Synoptic atmospheric circulation patterns associated with deep persistent slab avalanches in the western United States" *by* Andrew R. Schauer et al.

Anonymous Referee #2

Received and published: 23 November 2020

General Comments

This is a well-written manuscript that utilizes a novel technique to assess synoptic-scale patterns that may promote deep persistent slab avalanche activity. The results may be useful for avalanche practitioners and researchers in U.S. close to the study sites and perhaps elsewhere. General comments are as follows:

1. You do not describe the snowpack setup conducive for a deep persistent slab avalanche; only minor discussion of depth hoar and faceting is provided in the discussion. I suggest including such information, as it is paramount to have such a snowpack setup for a deep persistent slab avalanche to occur.

2. The introduction does not refer to the relatively large amount of research conducted on deep persistent slab avalanches. A more thorough literature review would help set the layout of where this research fits into the overall goal of predicting such events.

3. I'd appreciate more details in describing the usefulness of this researcher for an avalanche forecaster, practitioner, or researcher. When may someone use this approach rather than assessing the snowpack to see if it is prime for such an avalanche type? I find it difficult to think that someone would assess the synoptic-scale weather rather than the snowpack to forecast for such avalanches. How can someone implement your findings within their overall workflow to better predict these hard-to-predict events?

4. Please discuss the potential for false alarms. Given these synoptic flow types, how many days did not experience deep persistent slab avalanche activity?

5. The SWE P75 values in Table 3 do not appear substantially different for the different flow types; for example, the differences are often single digits of mm SWE. Please better describe in the manuscript why this may be the case and if there are thresholds that a practitioner or researcher could use to better predict the release of deep persistent slab avalanches.

6. Consider comparing your parameter values to other studies. Are the precipitation and warming values comparable to other studies or substantially different, and why do you suspect this to be the case?

Specific Comments

Line 32: This suggests that no persistent deep slab avalanches release due to snowpack warming, or that they must be wet, i.e., due to melting. Consider reviewing.

Line 73: What snow climate are Bridger and Teton in? This is already listed for Mammoth.

Line 111: In terms of confidence in the dataset, it could be helpful to speak to whether

each avalanche was confirmed to have released on the recorded day or if interpretation/expert judgement was used to identify time of release.

Line 113: Why was 72-hour storm total used in this analysis? Please indicate its usefulness over 24-hour, 48-hour, or longer storm totals.

Line 127: What criteria was used to manually ensure each case was a deep slab? Were there comments associated with the avalanches indicating so, or information that they failed on deeply buried weak layers?

Line 194: Some of the top rows, for example 1D looks to have meridional flow. Are you referring to specifically over your study sites? If so, worth clarifying.

Line 381: I suspect any avalanche forecaster/practitioner would be able to tell you this. I suspect there are substantially more references that indicate a low early-season snow year can lead to late-season persistent deep slab avalanches. Perhaps worth deliberately stating that this paragraph is not a new finding but agrees with extensive previous observations and research.

Line 400: Perhaps some of the precipitation discussed occurred as rain, forming a melt-freeze crust. Jamieson et al. (2001) found a facet-on-crust snowpack setup particularly prone to deep persistent slab avalanche activity. This again refers to the manuscript not discussing snowpack setup prone to such avalanches.

Line 412: Some deep persistent slab avalanches occurred in November? Would these weak layers not only be a couple of weeks old?

Line 438: Perhaps also increased strain rate?

Figure 1: International residents may not know the state codes. Consider writing out state names, and perhaps in a darker colour for improved legibility.

Table 3: Maximum daily air temperatures appear to be quite high. As an avalanche practitioner, I would certainly be wary of a snowpack with a deeply buried weak layer

and a daily high air temperature close to or above 0°C. Even more so if such warm air temperatures were prolonged over days. Can this be further described/refined? Further, how many of these above-freezing air temperature days correspond to rain vs. no precipitation and does this correlate with activity?

Table 4: Bridger Bowl and Jackson Hole appear relatively similar in terms of location in Figure 1. It is interesting that Bridger Bowl and Jackson Hole seasons hardly align. Please describe why this may be the case, or if this is expected.

Technical Corrections

Line 138: period missing after y

Line 198: A should be An

Line 288: Move the ‘a’ to before ‘seasonal’

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-302, 2020.