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Interactive comment on "Using avalanche problems to examine the effect of large-scale atmosphere-ocean oscillations on avalanche hazard in western Canada" *by* Pascal Haegeli et al.

Anonymous Referee #2

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General comments:

This manuscript provides an interesting window into climatological drivers of avalanche hazards of different types and in different regions of western Canada. The study appears to be well-designed and carefully executed overall, and the paper is well-organized. It seems to have potential to be a significant and socially relevant contribution to understanding intersections between climate science and cryospheric science. The authors' closing point is an excellent one: that given the existing, and continuously improving, ability of the climate community to forecast ENSO and other seasonal climate conditions a few months in advance, these climate-avalanche relation-

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Discussion paper

ships have potential practical advantage for general avalanche season forecasts. The article seems suitable for publication pending minor revisions.

Specific comments:

Some additional referencing for AO impacts in the mountains of western Canada could be helpful. The impacts of Pacific-centered circulation patterns are very well-studied there, but the AO less so. Off the top of my head I can think of four additional examples that could be useful to cite here for additional support. Vincent et al. (2015) mapped out statistically significant temperature and precipitation teleconnections for much of Alberta and British Columbia to the NAO, which is closely related to the AO. Other examples I'm aware of in the region are framed in terms of hydroclimatic teleconnections to the AO specifically: Gobena et al. (2013), Fleming and Dahlke (2014), and Fleming et al. (2016).

While the small sample size (n=10) in time is of concern when studying associations between interannual climate variability and avalanche impacts, these concerns are mitigated by the use of statistical significance tests as an objective basis for ascertaining the presence of associations, as these of course account for sample size. This was done in the study, but the catch here is that the effective sample size might be reduced by serially correlated observations. If such a lack of independence exists, it can be handled in the statistical modeling, but I didn't see any mention of it in the paper. This procedural detail ought to be addressed.

The wording of lines 365-373 require some fine-tuning. The description of PO impacts provided in this passage is accurate for southern British Columbia, but there is a spatial dipole between ENSO/PDO teleconnections in southern BC and the Pacific Northwest vs. those in northwestern British Columbia and southern Alaska. See the article by Fleming and Whitfield (2010) already cited in the article.

References:

Fleming SW, Dahlke HE. 2014. Parabolic northern-hemisphere river flow teleconnections to El Niño-Southern Oscillation and the Arctic Oscillation. Environmental Research Letters, 9, 104007.

Fleming SW et al. 2016. Seasonal flows of international British Columbia-Alaska rivers: the nonlinear influence of ocean-atmosphere circulation patterns. Advances in Water Resources, 87, 42-55.

Gobena AK et al. 2013. The role of large-scale climate modes in regional streamflow variability and implications for water supply forecasting: a case study of the Canadian Columbia River basin. Atmosphere-Ocean, 51, 380-391.

Vincent LA et al. 2015. Observed trends in Canada's climate and influence of low-frequency variability modes. Journal of Climate, 28, 4545-4560.

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