The Cryosphere Discuss., 8, C1587–C1589, 2014
www.the-cryosphere-discuss.net/8/C1587/2014/

The Cryosphere
Discussions
Open Access

Interactive comment on "Elevation dependency of mountain snow depth" *by* T. Grünewald et al.

J. Parajka (Referee)

parajka@hydro.tuwien.ac.at

Received and published: 20 August 2014

General comments

This manuscript explores the elevation dependency of mountain snow depth based on airborne laser scanning and digital photogrammetry. The evaluation is performed at three different spatial scales ranging from the regional scale (several km2) to the individual slope transects. The results show that most of the dependencies have a typical shape showing an increase of snow depth with increasing elevation up to a certain level followed by a decrease at the highest elevations. Such shape is explained by the interaction of snow cover and topography (e.g. preferential deposition of precipitation and snow redistribution by wind).

Overall this is a nice and compact paper. It presents a unique dataset of snow depth distribution (in a very high spatial resolution) in different regions. I have only a few

minor comments, which might be considered to strengthen the manuscript:

1) I would suggest to state more clearly that the main focus is on the spatial distribution of snow depth approximately at the time of maximum snow accumulation, rather than to investigate the temporal variability in snow depth - elevation relationship.

2) The introduction will be more balanced if more weight will be given to studies looking on snow patterns and scaling (please give more details/findings from already cited studies and some other papers given in the references below). The precipitation variability is certainly important, but the main focus here is the snow depth spatial variability (elevation dependency). A similar shape of the relationship is e.g. found in the Carpathians (see e.g. Turcan 1975 or Holko, 2000).

3) Please consider to extend the Discussion and to indicate the challenges and implications of the findings (e.g. temporal stability of snow cover patterns - within a season, between years, effect of vegetation, how can the findings improve the operational practice).

Specific comments

1) Please consider to move/split the sections 2.1 and 2.2 to the introduction (and Data section). In the methodology, some more details on how were the ALS/ADP data processed might be useful.

2) Study sites: A paragraph summarizing the similarity and differences between the study sites will provide some important information which will support the interpretation of the results.

References:

Kirchner et al. (2014) LiDAR measurement of seasonal snow accumulation along an elevation gradient in the southern Sierra Nevada, California, Hydrol. Earth Syst. Sci. Discuss., 11, 5327-5365.

Blöschl, G. (1999), Scaling issues in snow hydrology. Hydrol. Process., 13: 2149–2175. doi: 10.1002/(SICI)1099-1085(199910)13:14/15<2149::AID-HYP847>3.0.CO;2-8

Trujillo, E., Molotch, N. P., Goulden, M. L., Kelly, A. E., and Bales, R. C.: Elevation-dependent influence of snow accumulation on forest greening, Nat. Geosci., 5, 705–709, 2012

Turcan 1975, Snow storage distribution in mountain watersheds, http://ks360352.kimsufi.com/redbooks/a104/iahs_104_0335.pdf

Ladislav Holko : Evaluation of long-term snow cover data in a mountain catchment, Acta Hydrologica Slovaca, Vol. 1, No. 1, 2000, p. 15 (Figure 2, Obr.2 shows the relationship between snow depth and elevation for different months)

Interactive comment on The Cryosphere Discuss., 8, 3665, 2014.