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Interactive comment on "Factors controlling Slope Environmental Lapse Rate (SELR) of temperature in the monsoon and cold-arid glacio-hydrological regimes of the Himalaya" *by* R. J. Thayyen and A. P. Dimri

Anonymous Referee #2

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R. J. Thayyen and A. P. Dimri: Factors controlling Slope Environmental Lapse Rate (SELR) of temperature in the monsoon and cold-arid glacio-hydrological regimes of the Himalaya

1. General comments

The authors analysed data from six weather stations located in two Himalayan valleys with respect to factors that control changes in near-surface air temperature due to different altitudes. Three weather stations were operated at different altitudes between 2540 and 3763 m a.s.l. in a valley of the Garhwal Himalaya, which reveals a mon-

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soonal glacio-hydrological regime. The other three stations were located in a valley of the Ladakh Himalaya between 3500 and 5600 m a.s.l., where cold-arid conditions prevail. The term 'Slope Environmental Lapse Rate' (SELR) is introduced by the authors to distinguish observed changes in near-surface air-temperatures at different altitudes from those that would result from vertical atmospheric profile measurements of air temperatures, i.e., environmental lapse rates. The author observe different values of SELR in the two valleys. In general, near-surface air temperature in the monsoonal valley decreases with altitude only weakly as compared to the cold-arid valley. From their analysis they conclude that moisture is the single most important factor determining the temperature distribution along higher Himalayan slopes.

The scientific question addressed in the paper is fully within the scope of TC and scientifically highly relevant, since data scarcity is a general problem in high-mountain regions, and a particular one in the Himalayan mountain ranges. Many scientific questions and applications in glaciology and hydrology are related to or depend on spatially distributed weather data. Since only limited observational weather data are available, gridded data are usually interpolated from available measurements using altitude data from digital elevation models as input variable.

The data presented in the paper are highly interesting and have not been published yet, thus the study would be worth being published. However, the conclusions drawn by the authors are not justified by the analysis as presented in the paper.

The study is facing several major problems that need further attention. First, comparison of results from only two valleys, i.e., from only one altitudinal profile in each glacio-hydrological regime, does not allow to draw general conclusions. Second, the first problem is further aggravated by the fact that the two profiles are from different altitudinal ranges that do almost not overlap. Thus, the authors cannot exclude the possibility that limited availability of moisture is strongly influenced by altitude-dependent effects not related to glacio-hydrological regimes. Third, the description of data and methods for analysing humidity data is by far insufficient. Fourth, it remains unclear,

TCD
8, C2695–C2698, 2014

why moisture shall be the most important factor, since other factors were not analysed by the authors.

The authors also state that simple interpolation of near-surface air temperature would be 'extremely untenable'. This statement is, however, not substantiated by any kind of analysis how errors would propagate into glaciological or hydrological models.

In general, the article is well structured and gives reference to relevant published work. However, the English language requires improvement.

Since both the scientific question and the data are highly interesting, I recommend asking the authors for substantially revising the manuscript before publication.

2. Specific comments

I would suggest to change the term SELR in near-surface air-temperature lapse rate, since this term is also used in the scientific literature. The word 'slope' is particularly misleading, since altitude effects are also present over non-sloping surfaces like valley bottoms or glacial terraces.

I would also recommend to use the unit K per km instead °C per km. The SI requires to specify temperature differences alsways in Kelvin! Unfortunately, this mistake is frequently found in the scientific literature, but it nevertheless is not conform to the SI.

Instead of using ERA-Interim data, I would recommend using gridded data that is able to better resolve the complex topography of the study region. The authors may check, if data from the High Asia Refined Analysis (HAR) would be suitable in this respect (see Maussion et al., 2014). This data set is publicly available at www.klima.tu-berlin.de/HAR.

Relative humidity, which is analysed by the authors, is strongly depending on air temperature. Thus, it would be much better to analyse variables like specific humidity or water-vapour mixing ratio. These variables do not only better characterise atmospheric water vapour but are both not depending on air pressure (as e.g. absolute humidity). I

TCD
8, C2695–C2698, 2014

would also check if data on precipitable water are available. Then, it would be possible to take phase changes within clouds into account.

Maussion, F., Scherer, D., Mölg, T., Collier, E., Curio, J. and R. Finkelnburg, 2014: Precipitation Seasonality and Variability over the Tibetan Plateau as Resolved by the High Asia Reanalysis. Journal of Climate 27(5): 1910-1927. http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-13-00282.1

Interactive comment on The Cryosphere Discuss., 8, 5645, 2014.