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The Cryosphere Discussions

Interactive comment on "Modeling Slope Environmental Lapse Rate (SELR) of temperature in the monsoon glacio-hydrological regime of the Himalaya" *by* Renoj J. Thayyen and Ashok P. Dimri

Anonymous Referee #1

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Overall Comments: This paper evaluates the slope environmental lapse rate (SELR) variations in the monsoon regime of the western Himalaya, and suggest a modelling solution for the valley scale SELR assessment. In the Himalayan mountain system, the variations on SELR are mostly controlled by the moisture and orography, and with a significant seasonal variations, is a relatively basic findings of this paper. The authors further suggest the use of standard environmental lapse rate (free-atmosphere) for temperature extrapolate in the region is not appropriate. Fundamentally, as increased atmospheric water vapor content or inversions, as well as changing of topography can seriously influence the assessment of air temperature as function of elevation in a particular location, and in a particular time. Therefore, this kind of site specific work from

the Himalayan region could be useful for the wider reader not only in the field of snow-glacier runoff modeling but also modelling in various field, such as hydrology, forestry, ecology, agriculture etc. The paper is descriptive, and well written, however, there are still some issues that need to be fixed before consideration it for the publication. The comments are appended below.

Specific comments: 1. I felt that the introduction section is lengthy that could be shortened. The description of earlier studies from the surrounding regions is fewer, that mostly covered the information on the farthest mountain systems, thus, explained knowledge gap in this manuscript is shown weaker. In addition to this, the cited literature in this section look very old. Some latest information is also available, for example, authors can check Yao et al. (2012) and some others recent literature; I hope those literature can be useful to get some ideas of glacier variations in the HTP regions rather referencing of too old report (e.g., IPCC 2007). Authors have briefly outlined of sections in the introduction part, as I believe it is too conservative, and just kills the space. I also noticed some statements that included here could be shifted into the data and study sites section. 2. I am confused with the explanation of one major synoptic system that mentioned by the authors, such as "Indian Winter Monsoon (IWM)" that is responsible to carry moisture during winter season in the region. As per my knowledge, the monsoon in summer that originates in the Bay of Bengal, which is commonly known as the Indian Summer Monsoon or summer monsoon that affects the entire southern foot hills of the Himalayas, as well as the southeastern Tibetan Plateau on the northern sides. Generally, southern Himalayan region, particularly western parts with Nepal, north-western part of India, and northern mountainous region of Pakistan mainly influenced by the westerly synoptic system that brings moisture from the Mediterranean or Caspian Sea. How can it define as IWM, please make clear. 3. SELR variation is related to variations in topographic characteristics and pooling of cold air in the low-lying areas. Generally, the differences between the lapse rate for maximum and minimum temperature are likely to inversions for the minimum temperatures in the absence of wind and clouds. The inversion is the opposite effect of temperature lapse rate. This

phenomenon frequently occurs to the valley, and influences the mean temperature lapse rates. Your study sites are valley; thus, further investigation into this issue is suggested in the revised version. In addition to this, the variation in snow cover at higher elevation also influences the SELR. In your study region some sites are located at high elevation land, therefore, further assessment for the variation in SELR in relating to the variation on snow covers is suggested. For your reference, recent literature of Kattel et al. (2015) from the surrounding region could be useful. 4. Some arguments that included in the results section could be shifted into the discussion part; please check it carefully, and includes the results only that you have obtained from your own data. The authors have confirmed by citing earlier literature that the variations in the influx of moisture into the 'Himalayas catchments', its orographic lifting and resultant latent heat release during condensation are the major contributors for the SELR variations, however, still no clear discussion have made by the authors based on their own assessments because they have used numerous methods of hydro-statistic, as well as atmospheric thermodynamic system to interpret their results. Please also discuss clearly the effect of net radiation, orography, and especially the effect of turbulent heat flux in the discussion section before made the conclusions. One more missing explanation is that on page 16, in section 4.3 SELR and specific/relative humidity relationship; in this section the authors have just described the variation of specific/relative humidity, but no discussion is there of the relationship to SELR.

Minor comments: 1. On page 11, in para 5, Please define the DALR, and SALR 2. Somewhere the authors have used liquid condensation level (LCL) and somewhere the lifting condensation level (LCL), what is the difference? 3. Referring to Table 4; I have seen that there is a systematic differences of R2 and RMSE with increasing elevation. Please also explain the causes of variation of R2 and RMSE, accordingly in the text. 4. On page 26, Annexure (a and c), the value of a = 7.5, b= 237.3 is ok if T> 273.15, this coefficient is not valid if T ïĆč 273.15, did you check it? 5. Please merge the Figure 1 into Figure 2, and make only one. 6. There are still numerous typographical, grammatical and syntax errors throughout the text. I suggest to the authors please go

through it carefully and fixed all issues in the revised version.

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