

## ***Interactive comment on “Soil temperature-threshold based runoff generation processes in a permafrost catchment” by G. Wang et al.***

### **Anonymous Referee #1**

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Review comments on manuscripts entitled "Soil Temperature-threshold based runoff generation processes in a permafrost catchment" by Wang et. el submitted to TC for possible publication. The authors intend to propose a new term "temperature-threshold" but I do have a few major concerns on the concept and the manuscript as a whole.

1). After read the title with great interest about the "temperature-threshold", I found it is essential as a surface soil freeze fraction as the authors described in eq. (2). I suggest that the authors use surface soil "freeze-fraction threshold" much better than the "temperature-threshold".

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2). p. 5860, lines 18-25: there is a lot of information here, the authors do not provide any references, I am not sure this is the authors' own work in this paper or the others' work.

3). p. 5961, lines 3-18: here the authors stated that they drilled boreholes up to 1.6 m to measure soil moisture content and soil temperatures. It is not clear how the authors place the FDR in the borehole, how soil moisture content was measured by using FDR in a borehole. It is critical to know how exactly this worked. Borehole temperature measurements are common but borehole soil moisture measurements are rare.

4). p. 5962, line18: "... the thawed active layer...", this concept is wrong. The active layer is referred to the maximum thaw depth over permafrost in autumn, so what is the thawed active layer? I guess the authors mean for thaw depth at a given time. If so, say so.

5). p. 5964, line 13: what is "... the deep active soil temperature."?

6). The section 1 should be rewritten, especially the second paragraph, the authors just copy from the citations from the paper of Wright (2009). The following lists some sentences. They are as same as the sentences in Wright's paper but changing the authors of citation. a. . . ., the function of seasonal ice in the active layer is coped from the sentence in Writht (1999) b. The drainage of precipitation and meltwater inputs primarily formed the thawed watersaturated layer perched above the frost table. c. The depth and distribution of the frost table within the active layer controls the position of the water-saturated zone, which descends through the soil profile during soil thawing. d. On the slope scale, uneven or progressive soil thawing on frozen slopes heavily affects the mode and rate of water flow downslope and the flow concentrations in rivers (Quinton et al., 2004; Wright et al., 2009; Woo, 2012).

7). What is the seasonal dynamics of runoff-contribution areas? How the freeze-thawing cycles of the active layer effect on river discharge? The authors don't answer them for their study objectives.

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- 8). The authors refer more than 85% precipitation fall in summer. If so, why is has “no obvious relationship between precipitation and runoff”?
- 9). The description of parameters in Eq.2 and Eq.3 needs further improvements. What mean of  $Q_s$ ,  $f(T_{\text{É}})$ ,  $g(T_{\text{sd}})$ ?
- 10). How could the authors justify assuming the saturation excess runoff generation is the dominant type of runoff generation during the spring and summer season. In fact, the infiltration excess runoff is common in the snowmelt period when frozen soils limit infiltration. As ground thaw begins, a thin saturated soil layer is formed. The base of this thawed layer is the impervious frost table which restricts percolation such that overland flow is issued from the saturated soil. Thus, in this period when frozen grounds begin to thaw, the transition from infiltration excess runoff to saturation excess runoff cannot be defined rigorously (Woo, 2012). How could explain the transition infiltration excess runoff to saturation excess runoff by the soil temperature threshold?
- 11). The model only modeling one month in thawing period and freeze period, respectively. It may be too short for the model’s calibration and validation process.
- 12). P5959 line 23. The definition of permafrost should be improved. Base to the definition of permafrost by Van Everdingen (1998), it should be “wherever the ground remains at or below 0 °C for at least two consecutive years”. The authors should also provide references for their definition of permafrost, etc.
- 13). Section 2.1 The temperature, precipitation, soil temperature and soil moisture should be showed for the thaw period and freeze period, respectively.
- 14). P5960 line 25, The active layer thickness should cite references.
- 15). There is no location of boreholes in figure 1.
- 16). There is no table 1.
- 17). P5961 line 17. The runoff processes monitored and analysis need further descrip-

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tion.

- 18). p5965 line 24. Since the snow is monitored by sensor, why do you use the air temperature method to estimate the precipitation? How do you use the snow or snow cover parameters in your model?
- 19). p5967 line 2-3. This is not in fig.3. How could it is significant while the  $P > 0.15$ ?
- 20). p5967 line 14. The runoff varied in May should be presented.

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Interactive comment on The Cryosphere Discuss., 9, 5957, 2015.

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