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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Winter stream temperature in the rain-on-snow zone of the Pacific northwest: influences of hillslope runoff and transient snow cover" *by* J. A. Leach and R. D. Moore

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We have pasted the comments from the reviewer below. Our responses are inserted to follow each comment.

Comments from Referee #3

This manuscript deals with the potential impact of changing climate and precipitation pattern on dominant heat fluxes and consequently stream temperatures at the catch-

ment scale in the PNW. The authors state that, opposed to previous studies advective energy inputs from hillslope runoff can have a dominant effect on thermal dynamics in catchments with transient snow cover. The results present a novel take on stream thermal dynamics under changing environmental scenarios and broaden the view of the relative importance of different energy budget components. A long-term shift in winter temperature will have multiple implications on stream ecology, some of which are briefly discussed here. However the amount literature concerning winter temperature is dwarfed by work dealing with summer conditions. In my opinion, one of the strong points of this manuscript is drawing attention to changes in winter thermal dynamics. Given this, I absolutely support publication with just a few minor suggestions to the authors. The manuscript is well-written and each segment is easy to understand. However, given the sheer amount of data presented (and I appreciate the level of detail in which it is presented), the methodology somehow feels disjoint. Although aims are already stated earlier maybe a short paragraph should give an outline of sections 3 and 4 to help link these two parts.

RESPONSE: We thank Referee #3 for her/his review and comments.

We have included a reference to the corresponding sections (3 and 4) on page 12955 where we first mention how the study hypotheses are addressed with the energy budget (Sec 3) and historical (Sec 4) studies. We have also included further text at the beginnings of sections 3 and 4 to help guide the reader through these separate but complementary studies.

– Specific points:

12957 l 26: If snow depth was measured along a transect, describe the specifications of the transect.

RESPONSE: We have added the following information in the revised manuscript: "Snow depth was measured with a ruler at approximately 2 m intervals along transects at each site that were 80 to 100 m in length."

– 12959 l 2-10: Could you give the time interval for temperature logging, as it was given for all other logging instruments. Is there any information you can provide concerning cross-calibration of temperature logging instruments. This also relates to other parts of the manuscript where this would be appropriate (e.g. 12971 section 4.1). Given the magnitude of differences observed during winter, differences in logger functioning might account for substantial parts of observed differences between sites.

RESPONSE: We will include the following information in section 3.1.3 and Section 4.1: "The time interval for temperature logging was 15 minutes. Temperature loggers were cross-calibrated at 0 deg C (ice bath) and room temperature, before and after field deployment. The stream temperature loggers were also routinely checked in the field using a WTW 330i handheld conductivity and temperature meter and found to be within the stated accuracy range of the loggers."

– 12967 l 21: Are these instantaneous temperatures or mean daily? Please specify. Could you provide information on the average/max diurnal temperature range?

RESPONSE: We will clarify that stream temperatures reported here are mean hourly temperatures. We will also provide information on the average and max/min diurnal temperature range for the Q1 stream temperature site.

– 12979 Section 5.3: Include not only increased temperature as basis for discussion on climate change, but also precipitation pattern. What are the projections for shifts in the annual precipitation pattern in the PNW (e.g. increase of extreme events)? How would these projections impact thermal dynamics based on your findings, if they would at all?

RESPONSE: This is an interesting suggestion. Although there is less certainty around the precipitation response to climate change than for air temperature, the general prediction is that there will be an increase in winter precipitation for this part of the PNW (e.g. Rodenhuis et al 2007). We will provide a short discussion on the potential impacts this increase in precipitation may have on the winter thermal regime.

– 12980 l 1-2: The timing of spring emergence of the overwintering invertebrate generation provides the opportunity to link (maybe in one sentence) the results to terrestrial food webs (e.g. timing the onset of breeding to aquatic invertebrate emergence by riparian birds) and help broaden the significance of the presented findings.

RESPONSE: Thank you for this suggestion. We will include a brief discussion linking potential thermal impacts on aquatic invertebrate emergence timing to terrestrial food webs.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 12951, 2013.