

Interactive comment on “Precipitation Transition Regions over the Southern Canadian Cordillera during January–April 2010 and under a Pseudo-Global Warming Assumption” by Juris D. Almonte and Ronald E. Stewart

Anonymous Referee #1

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Overview

This manuscript evaluates winter precipitation in southwestern Canada, with a particular focus on mixed precipitation in a transition zone, using two simulation outputs from the Weather Research and Forecasting (WRF) model - control and pseudo-global warming (PGW). This research evaluates transition, or mixed, precipitation during a time period that includes the 2010 SNOW-V10 project. The results are discussed relative to changes in transition elevation and placed in the context of the ski industry. This research examines an important hydroclimatological feature that has implications for

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transportation and recreation sectors and snowpack integrity in general.

General comments

The manuscript is well-written, but lacking some key elements. In particular, very little information on the WRF model or PGW are given. It is unclear how the WRF model classifies precipitation phase or how the transition regions are defined. Add a few sentences describing the model itself. Add a few sentences about what a PGW simulation is and how it differs from traditional climate change scenarios, or a broad overview of what the output of PGW simulations. A sentence or two describing the original study by Liu et al. would be beneficial.

The phrase “transition regions” is used throughout the paper; however, I assume these regions are defined by the 4 km grid points, therefore, the phrases “transition precipitation” or “transition grids” would be more appropriate. Additionally, it should be clarified if a transition region refers to a larger spatial area where mixed precipitation occurs or if a transition region refers to a single grid in which mixed precipitation occurs.

Given the links between this research, the SNOW-V10 project, and the ski industry, there should be a comparison between the WRF CTRL model output and the results of the SNOW-V10 project. Very little reference to the SNOW-V10 project was given beyond the Introduction. The authors should revise the manuscript to include comparisons and discussion between this research and the SNOW-V10 project.

Specific comments

Line 21: links to impacts to avalanche activity and ski resorts seems like an afterthought, add more context, given the extent of the links to these impacts in the manuscript

Line 35: references to avalanche activity in southwestern Canada would be more appropriate for this sentence. There are many studies, particularly for the Columbia Mountains

Lines 36-37: would be useful to discuss transition regions as variable in time and space

Line 39: might be more appropriate to use “transition precipitation” rather than “transition regions”

Lines 93-96: Need more context for the importance of transition regions to society, including more on ski resorts, as this is one of the foci of the study, and as an indicator of climate change

Line 90: HRCONUS dataset is not discussed further in Section 2, there is only a quick mention of the boundary between this study and HRCONUS. What is the relevance of HRCONUS to the present study?

Lines 136-140: With respect to “substantial precipitation” is there a minimum daily accumulation or just 0.2 mm per hour? Because if there was only one recorded precipitation event at that grid point for a single day, and the total accumulation was 0.2 mm, it is not considered a substantial amount. Also, substantial is a subjective word. Perhaps revise to state that the total daily accumulation may be higher than the minimum ECCO standard. This model may underestimate the total number of occurrences.

Lines 143-144: it is unclear how the categories were defined, or how the WRF model delineates precipitation phases. What are the “additional steps” to categorize precipitation?

Table 1: unnecessary. It is intuitive by the transition region category that certain precipitation types are included within the category. For example, it is intuitive that rain-snow includes rain and snow but not graupel and freezing rain, where rain-snow-graupel includes rain, snow, and graupel but not freezing rain.

Line 164: A margin of error is given for the resulting temperature from the WRF simulation, but what is the margin of error for precipitation phase? Considering the “difficulty of forecasting for precipitation types within the transition region” it seems pertinent to discuss potential errors or precipitation misclassification from the model output. Was

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there any validation of precipitation phase done as there is for temperature? Would the overestimation or underestimation of temperature at given locations influence the resulting precipitation classifications?

Lines 355-363: This paragraph is poorly explained. The sentence “. . .when warm moist Pacific air entered the study area, the elevation of the 0°C isotherm would at times occur above the peaks of the Insular and Coast Mountains, effectively lowering the average elevation of the transition region” is unclear with respect to how the isotherm affects the elevation of the transition. Additionally, by “number of transition regions” are you referring to the number of grid points? If yes, then be explicit, perhaps refer to them as grid points with mixed precipitation or similar.

Figure 14: the y-axis is squished and hard to distinguish between the CTRL and PGW lines

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