

Linking ENSO and heavy rainfall events over Coastal British Columbia through a weather pattern classification

by P. Brigode, Z. Micovic, P. Bernardara, F. Garavaglia, J. Gailhard, P. Ribstein

General comments and recommendation

The manuscript presents the interest of a weather pattern classification to improve our understanding of rainfall characterization at regional scale. Heavy rainfall is the specific target.

The manuscript aims at identifying the relationship between ENSO oscillations, weather patterns and heavy rainfall statistics in the coastal region of British Columbia.

This subject is of a particular interest when considering the general context of climate evolution and its impact at regional scale. Understanding the actual regional climate, in particular the link between atmospheric circulations, ocean forcing and rainfall in a given region, will aim at building a robust method to study the evolution of the rainfall regime and/or the occurrence of heavy precipitation in the future scenarios.

→ Therefore, **the present study addresses relevant scientific questions that are within the scope of HESS.**

Nevertheless, the paper is difficult to read and understand. Concepts are not fully presented. For example, the description of the methodology to provide weather classification needs to be improved, in particular its evaluation is missing. The quality of the Figures is sometime very poor and makes the understanding difficult.

→ **It therefore needs major modifications to reach HESS standard.**

Major/Minor comments

1/ Introduction

Weather clustering is widely used in particular for rainfall issues. **The authors should better highlight the interest / limit of their approach to other methods** (e.g. Kohonen approach (e.g. work of Michaelides ; ...); Statisto-dynamical approach (e.g. work of Beuland et al. ; ...); Statistical downscaling (e.g. work of Boé et al. ; Hingray et al. ; ...) ; etc ...).

2/ Section 2

This section refers to previous published works. Nevertheless, as it is, **it is difficult for the reader to fully understand the main stages of the methodology, the hypothesis and the uncertainty.**

As an example, the choice of the 2 geopotential (1000 hPa, 700 hPa) is motivated by results obtained for other climatic contexts and for different issues (forecast). How the authors can be certain that such results can be extrapolated to another region. Moreover, as far as the reviewer knows, the same authors (Obled, Bontron) also showed that the moisture flux is an important ingredient to improve the forecast. Why this latter variable is not taking into account in weather pattern classification in this present study?

Moreover some choice needs to be better justified (e.g. definition of rainy days defined as the top 20% days? Why 20%? Can't we define a rainy day based on the spatial intermittency that has to be low?

→ This section needs to be carefully reviewed in order i) to clarify the different steps of the clustering methods, ii) to add some information concerning its evaluation (intra class variability; inter class variability) and/or the associated uncertainty to the choice of the number of weather class, and iii) to justify the choice of some thresholds, variables.

3/ Section 3

For the reader who does not know in detail the geography of the studied region, it would be helpful to have an idea of the distribution of the raingauges as regard as the altitude.

Page 12, line 20 – 22: I do not understand why the SST is only average within the DJF period to

characterize the winter period, previously defined as ONDJFM.

4/ Section 4

The use of several acronyms, the non-consistency between the choice of color for Nino (red in Fig2 and then Blue in Fig6) and Nina (blue in Fig2 and red in Fig6), the poor quality of the figures, in particular Fig4 and Fig5, makes this section very difficult to understand.

Page 13, Line 19: I do not understand the 8%. From Fig3, I am not able to extract this number. Please clarify.

Figure 4 and the comments Page 4, lines 4 – 15: Figure 4 needs to be explicitly split in 3 different panels a), b) and c). Figure 4c needs to be enlarged. The legend needs to be enlarged. Mean precipitation should be explicitly given for each weather class.

I do not agree about the circulation direction of WP2. It is oriented North-Western – South-Eastern and not North-South. I do not agree with the sentence “WP4 ... *the same oriented circulations ..*”, the orientation is different and it should be mentioned that the circulation is also weaker that explain the weaker precipitation pattern. Please clarify these points.

Page 15, lines 10 – 13: I do not understand these 2 sentences as regard as Figure 6. Please clarify.

Page 15, line 22: What do you mean by “more homogeneous sub-samples”

Figure 5 needs to be enlarged. Legends are too small as well as the table.

Page 16, lines 22 - 23: the sentence needs to be reformulated.

Page 18, line 2: I read in Figure 7, -40% instead of -30%. Could you clarify?

Page 18, line 10: *exprimed* should be *expressed*

Figure 8: I do not understand the unit of the legend. Could you detail more.

→ In general in this section, few comments are given concerning the findings and the uncertainties associated to the methodology. How robust are the main findings?

Principal Criteria	Excellent (1)	Good (2)	Fair (3)	Poor (4)
Scientific Significance: Does the manuscript represent a substantial contribution to scientific progress within the scope of Hydrology and Earth System Sciences (substantial new concepts, ideas, methods, or data)?		The main objective is relevant. The methodology is robust.		
Scientific Quality: Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)?			Limit of the methods is missing. State of art limited	
Presentation Quality: Are the scientific results and conclusions presented in a clear, concise, and well-structured way (number and quality of figures/tables)?				Figures vs the text Too concise (description of the methods, discussion of the results)