Hydrology and
Earth System
Sciences

Discussions

Interactive comment on "Evaluation of drought representation and propagation in Regional Climate Model simulations over Spain" *by* Anaïs Barella-Ortiz and Pere Quintana-Seguí

Anonymous Referee #1

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Title: Evaluation of drought representation and propagation in Regional Climate Model simulations over Spain.

Authors: Anaïs Barella-Ortiz and Pere Quintana-Seguí.

Recommendation: reject/resubmit

Summary:

This paper evaluates the meteorological and hydrological drought (here including soil moisture) representation using the standardized indices (SPI, SSMI, SRI, and SSI) in Spain. Moreover, meteorological drought propagations into hydrological droughts (soil

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moisture, runoff, and streamflow) were analyzed by correlating SPI-x (x=accumulation periods) with hydrological drought indices (SSMI-1, SRI-1, and SSI-1). 2 forcing data (SAFRAN and ERA-i), 6 models (RS4, CL4, PMS, ISB, ORC, and SMP), and discharge observations were used in the study. They conclude that RCMs is better suited for meteorological drought analysis than hydrological ones. In addition they also suggest to use more models and indices.

Assessment:

The topic of the paper is fit well in HESS and is of great interest for the HESS readers. The findings are also interesting for readers working on the drought and modeling of climate and land surface models. While the work and findings are interesting, the paper is poorly written especially in the abstract, introduction, data, and method sections. I have a problem in understanding some sentences and statements. The conclusion does not describe the important findings of this paper. Based on my review, I decide to reject the paper at this state. However, I encourage authors to reconsider to resubmit their work. I provide my comments below and would ask the authors to take these comments into consideration as they resubmit the paper.

General comment:

1. The title is misleading. This study is not only used RCMs but also LSMs and hydrological models (HMs).

2. The abstract is not informative and poorly written. The objective of this study is not clear. For example authors stated that it is vital to study the evolution of drought in relation to climate change, and therefore better understanding processes involved in "it" is a key. This is not your objective to study the evolution of drought related to climate change. Second, the methods and tools that authors used in the study are not well defined in the abstract. Last, the conclusion does not summarize the main findings.

3. The way the authors wrote their introduction can be concluded as follows: 1) many sentences in the introduction part are unclear and need to be re-written, 2) there is no clear story line, 3) the introduction is not well structured in reasoning, 4) missing many related references e.g., increase of drought in Mediterranean due to climate change, drought propagation, models uncertainty from WATCH. 4. Section 2 and section 3 can be combined and need to be restructured. For example: 1) in section 2 the authors already discuss about the precipitation amount simulated by the models. 2) Section 3.2 discusses about the models, but LSM, RCM, and HM models are also models. So why authors separated them? 3) SURFEX and ORCHIDEE are LSM and why authors wrote them in different sub sections than LSM section (3.2.1). 4) I suggest the authors start with RCMs first and then followed by LSMs and HMs.

5. Section 5 and 6 are well structured and also better in writing than other aforementioned sections. The conclusion is also expected. Of course the meteorological drought is better represented using climate model, and hydrological drought better represented using hydrological models. Moreover, authors also highlight the use of more models and indices, where in my opinion it is not necessary. This paper already used many models (RCMs and HMs). Different indices can be used but it depends on the goal of the study.

6. Some typos and grammar mistakes found in the texts.

Line by line comment: L refers to Line and P refers to Page Note: Authors still need to pay attention for other sentences that are not mentioned here.

L171: Already in line 1 I do not understand with your sentence. Here you stated: "Drought is an important climatic risk, of modeling.." what do you mean with that? Rephrase the sentence.

L4P1: You may remove "comma" from: "The study here presented, analyses.."

L5P1: here you only mention RCM models. How about LSMs and HMs that you used?

L6-7P1: You stated: "...these models improve meteorological drought representation, but..." It is unclear how you tested this? It was not stated in the previous sentences.

L8P1: You said: "These are mainly due to the relevance of model formulation" Is it model formulation or structure?

L13-14P1: You stated: "...impacts from recent climate related extremes show a significant vulnerability..." I do not understand this. Impacts from climate extremes show vulnerability?

L15P1: Do you mean different development level such as less develop and well develop countries?

L18P1: Limited references. There are many.

L22P1: There are more references for drought types, e.g., Van Loon (2015): hydrological drought explained, Mishra and Singh (2010): A review of drought concepts.

L4P2: What do you mean with there are no thresholds for soil moisture drought?

L6P2: Runoff is also one of hydrological drought where you also used in this study.

L9P2: Here you introduce environmental drought. Can you give references about that? As far as I know, it is socio-economic drought.

L10P2: You may add Van Loon et al. (2012): Evaluation of drought propagation in an ensemble mean of large-scale hydrological models.

L12P2: I do believe it is not potential evapotranspiration but actual evapotranspiration.

L12-13P2: This statement: "....related to the availability of irrigation water in irrigated areas, thus depending on the hydrological drought" is unclear.

L15P2: You may write "some years"

L15-16P2: You wrote: "However, if there is no further delay in precipitation, it can occur that no hydrological drought is observed" What do you mean? Small precipitation

amount may not alleviate hydrological drought.

L19-20P2: Repetition with first paragraph.

L21-22P2: It is not necessary if you analyze drought without human influence where this may be the case in the models that you used.

L28P2: You may remove the word "used"

L32-33P2: It is not clear sentence: "following this line". Also you may replace ";" with "."

L4-5P3: I do not agree that RCM simulation is cheaper than GCM in terms of computing resources. First RCM needs GCM outputs for boundary model's inputs, second the computing resources depends on the resolutions of the model.

L13-14P3: Unclear sentence. What kind of tools and what will be improved?

L15P3: You may remove ","

L15P3: you may replace "capacity" with "capability"

L17P3: Too many "it" can you define what are it?

L19P3: Should be analyzed since they did the studies in the past.

L20P3: Replace "uses" with "used" and also define those three drought indices. What are they?

L21P3: Replace use(s) with used. The word "too" is informal.

L23P3: Replace analyse with analysed.

L25P3: Replace use and study with their past tense form.

L26P3: you may replace: "..studies are..." with "...those studies were..."

L27P3: Replace analyse with analysed.

L28P3: Replace are with were.

L29-32P3: Why don't you combine these two sentences?

L6P4: Missing "the". The standardized indices.

L7P4: You may replace "with" with "using"

L8-10P4: Please write the full meaning of SSMI, SSI, and SRI first since this is the first time you introduce these acronyms.

L11P4: Rewrite: "...we will detail the study are".

L18-25P4: This paragraph should be in the result section.

L26-27P4: Can you elaborate more why soil moisture anomaly in spring may influence droughts and heatwaves? Also this statement is not belonging to study area.

L29P3: I suggest you to use different word for relief such as mountainous areas?

L31P4: What is "it" refers to?

L32P4: Rewrite "to use" into "to be used"

L2P5: You may write: "..a reduction of precipitation..."

L5P5: What is "it" refers to?

L8P5: You write: "...increase this type of drought". In my opinion snow melt can increase or decrease the hydrological drought depend on early or late snow melt.

L17P5: Why don't you combine paragraph 2 with 1?

L23-24P5: This paragraph stands alone and can be combined with previous paragraph.

L28P5: Rewrite: "...detailed in Quintana-Segui et al. (2016).

L31P5: You may replace "in" with "for"

L6P6: Again you may combine all paragraphs in this section (3.1.2) into 1. Paragraph 1 consists of two sentences, which are about ERA-interim and then paragraph two starts with the word "it". You should combine this paragraph since you still discuss about the same thing. Also you cannot start new paragraph with the word "it".

L9P6: What is "it" refers to? Spatial resolution?

L11-12P6: please give reference.

L12-13P6: You write: "…they can be corrected". How?

L1P7: Rewrite this sentence: "Since there is no observed truth for soil moisture available,…"

L8-9P7: You should write the full names first before the acronyms.

L14P7: You may add "in" before 1 km resolution.

L14P8: Rewrite the opening sentence.

L18P8: Replace "is" with "are" since you mention about drought representation and propagation.

L20P8: You may reverse the words into "…represent physical processes in different ways…"

L22P8: You used the name CNRM-RCSM4 but for previous sentence you use the name RCSM4 only. Please be consistent. Also for COSMO-CLM in L27.

L1P9: In the section 3.4, please mention the number stations that you used in your study.

L2-3P9: Missing verb in this sentence.

L3P9: You may write: "To obtain monthly time series…"

L4P9: Can you elaborate why south is not as represented as the north?

L5P9: You may rewrite "to having" with "to have"

L7-8P9: You wrote: "In this way, both studies complement each other. . .." It is not clear sentence. What is in this way?

L10-11P9: This sentence is not clear. You may write: ". . .we compute SPI and SSMI, which require precipitation and soil moisture data, respectively".

L14-16P9: Proper citations for all indices you mention here, except if you already did so before.

L1P10: You said the variable's time series is transformed from its original distribution to a normal one. What kind of distribution? Gamma, GEV, Pearson, etc?.

L3P10: You may rewrite: ". . .in the meteorological case. . ." into "for meteorological case. . .."

L4P10: You may change "for" with "from" and also missing verb.

L8P10: Why only for SPI-12?

L13-14P10: Please give reference.

L17P10: Please use better opening sentence.

L19P10: You may write actual evapotranspiration.

L15P11: You can combine second paragraph with the first.

L17-18P11: What do you mean with relief is a determining factor in distribution?

L21P11: Modeled precipitations usually have higher results than the observed and ERA-i. There are some papers show that.

L4P12: Drought in 2005-2006 does not coincide with those found "in" Belo-Pereira et al. (2011) but it occurred. So please rephrase.

L6P12: It is hardly to see in the Figure. Can you write the number of months?

L2P13: typo for tan

L10P13: You may write: "The difference is the degree to which they deviate"

L11P13: What are "it" refer to?

L12P13: What do you mean with "do it"

L6P15: How about the white color in the table?

L12P15: Please rewrite: "...RCMs compared between them..."

L14P16: Please elaborate more why SPI with higher accumulation period is slower.

L3P17: you may rewrite: "...to the LSM with the surface scheme it is coupled to." Into "...LSM coupled with the surface scheme."

L7P18: Rewrite: "To single out stations"

L19-20P18: I thought LSMs should have better results for hydrological drought than GCMs.

L22P18: I saw 0.6 and not 0.7. Also you said that PMS behaves better over both basins. How do you define PMS is better? By average value or by color?

L4P19: Again what is white?

L14P21: You may change from "the 9025 station" to "station number 9025"

L10P22: What is extension?

L33P23: You may rewrite: "..that PMS' precipitation extremes are too strong" into "...that PMS simulates higher precipitation amount."

L9P24: I believe you cannot avoid the error but you can minimize the error.

L15P24: Replace use with used. Past tense passive sentence.

Figures: They are too small, cannot see them clearly.

Table 6: I cannot find the number in bold. Can you also please write the correlation numbers for each color in the caption?

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