

Interactive comment on “Multilevel and multiscale drought reanalysis over France with the Safran-Isba-Modcou hydrometeorological suite” by J.-P. Vidal et al.

Anonymous Referee #1

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General Comments

This is an excellent paper on the spatial and temporal dynamics of meteorological, agricultural and hydrological droughts in France. Whilst this a novel and particularly valuable contribution as a regional study (as the authors note, this has not been carried out before in France), it is also a valuable and timely contribution to the international research community. Whilst space-time drought analysis have been well advanced recently in the USA and on global scale, this kind of work has not been applied in Europe so comprehensively; there are also significant methodological benefits in the current

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paper, compared to previous approaches. As such, it is an internationally significant dataset and suite of analyses. The methods used are robust and allow consistent application across levels, space and time. The paper is very well presented, with very clear graphics which do a good job of synthesising a great deal of complex information in a manageable way to the reader. The authors should also be congratulated on doing such a good job of ensuring a top-quality manuscript which generally needs only minor attention. The paper is almost publishable as-is, but some minor English adjustments would enhance it; equally, in my view, a slight rebalancing of the paper could make a big difference, with some detail cut from earlier on and replaced with a little more penetrating discussion later.

Specific Comments

Whilst the authors do consider the limitations of their work, I think it would be well worth them underlining in the discussions and conclusions that this is all based on modelling assessments. There is some consideration of uncertainties in section 7, but I feel this could be strengthened. At several places in the paper, they acknowledge that the model has been tested elsewhere (e.g. section 2.1), and do make comparisons with independent observed data (e.g. section 4). However, it may be worth strengthening the discussion, to make it more transparent and to underline an ongoing need to provide ‘ground-truth’ for these sorts of broad-scale modelling assessments.

The paper feels a little on the long side in places. Overall length is probably OK, but perhaps there could be more discussion of the implications of this work later in the paper, at expense of some of the detail in earlier sections (as noted in the technical comments). The authors describe some applications of the method in the conclusions, but there are probably wider implications of this study (for drought monitoring in Europe, for example) which could be brought out in the discussion.

I was confused by the section on seasonality (5.2), and Fig 7. Which I think is slightly ambiguous and potentially misleading. This may just be my reading, but I would be

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grateful if the authors could clarify this.

Language generally very good – worth a thorough proof read, many minor corrections below but some generic points (over use of ‘indeed’ and ‘besides...’ times; some confusion with plurals).

Technical Comments

6456, 25. “Drought events occurred regularly over the last decades”. “the last” does not sound suitable here; “recent decades” or “the last few decades”?

6457, 9. The authors point to the three types of drought identified by Wilhite and Glantz (1985). Other authors discriminate drought types along different lines (e.g. separating groundwater and streamflow). Perhaps just worth an additional sentence to set the wider background of drought type discrimination, before referring to W & G model.

6457, 11. “Also depending on the socio-economic sector considered is the time scale of water deficits..” sounds ambiguous and is not clear. Reword to “Also, depending on the socio-economic sector considered, water deficits will have impacts over different timescales..” or similar (if this is what the authors mean)

6457, 18. This ‘indeed’ is superfluous (several other examples). Would be clearer to just say “many studies have attempted”.

6457, 23. “allow to consider” . Should be “allow the consideration of ...”

6457, 28/29. “Very few large-scale assessment...has been made”. Very few implies the plural. Should be “assessments.have been made”

6458, 29. “Sect. 4” – earlier sections referred to as “Section 3” etc. Also “Sect.” is used at top of 6459. Check consistency through paper.

6459, 25. The term and concept “force-restore” may not be familiar to many readers. No need to go into detail as there are references to other work, but might be worth a very brief sentence in parenthesis with reference. “force-restore (i.e.)”.

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6460, 15. Multi-layers aquifers. Double plural. Should presumably be “Multi-layered”.

6460, 17. “3-h” should probably be spelled out as 3-hourly.

6460, 24. The hyphen-comma combination could probably be removed, by just putting this section in parentheses

6461, 19. “Sicily and Elbe basin in Germany” is ambiguous. Maybe “in both Sicily and the Elbe basin in Germany (Bordi et al. 2004)”.

Section 2.2.1 Do the authors need to cite all of this work (e.g. the multiple studies carried out by Sheffield, Wood and colleagues?) If the aim is just to refer to where other authors have applied SPI-type analysis to soil moisture and runoff, this whole section could be trimmed down, with just a few references, without losing much.

Section 2.2.2. Could probably also be trimmed down by being sparing with refs to previous work. This may allow a fuller description of the method used in this paper (which only gets a short para at the end). As it is, this last para is not that informative.

6464, 8. “..a probability of occurrence 20%”. Should be “...occurrence of 20%”.

6464, 9. “...of all drought indices”. This is a bit ambiguous (sounds like referring to SPI, SSWI, SFI). Surely this is the distribution in time of all values for a particular drought index for a given location.

6465, 25. “% of France total area”. Would “% of the total area of France” be more suitable?

6466, 9. “...curves enable to remove...” grammatically incorrect. Replace with: “...curves do not suffer from the artificial reduction...” Or “curves enable the removal of...”

6466, 24. “It thus hides periods of less extensive but less extreme drought conditions”. If these periods are hidden, it is not clear that this statement follows on from the graph; should the authors refer to an example?

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6467, 1. “appear to associate characteristics” should be “appear to be associated with characteristics”

6467, 10. “remaining” should be “remainder” or just “the rest of this article. . .” This is also factually incorrect as Section 4 focuses on the 3-month duration. Perhaps the authors could rephrase to ensure this is consistent.

6468, 1. Onwards. Comment: this is very useful as it does allow a direct comparison with observed data, and this section is very well informed, with good cross references to previously published work in France and elsewhere; this does provide the reader with increased confidence in the results from the modelling work.

6469, 28. The use of the term ‘globally’ here is potentially a bit misleading. Do the authors mean overall, across France, if so perhaps rephrase.

6470, 12. There is some tension here between the use of the term “about a drought event” and then the first bullet point which asks how often it will occur. In the strict sense, a drought event can only happen once. Perhaps the final sentence should read “..about drought events”. And then the bullet points be made plural “how often do they occur” “when do they start” “how long do they last” etc. Or just change the first bullet to read “how often do droughts of this type occur” or similar.

6471, 1. spelling: “exemplify” should be “exemplify”

6471, 3. Is the spatial variability of SPI really so limited? There appears to be quite a reasonable gradient in SPI12.

6471, 6 – 10. The authors pick out general patterns, but there are clearly exceptions (very sandy, low clay area in NW does not have many events), and the authors do not really explain why there are differences between the centre and SW dependent on vegetation. The authors should explain more fully and/or underline that these are only general observations and more work is needed to explain the patterns.

6471, 24. Should be “Wilson’s” or “the Wilson. . .”

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6471, 25. “Thus hides situation..” should be plural, “thus hides situations”

6471, 20 – 28, and Caption to Fig 7. MAJOR COMMENT: I am confused by this section. I thought the idea would be to test for situations where the frequency of events in the most frequent starting season is not higher than that which would be expected by chance (1 in 4), and hide these. But reading the text, it sounds like the authors are referring to the significant cases being those shaded black. If they are shaded, I don’t see how the reader is meant to refer to the season in question. This makes this section very difficult to interpret. Please clarify the process and how the reader should interpret the black shading in the fig.

6473, 13. “The remaining of the country” change to “remainder” or “remaining areas” or similar.

6473, 13 – 14. Is this necessarily true? In many areas the streamflow droughts are shorter than the soil moisture droughts (although it is quite difficult to tell with the streamflow points comparing to the gridded points).

6474, 23. “reveals not exceptional” does not make sense. Perhaps “is revealed as being unexceptional”

6475, 4. This is a very important point. Whether these are independent events from a climatic or drought management point of view or not is an open question. Perhaps the authors should comment in more detail on the extent to which they see these sort of events as a truly unified entity as opposed to a construct of the method. Whilst the method is undoubtedly useful in integrating the space and time elements in characterising an “event”, presumably the individual phases have different signatures in terms of climatic causes and actual spatio-temporal evolution. The authors should perhaps consider this in the discussion.

Section 6.2. Is generally a good way to present this information. Perhaps the authors should address why the significance of this (why identify these benchmark droughts) –

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what is the practical utility of these findings?

6475, 13. "Led to build curves" is not correct. "Led to the building of curves"

6475, 15. "envelop" should be "envelope"

6475, 22. "take over" in the singular, should be "takes over".

Section 7, discussion. I would like to see this expanded, given the effort that has gone into such a comprehensive analysis over these three dimensions. The work has generated a mountain of data, but there is really only brief consideration of implications (6477, 14 – 21, and end of conclusion. The end of the discussion touches on usefulness of seasonality, but what about the drought duration & frequency findings, e.g. for regional water management, What is the significance for the scientific community?

6476, 18. "remains limited" should perhaps be "remained limited" if referring to the 2003 drought.

6477, 20. "suggests for example to explore" is ambiguous. Change to "suggests, for example, that relationships with flow regime descriptors could be explored".

6478, 5. "allowed to identify" change to "allowed the identification of. . ."

6478, 20. Similarly, "will allow to" should be "will allow the description of . . ."

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