Reviewer # 1 report

Authors reply to reviewer's comments is provided in blue.

The most important issues raised by the referees have been addressed. However the presentation quality still needs to be improved (see attached annotated manuscript, with some suggestions).

Authors thanks the anonymous reviewer for his/her encouragements. The manuscript has been amended according to the reviewer's comment.

Reviewer # 2 report

Authors reply to reviewer's comments is provided, point by point, in blue.

Overall comments:
I appreciate the authors taking the time to carefully consider all of my comments and suggestions and to improve the article. They have made substantial changes. Thank you. Following a couple minor changes (see below), I recommend the paper for publication, and I don't need to see it again.
I really like the new improved version of the Figure 1,2 and 3. I think it helps a lot. This is much clearer.

Authors sincerely thanks the anonymous reviewer for his/her encouragements. In the following a point by point reply to minor comments.

Minor comments and technical corrections:
L.43, should be "variability that affects the southern Europe regions. Indeed, In this context, historical in-situ long term measurements are.....".,

Thanks for this suggestion. Lines 40-48 have been completely revised. Please see the revised manuscript version.

L.67, should be: " Italy, a large area of about 13600 km2",

Thanks for this suggestion. Please see the revised manuscript version.

L.198, add the space between authors after the semicolon like this "(Guo et al., 2018; Wang et al., 2019; Fung et al., 2020),
Thanks for this suggestion. Please see the revised manuscript version.

Line 210, add comma after "Yevjevich"

Thanks for this suggestion. Please see the revised manuscript version.

L.246-248, the authors stated that "cells temporal variations did not appear significant, and this could represent an indication that likely the groundwater systems of the region, frequently characterized by very large delay times, could not be impacted by climate temporal variations". I am wondering to know if this affirmation is referenced in the literature or not? Is it a reported result or a given hypothesis? Please, the authors are suggested to be clear.

The sentence has been better framed in the light of the finding of a previous research paper. Please see the revised manuscript version.

L.252, the verb must to be in the present simple to express the results.

"..... Were also coherent with the findings of previous" should be: "are also coherent with the findings of previous",

Thanks for this suggestion. Please see the revised manuscript version.

L.264, I guess that the sentence should be: " It increases up to 15% and 24%, in ten years, for the case of SPI_12 and SPI_48, respectively",

Thanks for this suggestion. Please see the revised manuscript version.

L. 277, the sentence should be: A very similar behavior was found in the case of extremely severe drought episodes unless for the lower number compared.
write drought without "s"

Thanks for this suggestion. Please see the revised manuscript version.

L.353-354, I am so confused when reading this sentence "The SPI increase over time ranged from about 10%, in ten years, for the case of SPI_6 to 24%, in ten years, for the case of SPI_48". It should be “The SPI increases over time ranged from about 10%, in ten years, for the case of SPI_6 and to 24% for the SPI_48".

Thanks for this suggestion. Please see the revised manuscript version.

III. "Authors are aware of the limitation in the use of a single index drought assessment and, at the same time, of the limitation itself of the SPI index. However, the World Meteorological Organization has recommended that the SPI be used by all National Meteorological and Hydrological Services around the world to characterize meteorological droughts (World Meteorological Organization, 2012). Being the presented research a rather detailed focus on an area suffering from data availability and analysis, the authors found worth to take a start from a general broadly accepted methodology".

I totally agree with the authors when saying that WMO recommends using the SPI. In fact, the authors don't convince me when they stated that the data are scares. The satellite products are the alternative solution to overcome this issue of climate database. With the availability of new Remote Sensing products and Remote Sensing processing platforms, a capacity exists to downscale the PDSI and SPEI indicators at higher spatial and temporal resolutions. . It offers also perspectives to support more efficiently regional water management design and planning. (Anyway, it is my opinion). However, some advantages of using "SPI" and why this index is chosen given its limitations are given below:

Hayes et al. (1999) explored the severe droughts in the Southern Great Plains and southwestern United State. The authors found that the SPI could identify the drought onset and severity one month in advance of the PDSI. Furthermore, Lloyd-Hughes and Saunders (2002) also made a comparison of the abilities of the SPI and PDSI in monitoring large-scale drought over the Europe and pointed out that the SPI provided a more appropriate spatial standardization than the PDSI index. Moreover, in preserving the rarity of extreme drought events, several Scientifics highlighted that the SPI performed better than the Palmer indices (Hayes et al., 1999, Keyantash and Dracup, 2002, Steinemann, 2003). However, there are also some issues that need to be noted when using the SPI, such as its sensitivity to the precipitation record length (Wu et al., 2005), the selection of the probability model and the procedure used in the estimation of its parameters (Guttman, 1999, Núñez et al., 2014).

Authors thank the anonymous reviewer for highlighting and sharing research about the benefit in using SPI.