Response to Anonymous Referee #1

Thank you very much indeed for inviting me to review this paper. Having access to high-resolution drought dataset, especially in data-scarce region, is important for drought monitoring and management at watershed/ districts levels. I can be wetness that the paper "A pan-African high-resolution drought index dataset" could produce a valid significance for the African continent particularly in the drought vulnerable areas. This dataset is timely, and the paper is fully readable and has a good basis. When authors address the following comments and suggestions, I recommend acceptance.

Response: Many thanks indeed for your positive evaluation and constructive comments. We have revised the manuscript carefully according to your comments and suggestions. In the following, we provide an item-by-item response to your comments. Your comments are written in italic black color; our responses are shown in upright font blue color.

Comments

Line 35; I couldn't get the access to the dataset.

Response: Thanks. We have contacted CEDA team to solve the problem. The data are available now from the link.

Line 38-39; delete the key- words written in the title (i.e., high-resolution, drought index)

Response: Done.

Line 78-79; insert "and/or" between "runoff, groundwater deficiency"

Response: Done.

Line 80; references should be ordered in terms of publication year and authors alphabet. And do the same for the rest in the manuscript

Response: Thanks, changed.

Line 90; curiosity on using words/phrases "no best drought index", as multiscalar and multivariate drought indices are better than the single ones

Response: Thanks for your comment. The phrase here is reported by Van Loon (2015), which intends to note that there is no single index which is the best index and suitable for all kinds of drought events (meteorological, agricultural, hydrological, socioeconomic and environmental).

Line 93; change 'not enough' by 'inadequate'

Response: Done.

Line 113, curiosity on using words/phrases "too course".

Response: The term 'coarse' here refers to existing global products with spatial resolution of 50 km and 100 km. These datasets are not possible to provide detailed drought information at km scale that is required in district or sub-basin scale applications.

Line 121, Explain how the SPEI-HR dataset will be usefully to minimize the impact of water and food security and support to policymakers and the social sectors.

Response: Thanks for the comment. The important feature of SPEI-HR is its high spatial resolution compared to other coarse resolution datasets. The SPEI-HR dataset can be used to provide quantified drought conditions at sub-basin scales, which are essential for managing drought-related risks. One application of SPEI-HR for minimizing the drought impact on food security is our UK Space Agency's International Partnership Programme (417000001429). We have developed a framework to predict crop yield which can be used to infer the influence of droughts on agriculture and economics in general and specifically in Ethiopia.

Line 127, How can we sure that SPEI-HR can provide near-real time drought monitoring?

Response: The CHIRPS dataset is available from 1981 to near-real time, while GLEAM will be delivered in higher resolution and in near-real time. The idea here is to update SPEI-HR based on GHIRPS and GLEAM on a regular basis to make it near-real time.

Line 128; I have no problem with the name but I wonder why authors used Pan-Africa to represent the African continent. Does it actually represent the whole continent?

Response: It is a good question. The idea of using Pan-Africa is inspired by Pan-Africanism (https://en.wikipedia.org/wiki/Pan-Africanism). There is no difference for this study using either Pan-African or African.

Line 129; and any plan to provide data continuously in the future.

Response: Yes, the dataset is planned to be updated when there are new CHIRPS and GLEAM datasets released.

Line 147; I am interested to know if your or any other studies are undertaken in Africa, using CHIRPS for drought assessment. Better if you explain why you chose this dataset for Africa. This is helpful if you refer to studies done in Africa. And the same for the potential evaporation

Response: Thanks for your suggestions. The motivation of using CHIRPS for Africa is because it was recently validated over East Africa and Mozambique and demonstrated good performance compared to other precipitation datasets (Toté et al., 2015; Dinku et al., 2018). Furthermore, CHIRPS was specifically designed for drought monitoring over regions with deep convective precipitation, scarce observation networks and complex topography (Funk et al., 2014). Several studies (e.g., Toté et al., 2015; Guo et al., 2017) have used CHIRPS for drought monitoring. Similarly, GLEAM evaporation products have been widely validated/evaluated over Africa (e.g., Trambauer et al., 2014, Zhan et al., 2019). In particular, two recent studies detected global

drought conditions based on GLEAM potential and actual evaporation data (Vicente-Serrano et al., 2018; Peng et al., 2019c).

Line 168, 179 and 188; explain why you have chosen these datasets in the context of Africa.

Response: All these datasets have been validated and applied by many studies. Specifically, the GLEAM root zone soil moisture is the unique long-term root zone soil moisture product that is generated based on ESA CCI surface soil moisture. And the root zone soil moisture is more relevant to drought monitoring than satellite-based surface soil moisture. The CRU-TS datasets were used because the coarse SPEIbase dataset was produced from CRU-TS datasets. And the SPEIbase dataset has been used for drought related studies in Africa. The GIMMS NDVI dataset has been selected because it has been widely applied to investigate the effects of drought on vegetation in many areas including Africa (e.g., Rojas et al., 2011; Vicente-Serrano et al., 2013; Törnros and Menzel, 2014; Vicente-Serrano et al., 2018).

Line 200-201, make sure 'The negative and positive SPEI values 201 respectively indicate dry and wet conditions' is correct.

Response: Yes. The SPEI negative values indicate dry conditions while positive values correspond to wet conditions.

Line 204-205; how did you mask out and how did you manage it in your dataset

Response: The MODIS land cover product was used to mask out the sparsely vegetated and barren areas in the SPEI datasets. All the datasets were preprocessed to have same projection (geographic lat/lon) and grid size using Python.

Line 210, insert 'full stop (.)' after 'Vicente-Serrano et al., 2013)'

Response: Done, thanks.

Line 296, why the correlations have become low, any possible reasons

Response: The lower correlations against NDVI than against RSM are likely due to complex physiological processes associated to vegetation, and the fact that ecosystem state is driven by multiple variables other than water availability. Similar results have been reported by Nemani et al., 2003.

Line 313, What value does the y-axis represent in figure 4 and 5

Response: As mentioned in section 2.3.2 'To facilitate direct comparison between SPEI and NDVI as well as RSM, both NDVI and RSM are standardized by subtracting their corresponding (1981–2016) mean and expressed the resulting anomalies as numbers of standard deviations.', the y-axis has no unit and represents both SPEI and standardized NDVI and RSM.

Finally, it will be very helpful if you include discussions on how the SPEI-HR is correlated with each of the drought types (meteorological, agricultural and hydrological). This can be useful to plan for short and long-term drought events mitigation based on the datasets provided.

Response: Thanks for the suggestions. SPEI is similar to SPI when representing drought types. In general, the short time scale (e.g., 1 and 3 month) SPI/SPEI is more suitable for identifying agriculture drought. When the time scale increases, the SPI/SPEI is more relevant for hydrological drought. There are many studies using different time scales of SPI/SPEI to represent different types of droughts. In the manuscript, the sentence below describes the ability of SPI/SPEI for representing different types of droughts.

"The advantages of SPI are its relative simplicity and its ability to characterize different types of droughts given the different times of response of different usable water sources to precipitation deficits (Kumar et al., 2016; Zhao et al., 2017)."