Online reply to the comments of reviewer 1:

We appreciate the helpful comments (shown in black). We are confident that all of them can be easily addressed in a revision, should we be invited to submit a revised version. We briefly reply to them here online (in blue) for swift clarifications.

(1) It is not clearly defined in the manuscript, whether the P & T & SM variables are averaged over individual catchments or average over the entire BW region is performed (e.g., in Figure 2). There is a large spatial variation in meteorological variables due to the Alps, so this needs clear clarification.

In fact, there are differences among variables: only Q is averaged from gauging stations and hence catchments. For P, T & SM, three different spatial aggregations were considered. Local (individual grid cells) and regional averages over the individual NUTS-2 regions as well as over Baden-Württemberg (NUTS-1). For Fig. 2, we consider the NUTS-1 average drought signals to define the major drought episodes over the region. These episodes then serve as a starting point to further explore the spatial variation in local drought signals during major drought episodes later in the manuscript (Sect. 3.2 & Sect. 3.3). We will more carefully clarify this reasoning and the methods.

(2) What is the soil moisture representation from the TRAIN model? Please, provide some more details about the representativeness of this model with respect to soil moisture observations.

The model was recently used in a study on soil moisture drought (Tijdeman & Menzel, 2021), where a lot of detail is given, also about the representativeness of the model. We suggest that we can add some of that background here and will refer more clearly to previous model uses in Section 2.2.

(3) The title of section 2.4 requires a more intuitive name.

We agree. One suggestion might be a title more in line with the corresponding results section e.g.: "Different drought episode types and their characteristics and impacts". But we will revisit the title of Section 2.4 carefully in the revised manuscript.

(4) Line 224: how do you distinguish between quick and slow developing drought? I have missed this definition.

Quickly developing drought conditions refers to the moment of time when the first 5% of the local drought signals of a certain variable reached drought conditions (5^{th} quantile of all local initiation times). Slowly developing drought conditions refers to the moment of time when 95% of the local drought signals reached drought (95^{th} quantile of the local initiation time). We will clarify this in Section 2.5 of the manuscript.

(5) Line 232-235: More clarification for these conditions is required, the current explanation is too brief.

This comment is in line with the 3^{rd} comment of reviewer 2. We will provide more explanation and corresponding references on drought propagation processes and concepts in the introduction (Section 1). Then, in section 2.5, we will link this additional explanation to the hypotheses that are being tested, including those in lines 232-235.

(6) Section 2.6, provide a formulation of A in mathematic form. Additionally, in analogy to line 248, explain the meaning of A=1.

We will add a mathematical expression of A as well as the suggested explanation of the meaning of A=1.

(7) Figure 2: Why P12 and T12 do not have not the same scale. P12 is monthly, T12 is annual. Would not it make more sense to have it the same?

From a consistency standpoint this is a valid argument. However, we decided to have different timescales for P and T for the following reason. P12 is on a monthly moving temporal scale of 12 months to make it comparable to the commonly used SPI-12 (McKee et al., 1993). For temperature, it is not common to look at moving temporal scales but rather to fixed time periods (months, seasons, or years). To follow the more commonly used approach for temperature, we used a fixed monthly timescale to capture the more short-term anomalies as well as a fixed annual timescale to capture the general change in temperature that happened over the studied period. We will more carefully motivate this reasoning in section 2.2.

(8) Ticks on the x-axis of fig.2: ticks should be displayed for 1.1.YYYY, rather than the current version.

Thanks for pointing this out. The year labels were actually placed in the middle of each year (1.7.YYYY) but we realize, also from your next comment (9), that this is confusing and will make sure to have distinct axes labels in a revised manuscript.

(9) Please, explain, what happened during the year 2005? There were also several months of exceptional drought conditions identified but never discussed.

Thanks for pointing this out. These short-term drought conditions happened in the winter of 2005-2006 and are similar to the winter drought conditions experienced in the winter of 2016-2017 (also not discussed in the current version). We will discuss these short-term winter drought episodes, which did not have a range of impacts due to their timing, in a revised version of the manuscript.

(10) Regarding the impacts, considering just the number of reported impacts is a big simplification. Can you quantify them as well using more quantitatively (e.g., financial losses, crop-yield losses?)

Unfortunately, this is not possible as rarely financial or loss-numbers were provided in the original text-based sources used. The EDII database therefore focuses on simple registration of occurrence with a qualitative description. The issue is discussed in detail in the references named.

(11) Where is the statement on lines 423-424 supported by earlier presented results?

We did only bring this up in the discussion and not in the results, as the impact data collection did not specifically focus on capturing the drivers of impacts. However, some impact reports also mentioned drivers which could be used for the interpretation of the results. We will more carefully state that this statement is derived from a more detailed interpretation of textual drought impact report descriptions.

(12) Two sentences on lines 426-427 require reformulation.

Thanks for pointing this out.

(13) Discussion can be possibly extended with the following suitable references: https://doi.org/10.1088/1748-9326/aba4ca on impact assessment with text mining; https://doi.org/10.1088/1748-9326/abe828 on assessing multi-year droughts by different aggregation periods.

We appreciate the suggestions of publications which overlapped with our submission. We would carefully consider them in a revised and extended discussion.

(14) The current data availability statement is not sufficient. Please, provide your processed data presented in this manuscript on the online repository.

We will put the data in an online repository in case of acceptance of the manuscript.

References:

McKee, T. B., Doesken, N. J., and Kleist, J.: The relationship of drought frequency and duration to time scales. Paper presented at Proceedings of the 8th Conference on Applied Climatology, American Meteorological Society, Anaheim, USA, 17–22 January 1993, 1993.

Tijdeman, E. and Menzel, L.: The development and persistence of soil moisture stress during drought across southwestern Germany, Hydrol. Earth Syst. Sci., 25, 2009–2025, https://doi.org/10.5194/hess-25-2009-2021, 2021.