Review of the Gao et al. article "Assessing various drought indicators in representing drought in boreal forests in Finland".

General comments:

Nowadays we have large amount of drought-related articles in hydrology and these number will increase because of great importance of this topic in respect with changing conditions of climate and human-water interactions at all. I spent about two days for reading this article and now can say that authors did a great attempt to deep in research and analyze their results in different directions. I hope that this article take a noticeable place among another distinguish regional drought-related papers.

In this article authors try to answer some interesting question: "Is it possible to estimate drought event in a robust way with quite different metrics using LSM model on the regional scale and under shortage and weakness of available data?". And the answer (of course): "Yes". And this is a great attempt not only for estimation climate-watershed responses, but also for understanding how nature works and what kind of disasters it stores.

Methodical structure of the article is clear and sharp. Using the LSS-based model JSBACH provide wider range of possibilities for hydrological cycle processes simulation, criteria estimation and followed analysis. Combining regional scale unbiased meteorological reanalysis with extra measurements from field sites also provide the way we can think about various time and space scales interactions within hydrological system.

Of course in every paper we can find a lot of reasons to prevent publication (in the section of *specific comments* we will tell about that) but I highly rank this paper and for my opinion it aggregate all that modern geographical paper needed: data from various sources, physically-based model implementation, clear visualization, deep and critical description and analysis of results.

Specific comments and suggestions:

- Section 2: not so clear why authors use only ECWMF-ERA reanalysis (of course after bias correction) without any attempt to use real meteorological observations with any interpolation technique;

- Additional information about updated soil hydrology scheme required (8098, 21);

- Any LSM model have a large amount of parameters. How to set up these parameters? Apriori, global databases or calibration were implemented or one another standard technique?

- I find out that soil was parameterized over 10 m depth, but according to the Fig. 1 in Finland no soils with the same thickness;

- Not so clear description of JSBACH run for equilibrium of balances (8098, 24-26);

- No description for PTF abbreviation (8101, 2);

- Not so clear description about calculation periods of used indicators (moving window, aggregation, averaging etc.) - is the constancy of calculation time scale kept?

- It will be hard to understand common point of SPI and SPEI indexes without any prior knowledge in this field of study (more clear description needed);

- It is really necessary for approval of JSBACH robustness to provide comparison of simulation scenarios using real and reanalysis meteorology on selected sites. It also allows to estimate significance of meteorological inputs errors in overall error of modeling;

- It is not clear why Figure 2 subplots are not have the same timescale (and why this

timescale does not match with modeling period)? On the Figure 2c 2006 year should be place because of its great significance for that paper;

- On the Figure 2a,b no one remarkable bias in SMI in 2006 placed in compare to the other years;

- <u>The most controversial place</u> in this article is that we have no one really significant metric proves JSBACH efficiency – only figures (also quite controversial). And this place in the article really need more clear description (maybe authors can add some supplementary materials like a graphs or datasets);

- It is not a good idea to use 0.5 threshold of correlation coefficient for making strong conclusions about something efficiency. I recommend adding p-value on the Figure 3 (or add some phrases in text);

- It will be great to add to supplementary material maps of a spatial distribution of R correlation coefficient (because of lack information provided by the median estimations);

- Authors often use term "soil memory" but in the text we have no one word about assessment of this period duration;

- Authors provide information about the proportion of the damaged forests sites, but really significant information for that work is not about reached number, but about the spatial distribution of damaged sites. If authors have this information about spatial distribution it is necessary to provide it for readers and to do some additional analysis that could correct overall conclusions.