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Interactive comment on "Response of vegetation to the 2003 European drought was mitigated by height" *by* S. L. Bevan et al.

Anonymous Referee #3

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Bevan, Los and North use primarily remote sensing observations to identify differences in the response of characteristically tall versus short vegetation to the 2003 European summer drought. The topic is of interest to the readers of Biogeosciences but it is not clear to me how the findings here add new knowledge to the existing studies of Teuling et al. and others. The plant physiological mechanisms that are at play are the subject of additional speculation rather than clarity and advancement of knowledge. The results may reflect the shortcomings of using NDVI to capture variations in LAI rather than the impacts of drought on different vegetation classes. I recommend linking the findings to the proposed mechanism, rooting depth, in addition to vegetation height (a surrogate for rooting depth here) to draw a clearer link between vegetation state variables and climate mechanisms.

The abstract, which could benefit from some numbers to improve citeability, already brings up important challenges from the plant physiological perspective. Tall vegetation is often deeply rooted in places like Europe. In other areas like semiarid grasslands the situation is not as straightforward and differs by annual/perennial, by growth form, by species, by soil type, and more. Once trees get very tall, the upper leaves are effectively under drought stress as studies on redwoods and other very tall trees have shown. Height is important variable for canopy conductance. I understand the appeal from the remote sensing perspective to have a simple 'tall/short' basis for comparison, but I hope that a detailed discussion of the pitfalls of this viewpoint is made clear later in the manuscript. Upon further read they were not. People heaven forbid may think that growing vegetation taller will make it more drought resistant, when the opposite is likely be true in many situations. Height is a covariate, not the most important explanatory variable, which appears to be rooting depth, and a real root person may argue that the volume of soil mined for water by the roots is more important than the maximum depth itself.

On 16077 line 3 please specify summer 2003.

I find the Introduction interesting and well-written in principle, but am having a difficult time at the moment understanding what is new if Teuling, Zaitchik, and other manuscripts have already ascertained the importance of tall versus short vegetation on surface biogeophysics and biogeochemistry during the 2003 summer drought in Europe. The problem statement appears to be the difficulty in simulating these effects in models, and contributions from the remote sensing community in improving these simulations. My answer would be to improve plant physiological mechanisms in the models, but the manuscript uses instead surrogates like NDVI (sometimes related to LAI). At the same time, NDVI is sometimes useful and often linked to models. If the purpose of the manuscript is to use remote sensing as a means for model improvement, I understand the justification, but this could be made more clear. Shortly before section 2 begins one may also ask if NDVI can change very much in coniferous forests,

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compared to grasses because of the limits of leaf area change in response to drought and the saturating NDVI/LAI relationship. EVI (Huete et al.) would be more sensitive and it has never been clear to me why NDVI is so ubiquitous when EVI offers so many advantages.

Please define 'resilient', which has different meanings to different fields of science. A quantitative definition may be an improvement, something like the length of time that previous LAI was recovered? (This gets at the challenge of the definition, resilient could have time units or LAI units or biomass units etc.

In the beginning of page 16081 increased temperatures and decreased precipitation are not always linked, but often are during large droughts. Please specify that this statement is relevant to this event but not universal.

There are few minor usage errors throughout the manuscript but please note 'within a 50 km in Germany' on 16802 line 25 and a few other minor examples.

On page 16083 I would hope for the reader that more than just a working hypothesis can be delivered. Could rooting depth databases be mined? Could representative rooting depth for different vegetation types (i.e. Jackson et al.) be explored? Also, at what height is the diurnal temperature range (DTR) measured? Might the forests, regardless of drought, have a smaller DTR than non-forests because of their closer coupling to the atmosphere (Jarvis-McNaughton omega), or larger DTR because of their lower albedo, or lower DTR because they may contribute to a larger boundary layer? The discussion regarding DTR is important and worthy of further exploration to clarify the mechanisms. It would also be revealing to go into additional detail regarding the groupling and use possibly an ANOVA to further identify if different classes have different NDVI and DTR dynamics during drought. Or even a classification tree. Is 'Forest' the most logical distinction with regards to the effects of drought? It might be, but other deep-rooted vegetation classes like dryland shrub/scrub may be more like forests than other short-statured vegetation and lend support to the rooting depth

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argument.

Most of the Discussion section sounds like expository material best found in an Introduction section. The findings of the manuscript are not discussed in the context of other studies.

In Figure 3, a pdf (that sums to one) rather than a histogram may be an improvement.

Figure 4 is interesting but more description of the flight lines is necessary to explain it to the reader.

Red and green should not be used simultaneously in Figure 8. A different color can be chosen to assist our colleagues with red-green colorblindness.

Interactive comment on Biogeosciences Discuss., 10, 16075, 2013.