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Interactive comment on "Spring phenology and phenology-climate links inferred from two remotely sensed vegetation indices across regions and biomes" *by* Xiyan Xu et al.

Anonymous Referee #2

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Summary:

Xu et al. manuscript presents a comparison of spring greenup (SG) and its sensitivity to temperature and precipitation over the northern hemisphere inferred from two remote sensing NDVI products (MODIS and GIMMS) over the period 2001-2013. They aim at exploring the uncertainties in NDVI SG trends and sensitivity to climate. They conclude that both products are consistent in mid latitudes both for SG and its sensitivity to climate, but show different magnitude and trends in high latitudes.

General Comments:

The analysis performed in this study is timely, but the main message and the novelty

of the study remain unclear.

First, the authors did not really assessed the uncertainties induced by NDVI products and the approach used. Previous studies already highlighted differences in SG and its temporal trend estimated by several approaches and different NDVI products (Chang et al. 2016, Wang at am. 2015, Ding et al. 2015 for example). It is already known that main uncertainties in estimating SG are found in high latitudes. Xu et al. went one step further by comparing SG sensitivity to climate between products but mainly concluded about observed differences, not the uncertainty behind, which in the end led to the same conclusion than previous studies. Because differences in SG estimates leads to differences in pre-season length, the authors compared sensitivities that are not really comparable. The uncertainty in sensitivity to climate results from the propagation of the uncertainty in SG estimates, however these aspects are poorly discussed in the manuscript.

Secondly, the methodology suffers from major flaws. Only one method is used to smooth and fit the data while previous studies highlighted a strong impact of the smoothing method (Atkinson et al. 2012) and approach used to estimate SG. Moreover we don't have information about the performance of the approach. The authors did not take into account partial correlations between temperature and precipitation, thus leading to weak interpretations of the results (Fu et al. 2014). Finally the filtering of data performed in the analysis is sometimes unjustified or incomplete (see specific comments).

The authors should refine their research question to be in adequation with their approach or go deeper in the analysis of uncertainty propagation from NDVI products to the estimation of climate sensitivity of SG.

Specific Comments:

L.96: the paper from cong et al. is not an evidence that methods in estimating SG has no impact on resulting trends and sensitivity. Especially for sensitivity to climate that requires the estimation of the pre-season length, there will be a propagation of errors that will influence final results.

L.135: now CRU-NCEP v.8 is extended to 2017. Remove “recently extended”

L.145: maybe use the median value.

L.142 & 179: Is 15days observation fine enough to estimate sensitivity to climate change properly? Moreover, is it significant to estimate the pre-season length with a 3days step when observations are performed every 15 days?

L.179-183:explain why?

L.184: the authors should use partial correlations to take into account co-variations of climate.

L.187 & 195: why removing positive correlations? Several studies highlighted different behaviours according to species and regions (Zhang et al. 2016 for example). By removing positive correlations you start the analysis by assuming that vegetation respond all the time negatively to climate change which is not true. If the aim is to compare both products the authors should keep all the information available.

L.194: OLS or SMA regression. In this case SMA regression are more appropriate

L.195: why not excluding non vegetated pixels? It would improve the analysis.

L.195: to avoid a bias due to the number of significant pixels, the authors should compare only pixels for which significant sensitivities can be estimated for both products.

L243: check partial correlations between SG temperature and precipitation.

L247: a significant correlation does not mean a control. Please reformulate

L.252-256: how does it relate to changes in SG?

L.271: Does +/- 7 or 4mm means a significant change in precipitation? .

L.275: because we don t have the same pre-season length it is difficult to conclude.

L.280: why it is not responsive to precipitation?

L.283: percent compared to which value?

L.300: interesting result. It is consistent with field observations over Europe (Fu et al. 2015)

L.312: recent studies showed that CCI is better than NDVI in detecting phonological changes for evergreen (Gamon et al. 2016). That may explain the behaviour of evergreen vegetation in this study.

Technical comments:

Figures 2abc are not cited in the text

As you compare both products figure s1 is more relevant than figure 1. Try to use absolute or relative comparisons in the main figures and put absolute values in supp, also for fig3. Moreover the scale make it difficult to see where differences are null.

Atkinson, Peter M., et al. "Inter-comparison of four models for smoothing satellite sensor time-series data to estimate vegetation phenology." Remote sensing of environment 123 (2012): 400-417.

Wang C, Cao R, Chen J, Rao Y, Tang Y. 2015. Temperature sensitivity of spring vegetation phenology correlates to within-spring warming speed over the Northern Hemisphere. Ecol Indic. 50:62–68.

Ding M, Li L, Zhang Y, Sun X, Liu L, Gao J, Wang Z, Li Y. 2015. Start of vegetation growing season on the Tibetan Plateau inferred from multiple methods based on GIMMS and SPOT NDVI data. J Geog Sci. 25:131–148. Better consistency with observations is the threshold

Chang, Qing & Zhang, Jiahua & Wenzhe, Jiao & Yao, Fengmei. (2016). A comparative analysis of the NDVIg and NDVI3g in monitoring vegetation phenology changes in the Northern Hemisphere. Geocarto International. 33. 1-20. 10.1080/10106049.2016.1222633.

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