Hydrology and
Earth System
Sciences

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Discussions

Interactive comment on "SACRA – global data sets of satellite-derived crop calendars for agricultural simulations: an estimation of a high-resolution crop calendar using satellite-sensed NDVI" *by* S. Kotsuki and K. Tanaka

Anonymous Referee #1

Received and published: 18 February 2015

General comments

1. Does the paper address relevant scientific questions within the scope of HESS?

The authors present a method for the derivation of a global crop calendar based on a combination of census and Earth Observation data. Global crop calendars provide important information for the description of land surface processes not only in agronomical but also in hydrological and climatological context. The presented paper

thus well meets the scope of the HESS journal. However, the manuscript should be carefully revised in order to enable the scientific community to benefit from its findings.

2. Does the paper present novel concepts, ideas, tools, or data?

The idea of using simple (and thus easily globally applicable) remote sensing techniques for the derivation of crop cycles is not entirely new. Especially the use of simple multispectral vegetation indices such as the NDVI is very critically discussed among the remote sensing community, because VIs only provide relative estimations and must rely on a high degree of empiricism, if land surface information shall be provided by them. However, the authors have compiled a data set that holds some potential for future applications. Due to reasons of data scarcity, the authors resort to averaged data from three consecutive years (2004-2006). The data product generated from this study therefore is of limited use for the direct parameterization of global growth models. However, taking the current development in Earth Observation into account (e.g. the development of ESA's Sentinel series), data scarcity will soon be less critical compared to now. The proposed method represents a simple and thus easily applicable approach that can potentially make use of large amounts of temporally highly resolved global optical Earth Observation data and may provide interesting input parameters for global land surface models.

3. Are substantial conclusions reached?

The main conclusion of the paper is that using Earth Observation data opens new grounds towards current spatially highly resolved data on land surface processes compared to census-based approaches, while their applicability for future or climate change studies is limited. Although this is a quite substantial insight, it is not very surprising.

4. Are the scientific methods and assumptions valid and clearly outlined?

I experienced some difficulties with understanding the paper. Some of them surely were due to language and style, while others were rather due to a too unspecific description of the approach. Nonetheless, I think that the methods and assumptions in general are valid. The authors, however, should concentrate on precise and unmistakable phrasing. Reading some passages, I have gained the impression that the authors mean to describe the right thing, but resort to unfavourable terms. For example, the authors should more clearly discriminate between "food" and "biomass" or between "growth" and "vegetation vitality" etc. (please, above all, see my detailed comments in the manuscript).

5. Are the results sufficient to support the interpretations and conclusions?

True validation is hard to achieve in global studies. The authors therefore compare their results to the MIRCA2000 data set and analyse the disagreement. Deviations between the two data sets are very large in some regions (up to 4,5 months). However, it is hard to decide which data set is closer to the truth. I also think that neglecting triple cropping systems (only two crops during one growing cycle are taken into account by the presented algorithm) will lead to errors in some parts of the globe. This should be taken into account in the discussion section. Also, the fact that bimodal distributions of NDVI may occur on agricultural sites that are not part of a managed cultivation cycle, e.g. in the case of volunteer crops, is not discussed.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

From my point of view, it is hard to follow how the involved empirical thresholds were generated (e.g. which assumptions led to their determination). It is e.g. mentioned in section 2.3 of the manuscript that *"The values of two CC parameters $nNDVIpl$ and $nNDVIhv$ are determined for each crop to minimize the errors*

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between planting/harvesting dates of determined and MIRCA2000 over pure grids." However, it is not described how this optimization was performed (automated or manually), which statistical indicators were analysed to determine the error, which thresholds of confidence were applied etc. Also the determination of other empirical parameters, such as $NDVIparam$ used for noise suppression, is not explained.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

The authors discuss that the major benefit of the proposed approach lies in the high spatial resolution compared to other global products. A second benefit of a remote-sensing-based method is that actual current vegetation activity is monitored. It would be interesting to compare the findings of the presented study on actual growth cycles with results on growth cycles based on the agroecological potential (e.g. Zabel et al. (2014)). Such a comparison could provide interesting information on the current global distribution of cropping intensity.

8. Does the title clearly reflect the contents of the paper?

I think the title in its current form is somewhat redundant and limits the application of the SACRA crop calendars to pure agricultural simulations. From my point of view the title could be shortened and should be revised, e.g.:

"SACRA – A Method for the Estimation of Global High-Resolution Crop Calendars from satellite-sensed NDVI" or something similar.

9. Does the abstract provide a concise and complete summary?

The abstract should be more precise. Instead of adjectives/adverbs like "many", "well",

"similar" etc. the obtained results should be mentioned in numerical form the abstract.

10. Is the overall presentation well structured and clear?

In my opinion, the paper should be partly restructured. For example, the crop types taken into account are mentioned at a very late point in the manuscript (section 2.3, Page 8). This should be stated more clearly at the beginning. Also, the authors should focus on avoiding general and elusive adjectives, such as "large", and rather include concrete results in numerical form into the text. Subscripts should be explained without exception next to the equations. Some figure captions should provide more detail (e.g. the labels of Figure 6 are described in the text but not in the caption, the stand-alone figure thus cannot be understood).

11. Is the language fluent and precise?

Not being a native speaker of English myself, I don't feel fully qualified to judge English Language and style. The manuscript nonetheless seems a little bit hastily prepared, as indicated by a high number of typos. Trying to comprehend the manuscript, I therefore inserted some proposals for possible improvement while reading it.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

The Equations should be carefully checked. In some cases (e.g. Eqs. 3 and 4) not all of the subscripts are explained. Adding a comma between equation and equation numbering is potentially confusing.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

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Please see my detailed comments in the attached manuscript.

14. Are the number and quality of references appropriate?

The authors cite 35 appropriate sources in their manuscript. However, I would like to encourage the authors to have a look at:

Waha, K., van Bussel, L.G.J., Müller, C., Bondeau, A. (2012). Climate-driven simulation of global crop sowing dates. Global Ecology and Biogeography, 21(2), pp.247-259, doi: http://dx.doi.org/10.1111/j.1466-8238.2011.00678.x

Zabel, F., Putzenlechner, B., Mauser, W. (2014). Global Agricultural Land Resources – A High Resolution Suitability Evaluation and Its Perspectives until 2100 under Climate Change Conditions. PLoS ONE 9(9): e107522. doi: 10.1371/journal.pone.0107522

15. Is the amount and quality of supplementary material appropriate?

No supplementary material was provided with the paper. The authors, however, state that the data sets resulting from the presented algorithm will be accessible through their website. I think this would be a nice and welcome contribution.

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Specific comments Please see my detailed comments in the attached manuscript.

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Technical corrections Please see my detailed comments in the attached manuscript.

Yours sincerely, Reviewer

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/12/C222/2015/hessd-12-C222-2015-supplement.zip

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 1329, 2015.