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Hydrology and Earth System Sciences
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 #2

Received and published: 3 March 2015

General comments

1. Does the paper address relevant scientific questions within the scope of HESS?
I fully agree to Anonymous Referee 1 comments "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 climato-

logical 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?
I agree to the excellent comments of Anonymous Referee 1.

3. Are substantial conclusions reached?
I agree to the comments of Anonymous Referee 1.

4. Are the scientific methods and assumptions valid and clearly outlined?
As Anonymous Referee 1, I also experienced some difficulties understanding the manuscript, first due to language and style, but mostly due to the often too short, rather vague and often repetitive description of the approach and methods, while the approach in general appears to be valid.
Also, I often missed precise and unmistakable wording. Like for Anonymous Referee 1, while reading the text it appeared to me that the authors want to express the right aspect, but use unfavourable phrases and wording, e.g. unspecific terms or various terms for the same meaning. E.g. "typical crop" should be replaced by a better term, e.g. "dominant crop" which also includes the meaning of the maximum area covered per grid cell.

5. Are the results sufficient to support the interpretations and conclusions?
As Anonymous Referee 1, I agree on the difficulty of global-scale validation, e.g. always regions with mismatch occur.
In the comparison of crop calendars of remotely-sensed SACRA to MIRCA2000, it is hard to tell which one is better. While SACRA uses more current information, MIRCA2000 rather states average conditions and possibly conditions of nearby administrative units, used because of lack of more detailed reference information. So it would be possible that both are correct, e.g. if they referred to different time periods.
The authors should also state why they preferred crop calendars of MIRCA2000 to the

ones of Sacks et al. 2010, as the latter ones possibly might be better suited.
One important aspect is also no discussed: MIRCA2000 delivers crop calendars for either irrigated or rainfed crops, which possibly, but not necessarily coincide for a given administrative calendar unit. How is this fact represented in the evaluation or validation/comparison?
Anonymous Referee 1 mentions the importance of triple cropping. I am not sure to what extent triple cropping is really important, but multiple cropping occur with the cultivation of different crops on the same fields, especially in countries with intensive cropland use like India or China.
How does the SACRA algorithm / analysis of NDVI deal with that?
In the case where two crops with nearly identical area in MIRCA2000, to what extent would the selection of the dominant crop influence the validity?
In Fig. 6, the differences in planting months of MIRCA2000 and SACRA are only broadly shown, but not discussed on the basis of the specific dominant crops.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?
See comments of Anonymous Referee 1 and further specific comments.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?
See comments of Anonymous Referee 1.

8. Does the title clearly reflect the contents of the paper?
See comments of Anonymous Referee 1.

9. Does the abstract provide a concise and complete summary?
See comments of Anonymous Referee 1.
Line 21: Why is the peak date of importance? With a monthly crop calendar, this probably refers to peak NDVI or derived vitality.
The indication of a possible application or usefulness, e.g. reference for vegetation

modelling, would be helpful.

10. Is the overall presentation well structured and clear?
Again, I agree to Anonymous Referee 1 that the manuscript should be partly restructured.
Especially the selection of the considered crops should be mentioned before section 2.4 (page 1336).
I think that the aim of the manuscript on page 1332 is clearly stated, but afterwards the description flattens considerably.
Especially Figures 1, 4, and 6 are not very clearly produced or commented.

11. Is the language fluent and precise?
Some more precise wording would be appreciated to bring in more clarity and the ability to fully understand.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?
See comments of Anonymous Referee 1 (e.g. some equations miss full explanations of subscripts) and further specific comments.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?
Anonymous Referee 1 made excellent extensive detailed specific and technical comments that I do not need to repeat here. But see further specific comments which point out at important points.

14. Are the number and quality of references appropriate?
I agree to the comments of Anonymous Referee 1.

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

No supplementary material is currently provided with the manuscript.
A freely available data set via a website would be probably greatly appreciated by many scientists involved in global modelling.
I suggest to introduce some version numbering, as it seems to me that some probably necessary update of methodology will provide new calendars or regional improvements. Then the version number (e.g. of the method) would held distinguish the different resulting data sets.

Specific comments

Besides the comments of Anonymous Referee 1, the following comments summarize key issue that have to be dealt with in a revision of the manuscript.

Page 1334, line 2 : In Eq. (1) the case of t=tpv is not exactly defined.

Page 1334, line 11: It is not clear how NDVI-filled is produced. This is critical for the later evaluation.
It would be nice to know the percentage of grid cells occupied by either NDVI-Crops or NDVI-Filled.

Page 1335, line 11: Typical crop is the crop with the most crop area in MIRCA2000. Is the distinction of irrigated and rainfed areas important? Is it the maximum monthly area (growing area) or is it the harvested area. These might be different in grid cells with multiple cropping systems, e.g. of wheat and rice in India.
What about the effect of mixed pixels when aggregating for NDVI calculation?

Page 1335, line 20 "reanalysis temperature" of Hirabayashi et al. 2011. It would be nice if you mentioned/discussed the data source (ERA40, ...) behind that source, but especially how you used the 0.5 resolution of that data set within your 5 arc-min resolution, e.g. some necessary downscaling.

Page 1335, line 25: "Because we define winter crops by temperature, cultivated wheat in Australia and Northern India is defined as spring wheat. Regions having the minimum monthly-averaged temperature below 5.0°C in Fig. 4c are categorized as winter wheat or fodder (permanent crop) in Fig. 4a."
This wording is totally confusing, and it remains unclear when or whether you speak about (existing) MIRCA2000 or (new) SACRA, or of both, and whether Fig. 4 (a) is MIRCA or SACRA, and if it were MIRCA, how Fig. 4(c) would relate to Fig. 4(b) or what you want to show via Fig. 4(c).

Page 1336, line 6: The author mention they they consider crops "spring wheat, maize, rice, soybean, and cotton", but later (line 19) they refer to winter wheat which calendar is replaced by the one of summer wheat.
But how this important aspect is done, remains unclear. And how grid cells with MIRCA2000 winter wheat are treated with possibly observed summer crop calendars.
But does not Fig. 2 (page 1349) show that winter crops are somehow treated / treatable?
Fig. 4 (a) (b) (page 1351) obviously depict MIRCA2000 (or not ?) e.g. also specifying in Fig. 4 (b) sngWinter crops, but this is not stated in the figure caption.

Page 1338: USDA 1994 is missing in the list of references.
Line 23 "multiple usages of the two products are useful to take into consideration the uncertainty of the CC."
I do not understand the meaning of this sentence, please be more specific.

Page 1346, Table 2: How do you compare monthly calendar (MIRCA2000) (planting: possibly first day of month, harvest: possibly last day) with daily calendar (SACRA)?
Do the pure grids (5 arc-min?) include multi-cropping? If yes, which season do you consider? Are there grid cells with triple rice cropping of MIRCA2000 included?
What about the distinction of calendars for rainfed and irrigated in MIRCA2000? How is this important for this analysis?
How do you calculate the average error? Isn't it the average difference (in days)? Then

again the question about the used reference date at MIRCA2000 is important (first day, 15th of each month,...)
It would be nice to have a map / see the location of the pure grid cells, e.g. in Fig. 5 or Fig. 6.
It is strange that the differences ("errors") here are below one month, while in Fig. 6 (a) and (b) considerable areas have differences larger than 1.5 months. How can this phenomenon be explained, given also the monthly resolution in MIRCA2000? Perhaps one reason is the assumption of centred planting/harvesting days in MIRCA?

Page 1347, Table 3: The crop calendars (CC) should be more explicit where they are for more than one crop (MIRCA2000) as SACRA is only for the dominant crop for a given unit.
Also perhaps distinguish between calendars of MIRCA2000 and Sacks et al. 2010?

Page 1348: Fig. 1 is not clear. You do not distinguish between detection of dominant crop and the crop calendar.
Is SACRA-Filled the result of SACRA? What is the difference between NDVI-Filled and SACRA-Filled?
How is SACRA cultivation period adjusted to MIRCA (page 1338, line 2-3)?
What do you do with discontinuities of SACRA and SACRA-Filled (page 1337, line 9) because of filling?
How does this filling influence the comparison in Fig. 6, for the selected regions?

Page 1350, Fig. 3
Fig. 3 (a) and (b): NDVI in (b) for 2004-2006 is smoother than in (a) (only 2004). It would be interesting to see the inter-annual variability, too.
Fig. 3 (b): Why is nNDVI for period 2 smaller than zero for September to December? Probably because NDVIbas of period 2 is defined in June.
But shouldn't negative nNDVI be avoided? Or at least suppressed, for better subsequent treatment, which might be corrupted through?
It would help to have tpl, tpk, and thv as in Fig. 2 also for this more complex case.

Page 1353, Fig. 6
Fig. 6 (a) the unit for the comparison of the crop calendars are missing (probably months as units).
How are planting months in different years considered, e.g. seen in Fig. 6 (b-3 Mongolia) and (b-8 Shandong)?
Again as for Table 2: How do you compare monthly calendar (MIRCA2000) (planting: 1st day of month) with daily calendar (SACRA)?
How are daily data of SACRA transferred to monthly calendars in Fig. 6 (b)?
Why not specifying differences in days, too, as done in Table 2 (page 1346), rather than months, as days would yield more precise differences?
It would be nice to have the differences as positive and negative deviations, as proposes by Anonymous Referee 1. Are then the differences MIRCA - SACRA or SACRA - MIRCA?
In Fig. 6 (b) the dominant crops that are used should be specified. Without this information, an interpretation of differences is not possible.
The case of Fig. 6 (b-1) needs to be explained: Two NDVI peaks get only one cultivation season in SACRA, without considering the major peak for the season? Are the crops perhaps defined differently (one rainfed, the other irrigated)?

Technical corrections
See comments of Anonymous Referee 1 and section "Specific comments".

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