

MS No.: essd-2020-69

MS Type: Data description paper

Title: Early season mapping of winter wheat in China based on Landsat and Sentinel images

Journal: Earth System Science Data

Dear Editor and reviewer:

We are very grateful to you and reviewers for your constructive comments and suggested amendments on our manuscript “Early season mapping of winter wheat in China based on Landsat and Sentinel images” (MS No.: essd-2020-69). The comments have helped improve the paper quite tremendously. We have carefully studied the comments, and revised our manuscript accordingly. Consequently, our manuscript has been considerably improved.

Here are our detailed responses to reviewer’s comments. Please note that the comments from the reviewers are in **bold** followed by our responses in regular text. The contents we revised in the manuscript are underlined and highlighted in **yellow**.

Please contact us if further materials or information are required. We deeply appreciate your consideration of our manuscript.

Sincerely,

Jie Dong, Wenping Yuan, on behalf of all co-authors

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Review #1

General Comments:

Early season crop identification is difficult but also important for monitoring crop growth and predicting yield. As one of the most important cereal crops in China, the winter wheat distribution maps over regional scale with high spatial resolution is scarce. This manuscript developed accurate winter wheat maps with 30 m spatial resolution based on a phenology-based vegetation index. Moreover, this method requires low volumes of training data and can identify winter wheat by the end of March, three months earlier before harvest. These databases are valuable and the method is also instructive for other crops identification. This manuscript is well organized. I suggest a minor revision.

We appreciate your positive comments on our manuscript and the insightful questions for us to further consider. Please find below the point-by-point responses to your comments.

Specific Comments:

1. Line 23: Make sure the use of “correspondence” is suitable or not?

Line 22-23: The winter wheat map exhibited good correspondence with the agricultural census area data at the municipal and county levels.

Response 1:

Thanks for your reminding, “correspondence” doesn’t seem right. In the revised manuscript, we changed the sentence into

“The estimated winter wheat area exhibited good correlations with the agricultural statistical area data at the municipal and county levels.” (Line 22-23)

2. Line 26: What “crop conditions” is? It is ambiguous.

Line 26: These results are expected to aid in the timely monitoring of crop conditions.

Response 2:

Sorry for the ambiguous expression. We changed “crop conditions” into “crop growth” in the revised manuscript.

3. Line 35: Does “quantity” mean area of winter wheat?

Line 35-36: Quickly acquiring the detailed location and quantity of winter wheat planted provides the basis for forecasting winter wheat yield...

Response 3:

Yes, “quantity” means winter wheat planting area. In order to avoid ambiguity, we modified this sentence to

“Quickly acquiring the detailed location and planting area of winter wheat

provides the basis for forecasting winter wheat yield” (Line 35-36 in the revised manuscript)

4. Line 36: suggesting delete “production”.

Line 35-36: ... understanding winter wheat production management, and assessing food security.

Response 4:

Thanks for your suggestion. We deleted “production” in the revised manuscript.

5. Line 53-54: “The common method differentiates winter wheat and other crops based on.....”, differentiate....and or differentiate....from?

Line 53-54: The common method differentiates winter wheat and other crops based on the differences in key phenological phases...

Response 5:

Sorry for the grammatical mistake. In the revised manuscript, we changed this sentence into

“The common method differentiates winter wheat from other crops based on the differences in key phenological phases.” (Line 54-55)

6. Line 56: efficient or effective?

Line 56: ... has been proven to be an efficient solution for mapping crop distribution.

Response 6:

Thanks for your reminding. We changed the word “efficient” into “effective” in the revised manuscript.

7. Line 80: timeliness?

Line 80: ... meeting the timeliness requirement of yield predictions.

Response 7:

Yes, the word “timeliness” describes the fact of happening at the best possible time. Its meaning is similar to “timely”. This word can be made sentence like that “The system may help severe-weather researchers improve the timeliness and accuracy of forecasting storms.”

8. Line 84-85: suggesting delete “amount of” and “available”.

Line 84-85: Identifying the crop distribution at the early season is more challenging than that by the end of growing season, because of the limited amount of input information available.

Response 8:

Thank you very much for your careful review. We deleted the “amount of” and “available” in the revised manuscript.

9. Line 87: “investigated”?

Line 87: Moreover, we investigated the potential for early season mapping of the planting areas of winter wheat...

Response 9:

Sorry for the confusing expression. We modified the word “investigated” to “explored” in the revised manuscript.

10. Line 104-106: rewrite the sentence.

Line 104-106: (3) image classification, where TWDTW is used to measure the similarity of seasonal changes of NDVI for known winter wheat fields with investigated fields, and area census data at province-level are used to determine the thresholds of similarity measurements, in order to discriminate winter wheat.

Response 10:

Thanks for your suggestion. In the revised manuscript, we modified this sentence to that

“(3) winter wheat identification, where TWDTW is used to measure the similarity of seasonal changes of NDVI for known winter wheat fields with investigated fields, and area statistical data at province-level are used to determine the thresholds of similarity measurements.”

11. Line 123: “at each investigated pixel” or “of each investigated pixel”?

Line 122-123: The dissimilarity values can then be calculated by comparing the seasonal change in NDVI at each investigated pixel with the standard seasonal curve of winter wheat.

Response 11:

Thanks for your advice. In the revised manuscript, we changed “at each investigated pixel” into “of each investigated pixel”.

12. Line 123-127: It would be more robust if the determination of dissimilarity thresholds did not rely on census data.

Line 123-127: The pixels with low dissimilarity values have a higher probability of being winter wheat. In this research, we employ the area census data of winter wheat at the province level to determine the thresholds of dissimilarity. The pixels (Nth) having the lowest dissimilarity values are considered winter wheat in a given province, and the total area of all N pixels should be equal to the census area of winter wheat in the investigated province.

Response 12:

Please refer to the response No. 2 of the second reviewer.

13. Line 141: Good ideas! Removing the disturbances of other winter crops using various data is important. Especially, when this method was used in summer crops such as corn, the seasonal changes of NDVI may be difficult to differentiate corn from other summer crops, other data (such as plant growth height, spectrals) in key phenological phases should be taken more consideration.

Line 141: 2.2.2 Removing the Disturbances of Winter Rapeseed

Response 13:

Thank you for your recognition. It is very necessary to combine different data sources for crop identification.

14. Line 154: “avoid” replaced by “exclude”?

Line 154: we used radar data to avoid the interference from winter rapeseed.

Response 14:

Thanks for your suggestion, which has greatly improved the quality of our manuscript. In the revised manuscript, we replaced “avoid” with “exclude”.

15. Line 156: differentiate.... from?

Line 156: ... are a good indicator to differentiate winter wheat and winter rapeseed.

Response 15:

Thanks for your advice again. We modified this sentence to “... are a good indicator to differentiate winter wheat from winter rapeseed” in the revised manuscript.

16. Line 157-159: rewrite the sentence.

Line 156-159: The VH backscatter values in April for winter wheat were lower than -15.5 (Figure 5), whereas they were higher for winter rapeseed. Accordingly, winter wheat and rapeseed in HuB, JS, and AH provinces can be distinguished by assigning a higher dissimilarity to pixels with VH values (in April) greater than -15.5 .

Response 16:

Sorry for the confusing expressions. We rewrite the sentence in the revised manuscript that

“The VH backscatter values in April for winter wheat were lower than -15.5 whereas they were higher for winter rapeseed (Figure 5), which meant the pixels (with VH values greater than -15.5) had less possibility to plant winter wheat. Accordingly, by assigning a higher dissimilarity to these pixels, this study distinguished winter wheat and rapeseed in HuB, JS, and AH provinces.” (Line 155-158)

17. Line 187: differentiate...from?

Line 187: To differentiate winter wheat and other winter crops (i.e., winter rapeseed), this study...

Response 17:

Thanks for your advice again. In the revised manuscript, we modified this sentence to “To differentiate winter wheat from other winter crops (i.e., winter rapeseed), this study...”.

18. Line 232: 89.88% is repeated with Line 237.

Line 229-231: The identification accuracy increases with seasonal change length until March with an overall accuracy of 87.3%. From April onward, the identification results reach saturation in terms of the accuracy, with an overall accuracy close to maximum, 89.88%.

Line 236-238: Based on winter wheat and non-winter wheat survey samples, the overall identification accuracy is found to be 89.88%, averaged through all the investigated provinces (Table 2). The overall accuracy varies among the eleven provinces; the lowest is found for SC province with 84.97% (Table 2).

Response 18:

Actually, Line 237 and Line 232 described different contents. However, in order to avoid repetition, we modified Line 236-238 in the revised manuscript to that

“Based on winter wheat and non-winter wheat survey samples, the overall identification accuracy varies among the eleven provinces, ranging from 84.97% to 95.85% (Table 2).” (Line 234-236)

19. Line 251: transferring or extending?

Line 251: we examined the capability of the method for transferring the standard seasonal change of NDVI...

Response 19:

Sorry for the inappropriate expression. The word “extending” is more suitable. In the revised manuscript, we replaced “transferring” with “extending”.

20. Line 271: This sentence is repeated with Line 97?

Line 269-271: The results obtained based on field surveys and statistical data indicate that the proposed method can accurately identify the winter wheat planting areas over all the eleven provinces, which account for 98% of the winter wheat produced in China.

Line 96-98: These provinces are the most important winter wheat producing regions of China, constituting 96% of the total planting areas with 21.6 million ha and 98% of the total production of winter wheat in China with 125 million tons reported in 2017 (National Bureau of Statistics of China, 2018).

Response 20:

Sorry for the repetition. In the revised manuscript, we deleted this sentence in the Discussion section.

21. Line 298-302: Different from the standard seasonal changes of NDVI for winter wheat with two peak values in the growing season, the seasonal changes of NDVI for winter wheat in HuB and SC showed increasing trend from October to May, which make it difficult to differentiate it from other crops. That maybe the reason for relatively lower identification accuracy. So, the identification of winter crops in warmer regions should be paid more attention.

Line 298-302: Second, although the seasonal change of winter wheat is relatively consistent in each province (i.e., a low peak in NDVI in winter and a high peak in NDVI 300 in spring), there is an inter-class difference in winter wheat in each province, such as wheat variety, sowing time, and irrigation conditions. Some winter wheat fields may have an earlier sowing time, showing a pattern deviation from standard average pattern of this province, and therefore, may lead to some omission errors.

Response 21:

Thanks for your reminding. In the Discussion section, we added some contents about the possible reason which may affect the identification accuracy that

“Besides, there are some specialness in the NDVI seasonal change curves of SC and HB provinces, where NDVI shows increasing trend from October to April. This is different from the typical seasonal change curves with two NDVI peaks during the growing season and this may make it difficult to differentiate winter wheat from other crops. That maybe the reason for relatively lower identification accuracy. So, the identification of winter crops in warmer regions should be paid more attention.” (Line 298-302 in the revised manuscript)

22. Line 327: “condition” the same as Line 26.

Line 327: ... which are expected to contribute to the timely monitoring of winter wheat conditions.

Response 22:

Sorry for the confusing expressions. We changed “conditions” into “growth” in the revised manuscript.

23. Line 328-329: rewrite the sentence.

Line 328-329: In the future work, applying the method to other staple crops (e.g., corn and rice) is the main goal to be achieved, and completing the staple crops maps at national scales eventually.

Response 23:

Sorry for the confusing expressions. We rewrite the sentence in the revised

manuscript that

“In the future work, the main goal to be achieved is to improve the method and apply to other staple crop (e.g., corn and rice), and complete the staple crops maps at national scales eventually.” (Line 323-325)

24. Line 337: check the style of References, especially the Capital/Lowercase of the words in the title.

Line 337: References

Response 24:

Thanks for your reminding. We have carefully checked the style of references and revised the corresponding contents in the revised manuscript. Please refer to the references.