Reply to comments from Referee #3

Referee 3' comments are in Italic

General response:
We appreciate very much the referee#3 for his valuable comments and suggestions. Below our specific responses are given point-by-point.

Although the HANTS algorithm has been widely used for reconstructing NDVI time series, its performance still needs to be evaluated in the present study. Examples for comparing original and reconstructed NDVI series should be presented in the results.

The Temporal-similarity statistical (TSS) method was developed to deal with the NDVI data with large gaps. Similar with the previous problem, validation of the proposed method is needed. My suggestion is using the cloud-free NDVI data, and then adding manual gaps.

More discussion about the reliability of the MODIS-NDVI product should be included. For example, how much of the data was cloud-contaminated? To what extent the reconstructed NDVI is reliable?
Response:
These three points are relevant issues in defining the reliability of the reconstructed time series, we give our response to them together here.
We have included statistics on the number and length of gaps due to clouds in the revised manuscript. Likewise we have included examples of time series reconstructed with the improved HANTS and with the combination of HANTS and TSS. An in-depth evaluation of the performance of the two algorithms and of the previous version of HANTS would de-focus the paper. However, we have added a new section and new results to illustrate the performance of the algorithms in the revised manuscript.

In addition, as presented in the introduction part (Page 4181, 1st para), other methods for NDVI reconstruction, such as Savitzky-Golay filtering, MVI, least-squares linear regression etc., have several limitations. Results for comparing these methods with HANTS is needed to show its superiority.
Response:
The reviewer's comments are very much appreciated since they provided useful ideas for new studies and publications. In this study, we have focused on magnitude and timing of vegetation development in terms of NDVI and its phase values. Likewise the comparative evaluation of different methods to reconstruct time series of NDVI observations would have been useful, but beyond the scope of this study. Review on these algorithms as well as some preliminary comparative evaluation have been recently published by Gu et al (2006) and Li et al (2009). Moreover, we are not stating that HANTS is superior to other methods, we just use it to derive two phenological indicators, i.e. the yearly average of NDVI and the phase value of the annual component, both used in a rather qualitative way. Evidence built up through almost 20 years (since Menenti et al., 1993) suggests that HANTS is perfectly adequate for this application.

Discussion about the relationships among vegetation conditions, precipitation, groundwater, and streamflow should be clarified. Which is the essential factor determining the vegetation condition? The paper only tested the correlation between NDVI and streamflow. How about NDVI and precipitation? NDVI and groundwater? It would be helpful to make the paper significant.

Response:

Precipitation in this area is negligible relative to streamflow and potential evapotranspiration. The relationship of vegetation phenology with groundwater is discussed and taken into account by looking at vegetation response in relation to distance from river branches in the inner delta area and to groundwater table depth. Further quantitative analysis of relationship between vegetation and groundwater as well as the between the exchange of surface water and groundwater could be done if groundwater measurements would be available in the future.

Specific comments:

1. Throughout the paper, use of "ground water" and "groundwater" should be unified.

Response:

We have used 'groundwater' in the revision.

2. Page 4188, line 1. Which is the target year, aki, or Akj in Eq. (2)?

Response:

aki is the target year. We also noticed our statement for TSS algorithm in the previous manuscript is confusing. We have re-written this part.

3. Page 4188, line 8: 'The year having: : :: : :: : :..'. It was noted that CV is corresponding the two years, i and j in Eq. (2). "The year" refers to which one?

Response:

The question is similar to the one above (2), we noticed our statement for TSS algorithm in the previous manuscript is confusing. This part has been re-written.

4. Page 4188, line 21 and 23, HIS should be HIS.

Response:

It has been changed to 'IHS'.

5. Page 4191, line 13, Zhengyixa should be Zhengyixia.

Response:

It has been corrected.

6. Page 4191, line 23, Eq. (2) should be Eq. (5).

Response:

We have modified the text.

7. Page 4194, line 2 and 5, p-value of the regression should be provided.

Response:

Significance values are now given in the revised text.

8. Page 4197, line 15: "The implication : : :: : :: : :: : :". More explanation about the implication is needed.

Response:

We are grateful to th ereviewer for pinpointing our unclear wording. The implications are actually discussed in the paragraphs following that sentence. We have now rewritten this section.