Hydrology and Earth System Sciences Discussions

Interactive comment on "Water table fluctuation and its effects on vegetation in a semiarid environment" *by* L. Duan et al.

Anonymous Referee #3

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1   General comments

The paper aims to investigate the spatio-temporal variation of water table and its influence on vegetation in a case study in northern China. The data collected and presented here are potentially relevant within the scope of HESS since it provides a unique opportunity to investigate long-term interactions between vegetation and ground water both spatially and temporarily. To identify spatio-temporal variations the authors used contour maps and plotted the post-processed time series of observations. To identify the influence of water table fluctuations on vegetation multiple regression analyses were used. From this the authors conclude about the sensitivity of vegetation to water table fluctuations and state that ground water is a controlling hydrologic factor for ecosystems in (semi)arid environments.

I have major concerns that the stated conclusions can be drawn from the applied methods, which aim to provide a descriptive understanding of the system rather than a more process-oriented explanation of ecohydrological system functioning. The results can be considered as an indicator for an existing linkage between water table fluctuation and vegetation variability at the study site under consideration, and based on this possible implications for landscape management could be derived to avoid (further) desertification of the Horqin Sandy Land. But more sophisticated scientific methods are required to underpin the stated conclusions. Those methods can include (but are not limited to) statistical methods, which control for confounding variables such as nutrient

availability for plants, soil salinity, maximal rooting depths and water stress tolerance of plants, etc. Those methods could lead to a range of predictive statistical models, which could be applied to evaluate management strategies under future climate conditions and/or human activities. I understand, that a lot of effort is required to collect this data. Therefore, alternatively, existing models of ground water-vegetation interaction, which are more process-oriented could be fed with the huge amount of data provided in this study to investigate processes that govern the ecohydrology of the Horqin Sandy Land. As long as these methodological improvements are not applied the study won't go beyond a case study without any further implications for ground water-vegetation systems around the world.

At this stage I recommend to reconsider the paper for publication after major revisions concerning two major issues: (1) The methodological part requires strong re-work and re-writing (as proposed above) to support the conclusions, and (2) the overall presentation needs to be re-structured, condensed, and re-worked (as suggested below).

2   Some specific comments

Title: The title does not indicate the desertification problem which seems to be related to the ecohydrology of the Horqin Sandy Land?

Introduction: The literature review appears unorganised and the reader does not have the feeling of being guided towards the main scientifc question. E.g.: What is the study site typical for? Is it representative for other areas of ground water-vegetation interactions globally? Globally, what studies exist that support the statement that vegetation growth can be stressed when water table is above or below a threshold value?

Materials and Methods: The chosen structure is unclear and partly irrelevant or negligible (e.g. how to calculate the arithmetic mean).

  Study area: In general, this section should only include information relevant for the

research question. Why are meteorological data such as temperature (average annual, minimum monthly mean, maximum), wind speed (average annual, minimum monthly mean, maximum), and wind direction relevant for a study focusing on ground water-vegetation interactions?

Some more information about the plant species would be helpful such as maximum rooting depth or other physiological characteristics, which could be possible drivers for the observed ground water-vegetation interactions.

The last paragraph (p. 3275, lines 11-28) fits better to the 'Introduction' rather than to 'Study area'.

  Other data: Was NDVI calibrated to ground observations?

  Data preprocessing: Could most of this section (only information relevant for the research question) be re-written as equations rather than in words?

At page 3279, lines 11-13 is a result.

The last paragraph about NDVI fits better to the 'Introduction' rather than 'Data processing'.

Results and Discussion: The link to global studies of ground water-vegetation interactions is missing at all, which reduces the manuscript to a case study.

Fig.2: What is the purpose of this figure? It is not mentioned in Results and Discussion.

Fig.3: The information value of these figures is relatively low since the difference between seasons is marginal. Further, for a study on ground water-vegetation interactions the elevation is irrelevant. What is important is the depth to ground water. The same holds for Fig. 4, 5, 6.

3 Technical comments

The presented paper ingores the generally excepted format of scientific papers, which makes it difficult to be read and reviewed. In particular this refers to the merging of the Results and Discussion section. Moreover, parts of the literature review and results can be found in section 2 (Materials and methods). Results can be found in section 4 (Conclusions). Further, the figures and tables should build a sense of the story being told. However, for most of the figures and tables the reader wonders whether it is relevant for the scientific question and whether it is appropriate to get the message across.