

Response to editor:

- (1) The EPIC model was used to predict daily water stress. However, the EPIC model was not seriously introduced at all. An independent section and the corresponding literature reviews should be added to provide sufficient information of EPIC.

Comments of reviewer are very valuable. A short description about EPIC and the corresponding literature reviews has been added in Section 2.2.1.

EPIC model is a field-scale crop model, which is capable of simulating daily crop growth, calculating crop yield under various climate and environment conditions and performing long-term simulations for hundreds of years (Gassman et al., 2005). In recent years, EPIC model has been applied in different fields, including climate change (Izaurrealde et al., 2012; Rinaldi and De Luca, 2012), simulation of crop yields (Pumijumnon and Arunrat, 2013; Xiong et al., 2014) and drought disaster risk assessment (Jia et al., 2012; Wang et al., 2013b). In previous study (Wang et al., 2015), a new method was proposed to determine drought hazard intensity index based on the daily water stress from EPIC model and yield loss contribution rates for different growth stages. In this study, the risk assessment of agricultural drought was conducted from the physical vulnerability curve.

- (2) In conclusion, what will be message to the general public by the proposed work? What could be the limitation(s) of the proposed work? What might be improved in the future based on the proposed work? The conclusion should be substantially revised accordingly.

Some revision has been made in discussion and conclusion part.

The risk assessments showed the farming-pastoral ecotone in Northern China is a region with high risk of agricultural drought and high sensitivity to climate change. Three different parts showed different spatial and temporal distribution of drought hazard intensity index and yield loss ratio. Drought is one of the most manifestations of climate variability in this region and severe droughts are becoming more frequently in recent years. To better adapt to drought, measurements can be taken based on the risk assessment in this study: to reduce the drought hazard intensity, the planting environment can be changed like improving the ability of irrigation or changing soil property through fertilization and other tillage methods. To reduce physical vulnerability of crops to agricultural drought, improved varieties of crops can be developed to promote drought-enduring and drought resisting crops. To reduce crop's exposure to drought, planting structure can be adjusted during the planting process.

The uncertainty of this study mainly comes from the simulation of EPIC model and the construction of physical vulnerability curve. For EPIC model, the uncertainties are from the model itself and input data like meteorological data, soil data and field management data. For the construction of physical vulnerability curve, the uncertainty is mainly due to the limitation of selected sceneries.

For the further study, a larger study area including south and north part of China will be selected to better assess drought risk and describe the impact of climate change to agriculture along different latitudes.

- (3) The description of ecotone in 2.1.1 should be shortened and most of the section should be moved into the section of introduction.

The description of ecotone in 2.1.1 has been modified and moved to introduction part.

- (4) China meteorological data sharing service system of China only offers sunshine hours. So, how to transfer the sunshine hours to global radiation?

Daily solar radiation information was recorded in 27 stations. The daily solar radiation data for the remaining stations were estimated based on the sunshine duration data using the Angstrom-Prescott model (Angstrom, 1924; Prescott, 1940)

- (5) The authors should offer the genetic parameters of maize used in the EPIC model for the three sites in Fig.3. Moreover, please provide the station name of six validation sites.

The genetic parameters of maize for three sites have been listed below. The six validation sites are Chifeng, Tongliao, Zhangjiakou, Jining, Guyuan and Dingxi.

Parameter name	Meaning of parameter	Baicheng	Datong	Yulin
WA	Energy- biomass conversion factor	37	39	44
HI	Harvest index	0,6	0,5	0,65
TB	The most suitable temperature for crop growth (°C)	25	25	25
TG	The lowest temperature for crop growth (°C)	5	5	5
DMLA	The maximum potential leaf area index	7	7	7
DLAI	The ratio of LAI downward stage accounted for the growing season	0,18	0,2	0,15
DLP1	Crop area growth curve parameter 1	15,05	15,05	15,05
DLP2	Crop area growth curve parameter 2	50,95	50,95	50,95
RLAD	Leaf area index decreasing parameter	0,1	0,1	0,1

- (6) Please provide sowing date of maize, planting density of maize, fertilization amount used in running EPIC model at three representing sites under sufficient and no irrigation conditions.

The sowing date of maize is set to be April 25th (Baicheng), April 15th (Datong) and April 10th (Yulin) separately based on the Chinese Planting Information Network (<http://www.seedchina.com.cn/>). Planting density and fertilization amount are set to be automatic mode in EPIC model.

- (7) The linear regression curve seemed more appropriate to fit the data than the logistic curve. So, why you select the logistic curve as the physical vulnerability curve?

Here we chose logistic curve instead of a straight line to simulate physical vulnerability curve because logistic curve can be used to describe the drought hazard intensity dependent biphasic effect of maize physical vulnerability to drought disaster. At the beginning and the end of the curve, the slope is small. This means for both low hazard intensity and high hazard intensity, the increasing of drought hazard intensity has relatively small impact on the yield loss ratio. However, for the middle part of the curve, the slope is large. This means for middle hazard intensity, the increasing of drought hazard intensity will have larger impact on the yield loss ratio. In this study, restricted by the meteorological data, it was hard to include every different meteorological scenery in theoretical like extreme drought ($H = 1$) or no

drought ($H = 0$) to simulate a real physical vulnerability curve to drought hazard of spring maize. In addition, errors from meteorological data and the model itself might also have impacts on simulation results. So considering the accuracy of the input data and some uncertainties during the calculation process, the simulated drought physical vulnerability curve of spring maize for each part was satisfied.

- (8) The discussion section should be strengthened by comparison with previous studies, including the impact of drought on spring maize in the farming-pastoral ecotone, the measures used to adapt to climate change, etc.

We thank the reviewers for the suggestions. Some revisions have been made in discussion part. The risk assessments showed the farming-pastoral ecotone in Northern China is a region with high risk of agricultural drought and high sensitivity to climate change. Three different parts showed different spatial and temporal distribution of drought hazard intensity index and yield loss ratio. Drought is one of the most manifestations of climate variability in this region and severe droughts are becoming more frequently in recent years. To better adapt to drought, measurements can be taken based on the risk assessment in this study: to reduce the drought hazard intensity, the planting environment can be changed like improving the ability of irrigation or changing soil property through fertilization and other tillage methods. To reduce physical vulnerability of crops to agricultural drought, improved varieties of crops can be developed to promote drought-enduring and drought resisting crops. To reduce crop's exposure to drought, planting structure can be adjusted during the planting process.

- (9) It is important to include in some part of the introduction the differences about hazard, vulnerability and risk, because sometimes are used indistinctly. For example, the author can use as basis the terminology used by UNISDR (<https://www.unisdr.org/we/inform/terminology>).

In the revision, the differences about hazard, vulnerability and risk have been added in the introduction part. The hazard is called a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UNISDR, 2009). The risk is defined as the combination of the probability of an event and its negative consequences (UNISDR, 2009). Initially, vulnerability was defined as the human response to hazard events (Blaikie and Cannon, 1994;FAO, 2001). Gradually, vulnerability is added with some new meanings including the different systems of human society responding to hazard, the interaction process of multi-factors like nature, society, economy and environment (UNDP, 2004) , the sensitivity or susceptibility to hazards and the capacity to cope and adapt to hazards (IPCC, 2014).

- (10) It can be seen in figure 5 that the drought hazard intensity index has a cyclic behavior with a return period of 20 years aprox. How is this considered in the risk assessment?

In Figure 5, there exist two extreme drought hazards in 1980 and 2000 with the average of drought hazard intensity index larger than 0.8. For other years, areas with the drought hazard intensity index larger than 0.5 mainly centered in the west part. A cyclic behavior with a

return period of 20 years aprox appears from 1965 to 2000. It show the periodicity of the extreme drought event and can be used as the reference for the prediction of drought hazard.

- (11) It could be illustrative to include in the conclusions the weaknesses and limitations of the approach.

We thank the reviewers for the suggestions. Some revision has been made in discussion part.

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For the further study, a larger study area including south and north part of China will be selected to better assess drought risk and describe the impact of climate change to agriculture along different latitudes.