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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Exploration of diffusion kernel density estimation in agricultural drought risk analysis: a case study in Shandong, China" *by* C. Wen et al.

W. Chen

wchen2@e.ntu.edu.sg

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Dear Referee,

Thank you for the invaluable time for the review. Your suggestions are informative and constructive, especially the suggestions on the results discussion part. I did necessary amendments on the paper based on your suggestion as shown below:

Discussion

In the study, historical rainfall data of 19 weather stations are collected for the comparison of PDF analysis of DKDE and GKDE. To show the results, results of three more

station besides 57414 will be added in Figure 6, 7 and 8 and the figures will be well labeled. The comparison of joint return period of agricultural drought duration and intensity by two methods will be added in the discussion. To elaborate the difference between result maps using DKDE and GKDE, joint return period map estimated by GKDE will be added in figure 11.

Aim of study:

Insurance is one of the major drought risk mitigation measures. The frequency and return period analysis of agriculture drought risk plays an important role in helping insurers to (a) identify the spatial distribution of risk in the insured area; (b) make decisions about risk pooling; and (c) calculate the potential extreme losses. Therefore, it is the duty of the insurance institutions to conduct ample analysis of the related risks beforehand, for the benefit of both the insurer and the insured. Using the DKDE function to analyze agricultural drought will eventually help the institutes determine premium pricing by providing a reference for identifying regional drought risk, and offer important technological support for drought management.

SPI:

One of the main objectives of the study is to provide a reference for the insurance company or government to identify regional agricultural drought and offer an important technological support for drought risk management. As in the practice of agriculture insurance, the contract is based on the growth period of the insured crop. Therefore, the SPI based on the crop phenological period is chosen for the study.

The agricultural impact of drought is a combination of short-term precipitation shortages, temperature anomalies, and soil-water deficits. Hence the SPI alone may not be sufficient to monitor drought risk in all scenarios. The future study should consider employing multiple drought indices to model drought risk. An agricultural drought index that integrates various parameters such as rainfall, temperature, evapotranspiration (ET), runoff, and other water-supply indicators should be adopted to meet the

demands of different applications and give a comprehensive picture for decision making. However, more factors to consider means more data limitations and uncertainty, which will in turn result in a reduction of the transparency of the contracts for policyholders. Therefore, it is important to choose an appropriate and reliable index to evaluate drought risk.

Abstract

The abstract has been modified as: Drought caused the most widespread damage in China, making up over 50% of the total affected area nationwide in recent decades. In the paper, a Standardized Precipitation Index-based (SPI-based) drought risk study is conducted using historical rainfall data of 19 weather stations in Shandong province, China. Kernel density based method is adopted to carry out the risk analysis. Comparison between the bivariate Gaussian kernel density estimation (GKDE) and diffusion kernel density estimation (DKDE) are carried out to analyze the effect of drought intensity and drought duration. The results show that DKDE is relatively more accurate in estimating the Probability Density Function (PDF) without boundary leakage for the left skewed positive variables, such as precipitation. Combined with ArcGIS spatial analyst tools, the drought risk is presented which reveals the spatial and temporal variation of agricultural droughts for corn in Shandong. The estimation provides a different way to study the occurrence frequency and severity of drought risk from multiple perspectives.

Introduction

The sentences on line 25 has been changed to: Mishra and Singh (2010) analyzed the commonly used indicators for assessing the drought risk.

Method

The methods of detrending, SPI calculation and threshold method will be shortened in the method section, but I will keep the important parts of calculation as the NHESS readership might be broad.

Figures and tables:

Figure 2 and Table 2 will be deleted. The color of Figure 11 will be inversed. Three more stations results will be shown for the comparison of DKDE and GKDE, making the results more clear and obvious.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 6757, 2015.