

Re: nhessd-2-C2577-2014 revised

Thank you for your affirmation of our study. The manuscript has been carefully revised. We appreciate the detailed and useful comments and suggestions from you. The point-by-point answers to the comments and suggestions were listed as below.

(1) Page 6706 Line 3, “metrological drought” may be “meteorological drought”.

Answer: We accept the referee’s suggestion; this error has been corrected in the revised manuscript.

(2) In “Introduction section”, the authors listed many drought indices. It is suggested that the advantages and disadvantages of some commonly used drought indices be introduced. And then illustrate the necessity of the proposed GDAI.

Answer: We accept the referee’s suggestion; this error has been corrected in the revised manuscript.

(3) Page 6708 Line 25, the sentence “the precipitation is decreasing from: : :” is not clearly stated.

Answer: It expresses that the precipitation is decreasing from upper reaches to lower reaches.

(4) In section 2.2, the hydrologic model is a very useful tool for GDAI, so the authors should describe the model structure simply.

Answer: We accept the referee’s suggestion; this error has been corrected in the revised manuscript. Line 15 (6709): Water and energy transfer process model in DRB (WEP-DRB) consists of the vertical structure within a grid cell and the horizontal structure within a watershed. Each grid cell in the vertical direction, from top to bottom, includes nine layers, namely an interception layer, a depression layer, three upper soil layers, a transition layer, an unconfined aquifer and two confined aquifers. To consider the subgrid heterogeneity of land use, the mosaic method is used which reflects composition of different land uses within a grid cell. The areal average of water and heat fluxes from all land uses in a grid cell produces the averaged fluxes in the grid cell. Land use is at first divided into three groups, namely a water body group, a soil-vegetation group and an impervious area group. The soil-vegetation group is further classified into bare soil, tall vegetation (forest or urban trees) and short vegetation (grass or crops). The impervious area group consists of impervious urban cover and urban canopy. In addition, for the convenience of describing soil evaporation, grass or crop root water uptake and tree root water uptake and reflecting surface soil moisture content change with changing root depth, the surface soil of soil-vegetation group is divided into 3 layers. Runoff routings on slopes and in rivers are carried out by applying one-dimensional kinematical wave approach from upstream to downstream. Numerical simulation of multilayered aquifers is performed for groundwater flows in mountainous and plain areas separately with the consideration of groundwater exchange with surface water, soil moisture and stream flow. More details of WEP-DRB can be found in the studies by Jia (2003) and Jia et al. (2006).

References:

Jia, Y.: Development and application of WEP model, *Advances in Water Science(AWS)*, 14, 50–56, 2003.

Jia, Y., Wang, H., Zhou, Z., Qiu, Y., Luo, X., Wang, J., Yan, D. and Qin, D.: Development of the WEP-L distributed hydrological model and dynamic assessment of water resources in the Yellow River basin, *J. Hydrol.*, 331, 606–629, 2006.

(5) It is suggested that the standard of model assessment should be described in detail, for example, how to calculate deviation and Nash coefficient.

Answer: We accept the referee's suggestion; this error has been corrected in the revised manuscript. The Nash–Sutcliffe model efficiency coefficient is used to assess the predictive power of hydrological models. It is defined as:

$$E = 1 - \frac{\sum_{t=1}^T (Q_o^t - Q_m^t)^2}{\sum_{t=1}^T (Q_o^t - \overline{Q_o})^2}$$

Where Q_o is the mean of observed discharges, and Q_m is modeled discharge. Q_o^t is observed discharge at time t . Its definition is identical to the coefficient of determination R^2 used in linear regression.

(6) Page 6714, Line 8, for the phrase “the centers of gravity” is not well defined. It can be illustrated in another way.

Answer: We accept the referee's suggestion. The centers of gravity mean the point within something at which gravity can be considered to act; in uniform gravity it is equal to the center of mass. We express the center of the space distribution of the generalized drought times in this paper.

(7) Page 6716, Line 11, please explain why “the results simulated by GDAI are better than the SPI”.

Answer: The damaged areas of the maize were 2440 km² during 1 to 28 June 2000 in Lishu County. The yields were reduced 70 % until 9 August 2000 in Lishu County. The damaged areas of the maize were 667 km² which accounted for 70 % during 2 July to 20 July 2000 in Gongzhuling city. The results simulated by the GDAI fit well with the above situation than the SPI (Fig. 10). The results calculated by the SPI for 1 month and 12 month are greater than the drought disasters actual happened in Lishu country in 10 June and in Gongzhuling city in July 2000.

(8) Page 6716, Line 16, the word “though” may be changed into “while”.

Answer: We accept the referee's suggestion; this error has been corrected in the revised manuscript.

(9) Page 6718, Line 17, “underlying conditions” may be “land use/land cover”.

Answer: We accept the referee's suggestion; this error has been corrected in the revised manuscript.

(10) In figures 8, 9, 10, 12, 13, 15, 16, the legend “DI” may be “GDAI”.

Answer: We accept the referee's suggestion; this error has been corrected in the revised manuscript.