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Interactive Comment

Interactive comment on "A dual-inexact fuzzy stochastic model for water resources management and non-point source pollution mitigation under multiple uncertainties" *by* C. Dong et al.

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We are grateful to Reviewer #2 for his/her insightful comments. The provided comments have contributed substantially to improving the manuscript. Accordingly, we have made significant efforts to revise the manuscript, with the details being explained as follows.

Point #1

COMMENT: Many abbreviations in Introduction are unnecessary since they are not referenced in the followings.

RESPONSE: We much appreciate the reviewer's suggestion. Accordingly, we have removed some abbreviations in the revised manuscript:

Previously, a plenty of modeling technologies were applied into water resources and farmland use system planning with non-point sources pollution mitigation (Satti et al., 2004; Chen et al., 2005; Riquelme and Ramos, 2005; Victoria et al., 2005; Kondilia and Kaldellis, 2006; Gregory et al., 2006; Khare et al., 2007; Castelletti et al., 2008; Qin et al., 2011; Mahmoud et al., 2011; Zarghami and Hajykazemian, 2013; Canter et al., 2014). For example, Satti et al. (2004) used the GIS-based water resources and agricultural permitting and planning system to simulate the effect of climate, soil, and crop parameters on crop irrigation requirements. Chen et al. (2005) established force-state-response (DSR) dynamic strategy planning procedure to assist responsible authorities in obtaining alternatives of sustainable top river basin land use management. Riquelme and Ramos (2005) built up a Geographic Information System (GIS) on vine growing for supporting decision making processes related to land and water management in Castilla-La Mancha, Spain. Victoria et al. (2005) adopted modeling tools, ISAREG model and SAGBAH model, to solve multi-scale problems with irrigation water uses and non-point source pollution in basins. Qin et al. (2011) proposed a system dynamics and water environmental model to operate the integrated socio-economic and water management system in a rapidly urbanizing catchment. Mehta et al. (2013) developed integrated water resources management models using the water evaluation and planning decision support system, for three towns in the Lake Victoria region. Zarghami and Hajykazemian (2013) proposed a new optimization algorithm by coupling the mutation process to the particle swarm optimization, which was successfully applied to an urban water resources management with non-point sources pollution problem for Tabriz, Iran.

Point #2

COMMENT: Specific examples to explain uncertain system components in various forms such as RBIs and intervals might be helpful for readers to understand the connection between developed models and real-world problems.

RESPONSE: We are appreciative of the reviewer's insightful comment. Accordingly, we have expanded the last paragraph in section 3.2 as follows:

Therefore, several optimization technologies will be introduced to handle these uncertainties in this system. For example, economic coefficients (e.g., unit benefit of water supply and pollutants treatment cost), technologies efficiencies, and continuous variables can expressed as interval numbers. Given the random and dynamic features of water resources availabilities (i.e., surface drainage water, ground and river water), it is rather hard to accurately determine their two bounds. And the random boundary interval (RBI) will be adapted to reflect their dual uncertainty, with the lower and upper bounds of RBI being continuous random variables. Then the developed dual inexact fuzzy stochastic programming (DIFSP) method will be applied into a water and farmland use planning model (WFUPM) with non-point sources pollution mitigation.

Point #3

COMMENT: (Line 5 on page 6): Should FBI be replaced by RBI? What does IFLP stand for? What is the origin of lamda?

RESPONSE: We much appreciate the reviewer's helpful suggestion, and have this sentence as follows:

Then RBI can be incorporated into the interval fuzzy linear programming (IFLP) model through the introduction of membership grade λ (Cao et al., 2010):

Point #4

COMMENT: Long sentences should be separated into short ones in technical writing, e.g.line 10 on page 9 and line 22 on page 11.

RESPONSE: We are grateful for the reviewer's insightful and helpful comment. Accordingly, we have revised these two sentences as follows:

Among these two submodels, and correspond to the lower and upper bounds of the objective function values. When the objective function is to be minimized, sub-model corresponding to is firstly formulated. And then the sub-model corresponding to can be obtained based on the solution of the first sub-model.

With the consideration of these elements, water and farmland use planning model (WFUPM) with non-point sources pollution can be formulated. Its objective is to maximize the total system benefit, covering benefit for agriculture irrigation, water supply benefits for industry, tourism, residents, and minus the costs for water pumping and delivering, as well as wastewater treatment. Specific as follows:

Point #5

COMMENT: (Line 11 on page 10): Should it be “with non-point sources pollution control/mitigation”? What do future system changes mean?

RESPONSE: We much appreciate the reviewer’s helpful suggestion, and have revised this sentence to “These all call for the need to integrate pollution mitigation efforts into the framework of water resources management.”.

Point #6

COMMENT: (Line 9 on page 16): What is the meaning of total quantity control? How are RBIs combined with water resources availability?

RESPONSE: We fully agree with the reviewer’s comment. Accordingly, we have revised the sentence “Finally, the total quantity control should be applied to the non-point sources pollutions (i.e., nitrogen and phosphorus).” to “Finally, the total quantity control should be applied to control the discharge amount of non-point sources pollutions (i.e., nitrogen and phosphorus).”. Besides, we have revised “And the random boundary interval (RBI) will be adapted to reflect the dual uncertainty of water resources availability, with the lower 5 and upper bounds of RBI being continuous random variables.” to “Given the random and dynamic features of water resources availabilities (i.e., surface

HESSD
11, C453–C458, 2014

Interactive Comment

drainage water, ground and river water), it is rather hard to accurately determine their two bounds. And the random boundary interval (RBI) will be adapted to reflect their dual uncertainty, with the lower and upper bounds of RBI being continuous random variables.".

Point #7

COMMENT: (Line 18 on page 17): An alternative expression for authors' consideration is "from [?, ?] in period 1, through [?, ?] in period 2, to [?, ?] in period 3".

RESPONSE: We much appreciate the reviewer's careful review. Accordingly, we have revised this sentence to "As the tourism develops, it would consume rather large a proportion of water usage, increasing from [14.26, 25.3] million m3 in period 1, through [31.95, 43.42] million m3 in period 2, to [44.77, 45.48] million m3 in period 3, which should arouse the general concern of relevant department."

Point #8

COMMENT: (Lines 6-9 on page 18): Why are upper bounds lower than corresponding lower bounds?

RESPONSE: We much appreciate the reviewer's helpful suggestion, and have revised these lower and upper bounds in the revised manuscript.

As shown in Table 7, the quantity from surface drainage water in period 1 would be [20.73, 21.54], [21.07, 21.96], [21.25, 22.18], and [21.37, 22.24] million m3 under a pi level of 0.01, 0.05, 0.10, and 0.15, respectively. The corresponding volume of groundwater would be [28.33, 29.14], [28.69, 29.62], [28.87, 29.88], and [29, 30.05] million m3. Similarly, when the pi value changes from 0.01 to 0.15, the amount of river water would increase from [102.79, 107.79] to [104.61, 109.38] million m3.

Point #9

COMMENT: (Pages 18-19): Revision suggestions: bigger –>higher, smaller –> lower,

HESSD
11, C453–C458, 2014

presents –> represents, and conversional –> conventional.

RESPONSE: We agree with the reviewer' suggestion, and have corrected these words in the revised manuscript.

Point #10

COMMENT: What are shortcomings of the developed method?

RESPONSE: We appreciate the reviewer's insightful comment. The developed DIFSP method can be effective and reliable for addressing real-world problems of water resources and farmland management systems, as it is capable of tackling the highly uncertain parameters that are common in those systems and pose challenges to the related decision-making processes. However, successful application of the developed method relies on the screening and adoption of practical approach as well as the accessibility of sufficient samples for obtaining the distribution information of lower and upper bounds of RBIs.

Generally, we are deeply grateful to Reviewer #1 for his/her insight and careful review. His/her comments have greatly helped improve the paper.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/11/C453/2014/hessd-11-C453-2014-supplement.pdf

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