Authors' Responses

We are very grateful to the anonymous reviewers for their constructive comments and suggestions that have helped us improve the manuscript (npg-2016-55). We have modified our manuscript according to your comments and suggestions in the revised manuscript.

In the following, we reply all the comments and suggestions:

Comments of Reviewer #1:

C1. Please state the advantages of the PSO algorithm in detail, especially comparing to the ADJ algorithm. On the other hand, the genetic algorithm (GA) was also applied to compute the CNOP by authors. And, the authors have published some related articles (Zheng et al. 2012, 2014). The authors should explain the difference between PSO and GA in detail for readers. It is better to compare the numerical results with the ones by using the three methods (PSO, GA, and ADJ algorithms) in the revised manuscript.

A1. Thank you very much for your useful suggestions! We have added the comparison between the PSO and the ADJ method, and discussed the difference between the PSO and the GA in the revised manuscript. Please See

Page 3, lines 14-21.

The comparison numerical experiments with PSO, GA, and ADJ algorithms have been operated and the results are showed in the revised manuscript. Please see

Page 12, lines 11-26.

Page 13, lines 1-7.

Page 20.

C2. The initial guess population size of the PSO algorithm is 60 for 40 optimization processes. The size is enough for the PSO algorithm. However, how many the number of the initial guess values is for the ADJ algorithm? 40 optimization processes and an initial guess values? Is it fair to obtain the CNOP using the PSO and ADJ algorithm?

A2. The PSO is a population-based heuristic optimal algorithm, it start with a set of potential solutions (i.e., the initial population), here 60 is the specified population size of the PSO in our numerical experiments. ADJ-CNOP is a deterministic optimal algorithm, there is one initial guess value in the search process. For statistical analysis, we conducted 40 times numerical experiments using ADJ-CNOP and PSO-CNOP respectively. For ADJ-CNOP, 40 times numerical experiments are performed with 40 different initial guess value. For PSO-CNOP, 40 times numerical experiments are conducted with 40 initial population. Therefore, the comparison scheme between PSO-CNOP and ADJ-CNOP is fair.

C3. Page 8, line 27-Page 9, line 1: Please introduce how to separate small quadrate patches.

A3. Thank you very much for your kind suggestions! We have explained in detail how to separate small quadrate patches in the revised manuscript. Please see

Page 9, lines 4-10.

C4. Page 9, line 5-8: “The population size of the PSO M = 60, the maximum evolutional generation is set as 200, inertia weight =0.729 and accelerating factors c1=2.05, c2=2.05. The norms measuring IC errors and prediction errors are both 2 L-norm, and the radius of the constraint ball is 8.201*10ˆ(-3)”. Please explain the reasons to choosing of the parameter. Whether are the results dependent on the choosing of the parameter or not?

A4. Inertia weight =0.729 and accelerating factors c1=2.05, c2=2.05 are commonly used parameter values for the PSO (Clerc, M., and J. Kennedy., 2002; Banks et al., 2007, 2008). Considering both the computational time and the optimal precision, we take the population size of the PSO as 60, and the maximum evolutional generation as 200. The radius of the constraint ball is set by the method given in (Mu and Zhang, 2006).

The results are dependent on the choosing of inertia weight and accelerating factors. Fortunately, 0.729, 2.05 and 2.05 are effective for general optimization problems. In addition, it seems that there is no general set rules of population size and maximum evolutional generation that are suitable for any optimization problems.

C5. Page 9, line 14: The authors emphasized the importance of the impact of the strong nonlinearity. Please tell the readers that how to define the strong nonlinearity for the dynamical system.

A5. Thank you very much for your helpful suggestions! We have added the explanation of the strong nonlinearity of the Ikeda model. Please see

Page 7, lines 10-12.

C6. The computational cost is considered as the index to calculate the optimal value. The computational cost (such as computation time, iteration times) should be shown by the PSO, GA and ADJ algorithms.

A6. Thank you very much for your useful suggestions! We have conducted the comparison numerical experiment of computational cost, and the results have been added in the revised manuscript. Please see

Page 12, lines 18-26.

Page 13, lines 1-7.

Page 20.

C7. When the optimization time increases, please show the numerical results of computing CNOP being similar to Table 1 and 2.

A7. When the prediction time increases, the objective function has multiple extreme values, the types of CNOP also increase, after the comparison with the CNOP calculated by the filtering method, we obtain the statistical analysis of CNOPs produced by PSO-CNOP and ADJ-CNOP at different time respectively.

Prediction time	Method	CNOPs		
		Global	Local	False
$16\Delta t$	PSO-CNOP	100%	0	0
	ADJ-CNOP	27.5%	5%	67.5%

$18\Delta t$	**PSO-CNOP**	**100%**	**0**	**0**
	ADJ-CNOP	**32.5%**	**17.5%**	**50%**
$20\Delta t$	**PSO-CNOP**	**100%**	**0**	**0**
	ADJ-CNOP	**5%**	**65%**	**30%**

Since no matter how small an area we take around one of these "CNOPs", there always exists one point whose objective function value is larger than the objective function value of the "CNOP". According to the definition of CNOPs, these "CNOPs" are not true CNOPs. Hence, we call them false CNOPs.

C8. The value of the PSO algorithm is that it is applicable to obtain the CNOP in high dimensional and more complex model. In the section of discussion, this issue should be further discussed.

A8. Thank you very much for your helpful suggestions! The issues whether the PSO is applicable to obtain the CNOP in high dimensional and more complex model are further discussed in the revised manuscript. Please see

Page 15, lines 4-6.

C9. Which ADJ algorithm is applied in the manuscript? The spectral projected gradient (SPG), the sequential quadratic programming (SQP), limited memory BFGS (L-BFGS)? The algorithm employed in the manuscript should be introduced. Please show the references of these algorithms.

A9. Thank you very much for your useful suggestions! The algorithm employed in ADJ-CNOP have been added it in the revised manuscript. Please see

Page 9, lines 23-24.

The references of these algorithms have been added in the revised manuscript. Please see

Page 15, lines 16-17.

Page 16, lines 18-19.

Page 17, lines 19-20.