Interactive comment on "A Parallel Hybrid Intelligence Algorithm for Solving Conditional Nonlinear Optimal Perturbation to Identify Optimal Precursors of North Atlantic Oscillation" *by* Bin Mu et al.

Anonymous Referee #1

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The paper describes a refined algorithm for identifying the optimal precursors (OPR:s) of the North Atlantic Oscillation (NAO).

The focus of the article is somewhat unclear, focusing both on the speedup of the computations and on the meteorological results obtained. There is a clear introduction in which the methods and problems investigated are put into the proper context with plenty of relavant citations, but I would like the authors to put also the results obtained into context, in particular by comparing them to the results of Jiang et al. (2013) and Dai et al. (2016). I would also like the author to highlight which of the algorithms that

are their original contribution.

I would also like the authors to include a section where it is explained what the usefulness of the OPR:s are. Are these states stable in the sense that an anomaly pattern that is close to the OPR (in some sense) is more likely to cause an extreme NAO event in 15 days than other patterns, so that the OPR:s can be used to make predictions about the future NAO state. The OPR:s are found by maximizing the error at the terminal date, but is the nonlinear process reversible in the sense that the OPR:s give us information about the future development of the NAO. A statistical investigation of this connection would be an interesting expansion of the article.

The equations in the article are not very well written and a number of variables and notations are not defined in the text. Some examples of these flaws are given below: Page 5, line 9: What is m and n? Page 6, equations (10) and (11). The choice of notation is not very good and it is unclear how it realtes to the notation $u\_0^*(NAO^+)$ used on line 6 of the same page. Page 6, equation(4): What is "Trop" and what are u', v', t' and pi' perturbations of? Page 6, line 20: What is meant by "nonlinear model propagator"? Page 7, equation (7): What is S_i here, what set is the sum taken over, what is n here? Use lat(i) instead of lat_i. If lat_i is the latitude of the ith row then, i should only take 65 different values. Page 7, equation (8): What is L and Sigma? Page 7, line 24: How are the ranodm values of V and X chosen? Page 7, line 25: Is $L_{\{1,...,m\}}$ an m times m diagnoal matrix with the first m eigenvalues?

Minor comments: Page 4, line 18: What is meant by "To explore the process of non-linear,..."? Page 18, lines 11-12: What is meant by "...are generated and calculate the objective value with probabilities".