Responses to Dexiang Li (dexiangli_pe@163.com) on interactive comments (SC2)

Geological models can be more accurate and actual with coupling more borehole data in models. Meanwhile, the data sizes of geological models increase with the developments of field projects and participation of new borehole data. During dynamic process of subsurface applications such as groundwater, geothermal, oil, gas, and CO_2 geostorage, uncertainty quantification is the key for decision making. As the authors mentioned, uncertainty reduction is a time-consuming work which requires iterative model rebuilding using conventional inverse methods. In order to make the model adhere to geological rules, geological modeling often requires significant individual/group ex-pertise and manual intervention which will need often months of work after new data is achieved. In this paper, the authors generalized a Monte Carlo-based framework for geological uncertainty quantification and updating. Their methodologies were developed with the BEL protocol for uncertainty quantification. The extension of directly forecasting results an extreme fast computation of posterior geological model, by avoiding conventional model rebuilding. The proposed framework also allows automation of geological UQ. This paper is interesting and in an area worthy of investigation. Overall, this paper is well-organized and well-written. This paper can be accepted by addressing the following minor comments.

We appreciate the independent reviewer's in-depth understanding of our paper. The comments are helpful to improve our paper. Please see below our responses and explanations on the revision.

1. The advantages and disadvantages using your method for UQ and updating should be further illustrated by comparing with typical conventional method. At the same time, its applicable scenarios are suggested to be provided which can give guidelines for field application.

We extended the discussions on limitations in the last paragraph of "Discussion and conclusions". The advantages of this method have been discussed in second and third paragraph (page 27, 28). The application scenarios are for uncertainty quantification using borehole data in geological modeling and prediction, which are common in oil&gas, geothermal, CO_2 sequestration applications. We have added a statement at the beginning of abstract for more context of this.

2. As you mentioned, current method is only designed to globally adjust the model, not locally at the borehole observation. Could you provide your idea on further solution in more details?

As we explained at the discussion section, one possible solution we like to explore is to combine geostatistical conditional simulation as posterior step to our current methodology. For example, once the posterior global parameters are calculated from AutoBEL, they can be used as the input to geostatistical simulation conditioned to the local well observations. This will enable posterior models locally matched to the borehole observations with reduced global uncertainty.

3. Could provide the specific performance parameters of CPU which can show the improvement on calculation efficiency more accurately?

The CPU is Intel Core i7-7820HQ. We added this specification to the revision.

4. The authors are suggested to unify the multiplication sign through the whole manuscript?

We unified the multiplication symbols in the revision.

5

5. Please add a "." between "Figure 19" and the "Prior and posterior..." to keep in accordance with other figures. Please check similar problems accordingly.

"." has been added to the figure captions.

6. The usage of abbreviation such as DF should be noticed. Abbreviations should be defined when they are first mentioned in the text and should always be used afterwards.

The abbreviation DF is defined at Page6/Line4

7. Discussion and conclusions are suggested to be separated into two parts. Please provide conclusions point by point which can help reader to understand the main con-tributions of the paper. Meanwhile, future researches should be clarified according to the limitations of proposed method.

Thanks for this suggestion. Discussion section now stands as a single section for more in-depth discussions. The conclusions are point by point already. In paragraph 1 of this section, we have clearly itemized the contributions by words such as "generalized", "second contribution", "third contribution" … We extended the discussion on future researches and provided relevant references in the new revision.