

Responses to Tao Feng (taof76@hotmail.com) on interactive comments (SC1)

Dear authors,

This paper presents an automated workflow to build geo-model using some hard data. The work is very interesting, and the paper is well written. I strongly suggest publication after some revision. I have a few questions and comments. I hope authors can clarify it.

We thank the reviewer for the interest and comments on our paper. Please see below our responses.

1. In BEL, you mentioned prediction. There is nothing related prediction from the field case, am I right? It seems to me this work is mainly related model building using data. The prediction variable h is the model parameters, right?

In the field case, the prediction variable h is reservoir storage volume, which is directly calculated from the models. Our main work was to develop an automated approach (Auto-BEL) to jointly update spatial models and storage volume uncertainties using data. The steps of Auto-BEL include build/update models using data.

2. Using observation d_{obs} , you can detect some outlier realizations. Do you just remove these realizations from your prior in practice?

No, we didn't remove these realizations. We keep all the prior realizations if they are not falsified. Removing the outlier realizations can change the prior distribution.

3. h^* , d^* are some subspace of h and d , right? If we talking permeability field with millions of cells, could you give me roughly number of h^* compared to h ? Is Formula (9) standard way to formula linear-Gauss problem?

Yes, h^* , d^* are subset of orthogonalized h and d (after PCA, and CCA). The dimension of h^* is the total number of model realizations, although h can be up to millions of cells. Yes, for linear-Gauss problem, Formula (9) is standard.

4. Your Python tool can be used to build geo-model (grid, etc..)?

Yes, it can directly update/rebuild geo-models, once new borehole data are provided, without using any external modelling tools. But it requires Monte Carlo of prior geo-models for "training". These prior models were built with a geomodeling tool (Petrel)

5. After CCA, elements in h^* is more independent (less correlated), right?

We don't think so. CCA didn't change the independency of h^* elements. h^* elements are independent already before CCA, because they are orthogonalized via PCA.

6. I am very interested in "sequential update model". It will be nice if the authors can describe this in more details. Thanks for the suggestion. We have added a paragraph to the application section (section 3.4.2) to explicitly explain how the sequential approach is performed.

7. Every time you update a parameter, do you use the posterior as a prior for next parameter update?

Exactly, the posterior from previous sequence is used as prior for the next update.