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Hydrology and Earth System Sciences
Discussions

Interactive comment on "3D Multiple-point Statistics Simulations of the Roussillon Continental Pliocene Aquifer using DeeSse" *by* Valentin Dall'Alba et al.

Anonymous Referee #2

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1. The starting point for the proposed strategy, as stated in the abstract, is a conceptual model. The conceptual model is considered to be known deterministically. There is no mention of alternative, conceptual models. This is not trivial, and the authors need to justify this approach and suggest how to relax the constraint imposed by using a single conceptual model (see abstract lines 3-5)

2. The strategy presented here is smart in that it assimilates concepts from geology with geostatistical concepts. For example, the use of a physical-mathematical model for establishing the spatial evolution of sedimentary patterns. But some additional work is needed.

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Discussion paper

3. I recall some work done along this line (Item 2 above) by Steve Gorelick's group. As I recall, it requires using weather patterns over geological time scales, for boundary conditions. So, different patterns would have a strong effect on the patterns mentioned in (2). I am trying to figure out how climate/weather conditions permeated into the modeling of sedimentary patterns. There is a brief and incomplete description of the solution of the diffusivity equation. Just a couple of lines, between Line 170 and Line 175, on the topic. The authors need to shed more light on this aspect of their approach, and to show how the math/physical model used in support of (2) is actually constructed.

4. Line 65: Listing the advantages of the a 2010 simulation model, the authors state "... no probability is computed..". Question is: why is that an advantage? What are the positive and negative implications or avoiding probabilistic models? In Sections 4.2 and 4.3 there is a reference to probabilistic models. Confusing, and some clarification is required.

5. At the top of Section 4.2, the authors state as follows: "Simulating a large number of realizations enables us to calculate probability maps". That is obviously true: when you generate multiple realizations, you can compute probabilities. Question is: what is the connection between these probabilities, on one hand, and uncertainty and risk, on the other? The authors need to make a convincing case that they model uncertainty accurately. Without it, they can only say that they can generate images.

6. We need to see how the innovation (generating sedimentary patterns using a math/physical model) proposed in this study could make a difference. How would the generated images look like without the innovation? How does this innovation help in reducing uncertainty and improving accuracy? Some sort of cross-validation study (comparing results obtained with and without the improvement) could be helpful

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