Is more always better?

Study on uncertainties introduced by decision-making process of model design – a case study with thermo-osmosis

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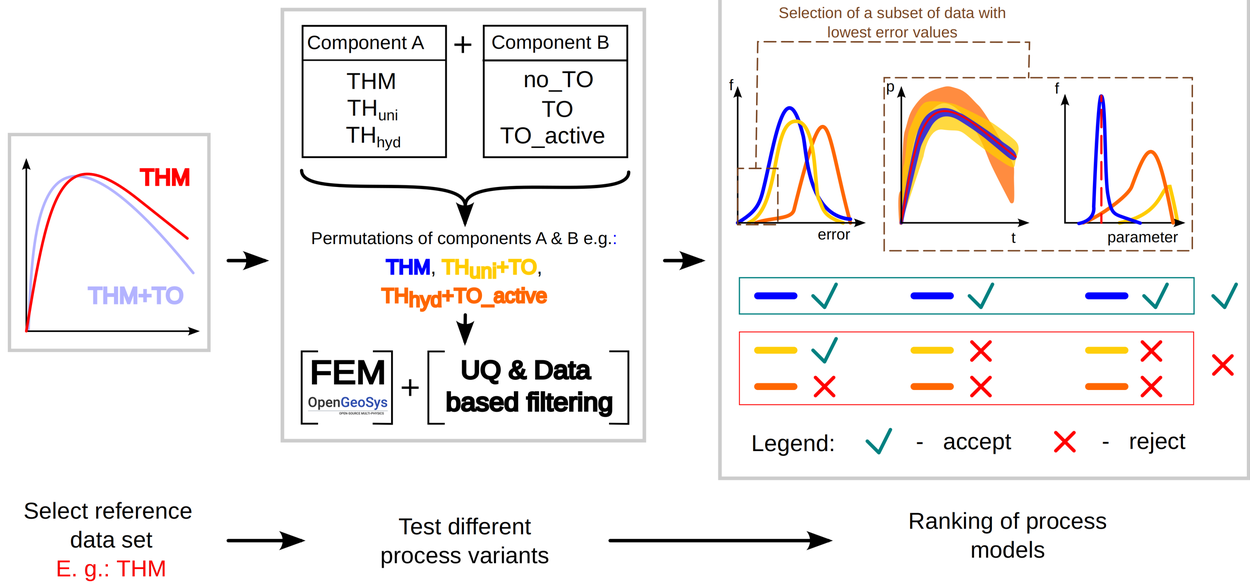
Introduction

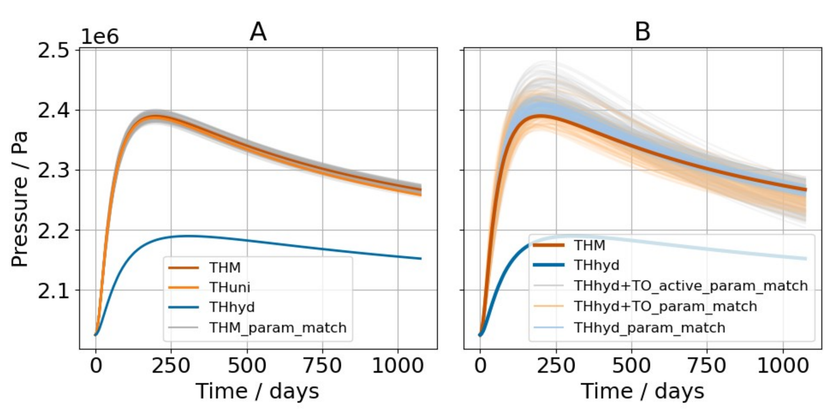
- Thermo-osmosis (TO) is a fluid flow caused by a temperature gradient [1].
- This study investigates how model assumptions can impact the estimation of pore water pressurization.
- It is tested if adding complexity to the model (without strong physical justification) will lead to a better fit with reference and/or observation data.
- A suitable uncertainty quantification (UQ) based workflow is presented to achieve this.

Methodology and workflow



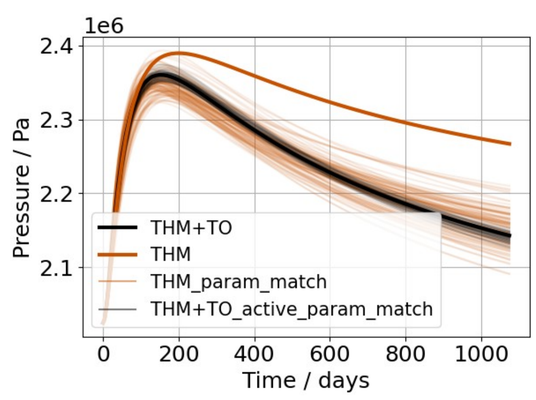
Results

Overfitting inadequate model with TO

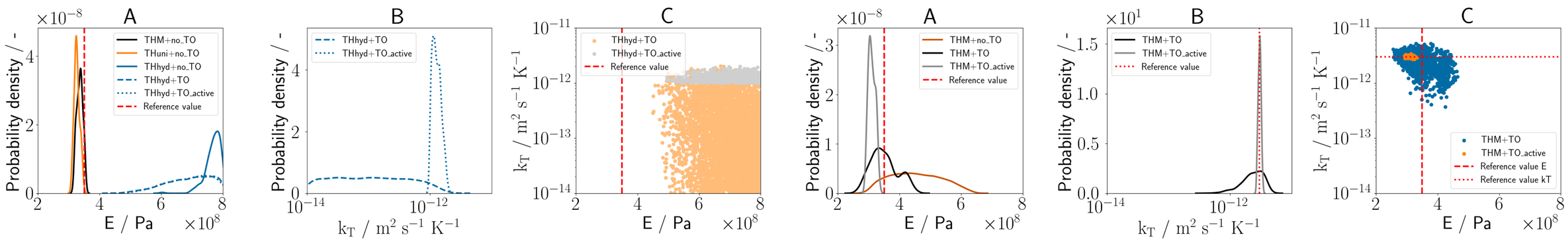


- ↑ Inadequate (THhyd) model choice can be overfitted using TO.
- ↓ However, it is achieved at the expense of the unphysical parameter choices. Adequate models (THM and Thuni) recover correct parameters.

Parameter identification in the presence of TO



- ↑ Removing TO from the model when it is present leads to a higher spread and worse fit with the reference data.
- ↓ With adequate process, it is possible to recover correct parameters.



Conclusions and summary

- UQ methods can be used to select a suitable level of complexity of the process model – overfitting can be recognized.
- With adequate process choice, it is possible to recover correct parameter values using UQ methods.

Acknowledgments & Bibliography

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[1] Gonçalvès, J., Marsily, G. de, & Tremosa, J. (2012). Importance of thermo-osmosis for fluid flow and transport in clay formations hosting a nuclear waste repository. Earth and Planetary Science Letters, 339–340, 1–10. https://doi.org/10.1016/j.epsl.2012.03.032

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