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Adaptive node adjustment for real-time subsurface flow modeling

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Real-time subsurface flow simulation is desirable for managing groundwater resources, geothermal exploitation, carbon dioxide geological sequestration, or underground hydrogen storage. Data assimilation methods are developed to achieve this goal. However, assimilation models usually use mesh-based numerical methods. Remeshing is frequently required whenever new data to be integrated into the model are not located at the existing computational nodes. This study aims to develop an adaptation algorithm to accommodate node layout to the exact positions of additional data. For flexibility, we chose a mesh-free numerical method. We combined it with a fast node generation technique called the advancing front method to adjust meshless node placement before assimilation by ensemble Kalman filter. A hypothetical flow problem was used to test the proposed approach. The results show that the adaptive node adjustment works effectively for the real-time updating model. The accuracy and precision of modeling states and parameters were improved when integrating additional data.

Participation

In-Person

References

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