Poster #1-14

Estimation of Soil Properties by Coupled Inversion of ERT and Hydrothermal Measurements

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BER Program: TES
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Studies indicate greenhouse gas emissions following permafrost thaw will amplify current rates of atmospheric warming, a process referred to as the permafrost carbon feedback (PCF). However, large uncertainties exist regarding the timing and magnitude of the PCF, in part due to uncertainties associated with subsurface parameterization. Development of robust parameter estimation methods is becoming urgent under accelerated warming of the Arctic. Improved parameterization of the subsurface properties in land system models would lead to improved predictions and reduction of modeling uncertainty. We developed a parameter estimation (PE) framework by utilizing the PEST (Model Independent Parameter Estimation and Uncertainty Analysis) toolbox and coupled hydro-thermal-geophysical modeling. The main goal of this study is to demonstrate the proof-of-concept by testing the parameter estimation framework against synthetic data. We use known subsurface parameters and coupled models to set up a synthetic state, then perturb the values of those parameters using our PE framework to recover the synthetic state. We consider a set of perturbed subsurface properties as a sample that consists of multiple sets of perturbed parameter values. The convergence is robust if most of the perturbed values from the sample are able to converge to their synthetic state. We evaluate the type and amount of data needed to allow the best convergence. In addition, we provide recommendations on the value and design of subsurface observations based on the results of our synthetic studies.