Poster #21-66

M&M: A Multi-Fidelity & Machine-Learning Approach to Model Hydrologic-Biogeochemical Processes in the Groundwater-Surface Water Interaction Zone

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We have developed a *multi-fidelity deep learning approach* suitable for optimal data acquisition, model discovery, model parameterization, and, ultimately, for predictive modeling of geo-physico- chemical processes for the Hanford site. Using a one-year exploratory grant we have developed a new multi-fidelity capability that has a tremendous potential for modeling hydrologic- biogeochemical processes in the groundwater-surface water interaction zone. We presented these results to SFA leader Dr. T. Scheibe and his team (January 23, 2019). We started with Gaussian Process Regression but we switched to deep neural networks (DNN) for easier training and scalability. We have designed a new architecture of a multi-fidelity physics-informed neural network (PINN) and obtained some results for solving the equation for unsaturated flows for the pressure height *h*. We assumed that we have *only two experimental measurements* and that we have several points from the FPLOTRAN simulation, which may not be very accurate. By using the multi-fidelity PINN we are able to obtain the correct solution and discover the correct hydraulic conductivity.