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Machine learning modeling of convective wall heat transfer in turbulent wall fire simulations JIE TAO, Purdue University, NING REN, YI WANG, FM Global, HAIFENG WANG, Purdue University — Accurate modeling of convective wall heat flux is vital for the predictive modeling of turbulent wall fire problems. High grid-resolution near the wall is required to produce accurate modeling of the heat flux on the wall. This requirement is not feasible in engineering modeling studies of wall fires. Wall models are thus needed to reconstruct wall heat flux so that the grid requirement is not so restrictive. In this work, we examine the feasibility and potential of using machine learning to reconstruct the convective wall heat flux in wall fire modeling. High-fidelity large-eddy simulations of a turbulent fire propagating along a vertical wall are conducted to produce the training data for machine learning. A temperature gradient correction factor is introduced to compensate for the loss of accuracy of temperature gradient when discretized on a coarse grid. The random forest machine learning model is used to train the model for the correction factor. The performance of the trained model is assessed in a priori analysis for the wall fire modeling. Good performance is observed. The potential of using this modeling approach in engineering wall fire modeling studies is discussed.

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