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**A temperature wall function for large-eddy simulation of natural convection based on modified Rayleigh number scaling** RANDALL MCDERMOTT, NIST, MARCOS VANELLA, The George Washington University, BRADLEY HENDERSON, The University of Alabama Huntsville — Natural convection heat transfer may be responsible for roughly half of the surface preheating in wildfire flame spread. Modeling flame spread, and convective heat transfer in general, is a challenge for large-eddy simulation (LES) since resolution requirements for wall-resolved LES scale as distance from the wall. In this work, we illustrate a deficiency in loglaw-based wall functions for LES with near-wall modeling of natural convection and propose a new wall function based on modified Rayleigh number (Ra) scaling. A thermal length scale based on heat flux similar to that of Yuan (1995) is employed. A local modified Nusselt number (Nu) is formulated in terms of nondimensional thermal wall units. The new model is implemented in a low-Mach LES code called the Fire Dynamics Simulator (FDS). Both the new wall model and a loglaw-based model are used in LES of natural convection in vertical and horizontal enclosed cavities for a broad range of Ra. The bulk Nu at steady state are compared with correlations in the literature. It is shown that the loglaw model, designed principally for forced convection, requires substantially higher grid resolution to achieve accurate Ra scaling.

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