Benchmark Evaluation of Radiation Models in Simulations of Compartment Fires

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Compartment fires feature complex phenomena associated with smoke accumulation and restricted air ventilation. While Computational Fluid Dynamics-based (CFD-based) modeling for fire applications has made remarkable progress in recent years, the ability of CFD models to correctly describe compartment fire effects is still an area of active research and an area that requires validation. The objective of this study is to evaluate the performance of current fire modeling capabilities in simulations of compartment fires with a particular focus on the Fire Dynamic Simulator (FDS) developed by the National Institute of Standards and Technology (NIST). FDS is here used to simulate a compartment fire configuration previously studied experimentally by Underwriters Laboratories (UL). The configuration features square-shaped gas-burner in a simple rectangular-shaped room featuring a single door. Experimental data are also available for the corresponding open-burn conditions. The detailed comparisons between experimental data and numerical results serve to evaluate the different modeling options available in FDS to simulate combustion and radiation, including the effects of spatial resolution in the gas phase solver and angular resolution in the thermal radiation solver.