1. CFD simulations of urban and wildland fire spread among discrete fuels under effect of wind

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Abstract: It is important to investigate the urban and wildland fire behavior to mitigate the fire hazards. There have been many studies on such fires, but the need of real time fire simulations has recent increased and a demand to predict fire spread patterns in urban and wildland regions for decision-making strategies against fires has emerged. However, the knowledge of fire spread behavior is still insufficient, particularly for the condition of discrete fuel distributions. Under this condition the fire spread behavior shows high complexity due to the significant interactions between the radiation, conduction and convection heat transfer, especially under significant ambient wind effects. This paper investigates urban and wildland fire spread behavior by utilizing CFD simulations for two types of fuels under the effect of wind. A 15×15 square array, consisting of 225 fuel sources, is used to simulate the discrete fuel distribution, with varying fuel spacing and wind speed. The simulation method is similar to that used in our previous study, but with different ignition heaters. The comparison of the simulated results for the reduced and real scale models is reasonable, as verified by the similarity law. The critical fire spread distance, the wind effect upon fire spread, and the variation of fire spread rate for the two types of fuels are extensively investigated. Copyright © 2010 by ASME.
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