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Turbulent Transport of Firebrands in Urban Boundary Layers
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— Generation of secondary fires by lofted burning materials (known as firebrands or flying embers) is an erratic process, in which wildland fires rapidly spread to unburned areas far downwind of the main fire-front. This phenomenon is the major mechanism of wildfire spread into fire-prone communities that poses serious threats to human lives and properties. The flight path and landing distribution of firebrands, and thus the spot fire risks depend heavily on the characteristics of ambient flow. By understanding the firebrand transport mechanisms in turbulent winds, it may be possible to better guide fire mitigation methods, reduce fire losses, and improve and guide fast fire-risk models. This study investigates the effect of topography-induced turbulence structures on firebrand transport, their smoldering lifetime, and spot fire risk over urban areas. Large Eddy Simulation is used to simulate the turbulent flow over arrangements of rectangular buildings. Evolving particles of different characteristics are released into the flow and their behavior is investigated in a Lagrangian framework. The fire hazard potentials and transport mechanisms are then analyzed based on the particle trajectories, their combustion state, and their landing distributions.

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