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Wildfire simulation using a chemically-reacting plume in a crossflow ROBERT BREIDENTHAL, University of Washington, TRAVIS ALVARADO[1], University of Texas, BRIAN POTTER, Pacific Wildland Fire Sciences Laboratory — Water tunnel experiments reveal the flame length of a chemically-reacting plume in a crossflow. Salt water containing a pH indicator and a base is slowly injected from above into the test section of a water tunnel containing an acidic solution. The flame length is measured optically as a function of the buoyancy flux, crossflow speed, and volume equivalence ratio of the chemical reaction. Based on earlier work of Broadwell with the transverse jet, a simple dilution model predicts the flame length of the transverse plume. The plume observations are in accord with the model. As with the jet, there is a minimum in the flame length of the plume at a transition between two self-similar regimes, corresponding to the formation of a pair of counter-rotating vortices at a certain crossflow speed. At the transition, there is a maximum in the entrainment and mixing rates. In an actual wildfire with variable winds, this transition may correspond to a dangerous condition for firefighters.

[1]HACU Intern

Robert Breidenthal
University of Washington

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