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Direct Numerical Simulation of Wildland Fires at Small Scales NICHOLAS WIMER, AMANDA MACKOWEICKI, University of Colorado Boulder, CHAD HOFFMAN, Colorado State University, ALEXEI POLUDNENKO, Texas AM, JOHN DAILY, GREGORY RIEKER, PETER HAMLINGTON, University of Colorado Boulder — Preliminary results are presented from a new research effort focused on understanding and characterizing wildland fire spread at small scales (roughly 1m-1mm) using direct numerical simulations (DNS). The simulations are intended to directly resolve, with high physical accuracy, all small-scale fluid dynamic and chemical processes relevant to wildland fire spread. Simulation of wildland fires is an incredibly complex and challenging problem due to the vast difference in scales associated with the problem. An understanding is needed not just of the burning of fuel, but also of the atmospheric conditions, weather patterns, topography, and turbulence-flame dynamics. This work is focused on the sub-meter scales associated with wildland fire; in particular, the dynamics of small-scale diffusion flames. Here, preliminary results are presented for DNS of centimeter-scale gaseous pool fires coupled with multi-step chemical reaction mechanisms. The results are connected to the fundamental structure and spread of wildland fires, and an outlook is provided for the future expansion of these DNS studies.

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