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Fire/atmosphere feedbacks that determine wildland fire behavior

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Abstract:

Wildfires can pose threats to life, property and critical infrastructure, but wildland fire is an unavoidable part of many ecosystems. Improving our ability to cope with wildfires and avoiding catastrophic fire scenarios requires better understand how they interact with their surrounding environment. Recent fire behavior research illustrates the importance of the two-way feedbacks between fires and the surrounding atmosphere, which is influenced by the vegetation structure and nearby topography as well as ambient winds and fire geometry. Both land management and wildland fire science communities are becoming increasingly interested in a more proactive solution to wildland fire challenges, including fuels treatments and prescribed fires. The result of fuels management activities on fire behavior depends not only on the removal of combustible fuel, but also on the changes in the ventilation associated decreased vegetation drag, which often increases fire spread. Likewise, safe use of prescribed fires to reduce wildfire risk while accomplishing ecologic objectives typically depends heavily on the purposefully designed ignition strategies. The design if ignition patterns and rates of ignition depends on practitioner's ability to anticipate the interaction of multiple fires. This interaction is tied to the competition between their fire-induced updrafts and associated entrainment. Even the influences of topography on fire behavior is dominated by terrain-induced changes in fire-induced circulation patterns that control the patterns of heat transfer to unburned fuel. Multi-scale two-way fire/atmosphere feedbacks determine heterogenous fireline dynamics and thus fire spread, effects of fires on ecology, and the near-field lofting and transport of the smoke. Deciphering the complex interaction between fires and surrounding atmosphere through field and laboratory experiments alone has been challenging due to issues with reproducibility, adequate characterization of natural conditions and complex scaling relationships. Recent advancements in computing power have created new opportunity for the complimentary use of numerical models to provide additional perspectives concerning fire/atmosphere feedbacks that have previously been challenging to explore.

Biography:

Dr. Rodman Linn is team leader at Los Almos National Laboratory and he is Expertise in solving and modeling problems involving complex thermal, mechanical, and fluid dynamics systems, including

Wildfire behavior modeling. Two decades of demonstrated leadership in the field of wildfire behavior modeling and application of coupled wildfire/atmosphere behavior models to study fundamental wildfire behavior and its response to various environmental conditions.

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