Wildfires and Climate Change

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Contents:

Research on wildfires covers different areas such as combustion physics and chemistry, fluid mechanics, heat transfer, forestry, ecology, geography, remote sensing and statistical mathematics. The workshop of "Wildfires and Climate Change" was held on Feb. 9 at Kirkwood Village of University of Canterbury. The major goal of this workshop was to create an interactive discussion among experts from different domains and young researchers, in order to discuss the fundamental research needs for extreme fire behaviors and WUI fires, to clarify the needs in fire modelling, and to understand the effect of climate change on wildfire trends. The major conclusions acknowledged by the participants of the workshop include:

1) Extreme fire behaviors usually play essential roles in the acceleration of large wildfires, and basically involve significant interactions among heat transfer, fluid mechanics and combustion, leading to new challenges for wildfire researches. Until today, extreme fire behaviors have been poorly understood. Challenges on extreme fire behaviors include physical mechanisms and dynamics of different extreme fire behaviors in steady states, critical conditions for transition among different extreme fire behaviors, and applied models for fire management under practical conditions of fuel, meteorology, and topography.

2) Wildland-Urban Interface (WUI) Fires is an emerging problem in fire safety science. Spot fires and radiation ignition have been recognized to be the major fire spread modes in WUI fires. A series of challenges were delineated that make WUI fires a hard problem to tackle. A pragmatic solution to the WUI fire problem will be hardening communities to WUI fire exposures. A series of presented research needs were outlined in order to provide a scientific foundation to harden communities to these fires. It was recognized that WUI fires are an important international problem and require extensive research going forward.

3) Fire is a climate influenced ecosystem process recorded in paleoclimate and paleoecology records. Climate, humans and other factors have shaped fire regimes. The atmosphere can affect the occurrence and the intensity of wildfires at different time scales. Cyclic anomalies of the surface temperature of oceans affect significantly weather conditions and consequently can induced perturbations in fire regimes. The first signs of global warming, with long periods of draught, the insect infestations, have affected the forest health in different part of the world, and especially in boreal regions where the effects of climate change are more pronounced. Other ecosystems such as peatlands, will also be greatly affected by global warming. The increase of fire hazard in these ecosystems, will pose great problems, with great consequences upon the health of populations. These constitute the major challenges for the future research on fire trends under rapid climate change.

4) In wildfire modelling, numerical simulation is a growing area of research with models ranging from fully empirical to detailed CFD-based. However, the models still used in simulators by end-users (firefighters, foresters and scientists) are empirical or semi-empirical models derived some 40 years ago. The numerical tools available today were not sufficient to answer the challenges of tomorrow. It is necessary to develop deeper studies of the fundamental phenomena that drive fire behavior and develop ambitious research programs that will allow developing the numerical studies that are necessary to further advance wildfire science and applied fire prediction tools.