Extreme Fires and Dynamic Fire Behaviours. New Challenges

Extreme wildfires create disproportionate risks to environmental and human assets. Fire propagation can be significantly affected by dynamic feedback processes that result in unpredictable behaviour, and the continual escalation of fire spread rates and intensities even when environmental conditions are consistent. These fires behave in a manner that goes beyond the suppression means and fire-fighters are unable to control the fire spread even in the most prepared and equipped regions. The erratic behaviour and difficulty to control mean that these fires can burn larger areas and result in the loss of life. Throughout the world, such wildfires have occurred almost every year for the past 15 years. During the 2019/2020 fire season extreme fires in Australia have burnt 18 million hectares, destroyed over 5 900 structures and claimed 34 lives. In most cases, these consequences are a result of dynamic fire behaviours (DFBs). DFBs are physical phenomena that can occur within any fires. In general, extreme fire can involve one to several DFBs simultaneously. These phenomena can influence the intensity, rate of growth and impact of wildfires.

The objective of this presentation is to synthesize existing DFB knowledge in a way that connects the weather, fuel, and topographic factors that contribute to development of DFB. This synthesis will focus on the state of the science.

Bio

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Dr. Alexander Filkov received his PhD in Ecology (Physical and Mathematical Sciences) in 2005 from Tomsk State University, Russia. His research program and expertise in fire behaviour is recognized at a national and international level. Dr Filkov's work covers a broad range of fire behaviour topics including research on the ignition and combustion of fuels, the spread of wildfire and transition mechanisms to the Wildland Urban Interface, and the performance of structural materials under different fire conditions. His international reputation and broad network of peers have allowed Dr. Filkov to organise and participate in several large field experiments on forest and grass fires in Russia, the USA, and Australia.

Dr. Filkov's early research at Tomsk State University in Russia was focused on the development of a new deterministic and probabilistic model to predict forest, grass and peat fire hazards. His research also focused on the field and laboratory study of forest and grass fires and their impact on wooden structures. Dr. Filkov's collaborations with the laboratory of the National Center of Scientific Research in France has resulted in some major findings in understanding thermal properties and smoldering of peat. He has also collaborated with Worcester Polytechnic institute (USA) and the University of Edinburg (UK) to conduct a series of pioneering experiments studying firebrand production and spotting mechanisms in wildfires. Dr. Filkov also studied the probability of fuel bed ignition by firebrands in laboratory experiments, resulting in the development of a mathematical model for the transport of firebrands from the combustion zone. Since Dr. Filkov's arrival in Australia in 2016, his work has focused on understanding the mechanisms that drive dynamic behaviour in wildland and structural fires.