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Abstract

Numerical Study of Junction Fires on Sloped Terrain for Grassland Vegetation †

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Junction fires involve the merging of two linear fire fronts intersecting at a small angle which gives rise to an interaction process with fire-induced convective flows that modify the behavior of both fires and produce very large values of the rate of spread (ROS) of the inner part of the two fires.

In this context, a study on the junction fires on sloped terrain was carried out numerically using the FIRESTAR3D model that predicts the fire behavior. FireStar3D belongs to a multiphase class of models that is based on a very detailed modelling of the physicochemical phenomena involved in a fire, from the thermal degradation of the vegetation to the development of the turbulent flame inside and above the vegetation layer. This approach solves two sets of problems, one for the vegetation and one for the surrounding gas which are coupled together through additional terms. The objective of this study was to analyse the effect of the junction angle variation on the fire behavior, especially on the junction point velocity. In a first step, the effect of terrain slope on the fire rate of spread was simulated numerically under no wind conditions, in order to determine the slope threshold value beyond which fire behavior changes noticeably due to flame attachment. Then numerical simulations of junction fires were conducted using two different values of terrain slope (above and below the threshold value) in order to establish the relationship between the fire rate of spread and the junction angle variation. Finally, numerical simulations were conducted to study the case where the junction axis is not aligned with the main slope direction, in order to investigate the effect of this rotation on the junction point speed and trajectory.

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