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Leveraging national forestry data repositories to advocate wildfire modeling towards simulation-driven risk assessment

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Abstract-

Modeling wildfire dynamics is complex and challenging due to the multiple scales involved in fire propagation, from physical–chemical processes to the interaction with topography and meteorological conditions. To provide reliable indicators of the risk of an ongoing wildfire, models aimed at informing policy-making should quantify the primary sources of uncertainty in their predictions. In this paper, we introduce a novel methodology built on top of Forestry Data Repositories. Uncertainty is embedded in the model considering the ±2σ deviations from the medians of linear regressions of the canopy stratum with LiDAR metrics as explainable variables. The relevance of dynamic meteorological conditions in contrast to static environment conditions is analyzed. Our results suggest that an accurate account of the fuel model, including time-dependent wind and moisture maps, is mandatory to provide reliable predictions. Using a real case study (Concentaina’s extreme wildfire), we also illustrate the importance of assessing the impact of the firefighters’ mitigation efforts.

Index Terms- Ensemble modeling; Uncertainty propagation; Forestry raster data; Rothermel; Cellular automata; Wildfires

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