Comparison between the semi-empirical Rothermel fire spread model and 1D physical Balbi fire spread model. This project will include the analysis of the fundamental concepts and assumptions behind these models and analysis of the results under various fuel and weather conditions.

This assignment requires submitting an abstract outlining the scope of the project you will be working on during this course. The abstract should be 0.5 - 1 page long (single spaced), and should describe the motivation behind your project and its scope. Please remember to include the tentative title of your project.

Comparison between the Rothermel and Balbi fire spread model

Accurately predicting the rate of spread of a propagating fire in various fuels, weather, and topography poses a challenge for those who model wildfire as there are small scale processes occurring that must be considered to predict the rate of spread. To predict the rate of spread, multiple models have been created to calculate the rate of spread in each environment. These models prove invaluable to those who model wildfires as they allow them to run simulations and generate forecasts for wildfires (given the models can run at an operational scale). The two fire rate of spread models in this study are the Rothermel model and the Balbi model. These two models aim to accurately predict fire spread in given conditions, however the way they calculate the rate of spread differ from one another. The Rothermel model is a semi-empirical model that was created in 1972, and the Balbi model is a physics-based model that is still being worked on to this day (with the most recent model being released in 2022). Both models can be used at an operational scale as well since the necessary calculations for the models can be solved by a computer quickly. To see which model performs best in various conditions, tests are necessary to see how the model compares to observations. To test the models, an experimental dataset from shrublands in South African fynbos, as well as comparing idealized WRF-SFIRE model simulations will be utilized to see how the two rate of spread models compare. WRF-SFIRE model simulations are being utilized for this study since the model currently uses the Rothermel rate of spread model, but efforts to implement the Balbi model are currently underway. With this implementation, both rate of spread models can be compared to then see how they perform under the same conditions in a model setting. By utilizing a model, microscale processes such as fire-generated turbulence can be better observed and compared to see how much each rate of spread model accounts for these processes and how they influence the rate of spread in each model. These processes can be seen by looking into the output files. By utilizing datasets such as the South African fynbos from the Van Wilgen experiment, the observed rate of spread can be compared to the calculated model rate of spread to see how accurately the models predict the rate of spread.