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 pose a challenge for fire modelers as there are many factors to consider when trying to calculate the rate of spread of a fire. There are also small-scale processes occurring that must be taken into consideration to produce an accurate calculation for the rate of spread (ROS). To predict the ROS, multiple models have been created to calculate the ROS in varying environments and atmospheric conditions. These models prove invaluable to those who model wildfires as the models allow modelers to run simulations and generate forecasts for wildfires. The two fire ROS models in this study are the Rothermel model and the Balbi model. These two models aim to accurately predict fire spread in various conditions, however the way they calculate the ROS differs 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). Within these models, varying assumptions are made about how each mechanism within a fire contributes to the overall rate of spread. Conceptually, the models also differ since the Rothermel model is a semi-empirical model and the Balbi model is a fully physical model. To see how each model performs, the models are converted into a MATLAB code and various tests will be run on the codes. These tests include changing parameters within the fuels, topography, fuel moisture, and weather conditions to see how each factor influences the models. Smaller scale processes within the code that lead up to the overall ROS can be analyzed to see how the individual calculations in the models weigh into the final calculations. With the smaller scale calculation at hand, that will allow the models to be compared at a much finer scale, which allows us to see how much certain processes contribute to the overall ROS rather than comparing just the ROS.

To see which model performs best in an operational setting, utilization of an experimental dataset will allow us to compare the model data to observations. The data is from the Kolgerberg dataset from the Van Wilgen experiment. These tests were performed in South African fynbos and the dataset includes the observed rate of spread. With this dataset, the modeled ROS can be compared to the observed ROS to see which model is more accurate in an operational setting.

Why is it important?

Why is this problem important?

In the lit study, express what we know, what we don’t know, etc.

In the project scope

This is what exatly I will try to accomplish, how I plan to accomplish that, and what is needed to do that. It is critical in business and in research. It allows us to wrap our head around the whole project and identify from a-z what we will be working on. Identify how many simulaitons are needed, how long each simulation takes, how much they will cost, what we will do with the simulations, what we are going to analyze (wind speed, temp, heat fluxes, etc..) Have to create a timeline and keep track of our progress. Need to be realistic. Spend enough time thinking of the scope of the project. This is the most critical part. We have to make sure that what we propose as a project is realistic. Like don’t make it too hard. It must come from us and what we want to accomplish.

For the fire weather briefing, Some people will record it and some people will be live. To find data, the time is now since fires are burning.

There will be a presentation outlining our project results. So the final report is two parts. We can record and post it on canvas.

Fire presentations should be 12-15 minutes.

Focus more on theory and physics behind the models.

It is 20% higher because of this concept under these conditions

Don’t include WRF-SFIRE