Weather Development On An Island With Variable Terrain

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Abstract

A Netlogo simulation was developed to provide a visualization of cloud cover and rain on an island with diverse biomes. We see the affect of jetstream strength and latitude on the average cloud cover and rainfall for the entire island as well as four distinct points throughout the terrain.

Introduction

One of the most important coverages in society is the weather. It is the primary determinant in how a day is going to operate. If the weather is poor, entire cities can come to a halt. Therefore, it is essential to understand weather patterns and make predictions on what may occur next. The goal of this report is to explore the variable changes in weather patterns within different terrains. To do so, a NetLogo agent-based model was created that tracks cloud coverage over a generic island. The island contains many of the common types of biomes across the world. To start the creation of an overarching weather prediction model, this model will provide general weather patterns, specializing in rainfall and cloud cover.

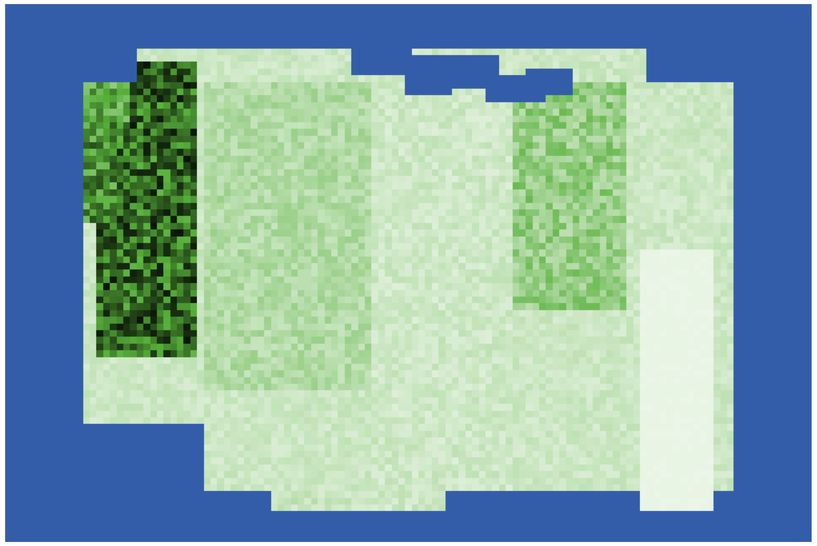

Figure 1: Picture of the island. Wind blows from west to east.

Model Creation

In order to ensure a realistic model, many factors were taken into account such as the humidity, elevation, time of day, season, solar intensity, temperature, pressure, ocean and wind currents, and soil moisture. We also defined geography on the island in which the simulation will take place. To do this, we built rectangular regions with differing statistics to demonstrate the effect of differing landmass on cloud cover. We also built rectangular regions in the water to define hot and cold sections of ocean. Propagation was implemented to encourage local clouds to create more clouds. The model was started on the summer equinox, and the first one hundred ticks were used to set the simulation up.

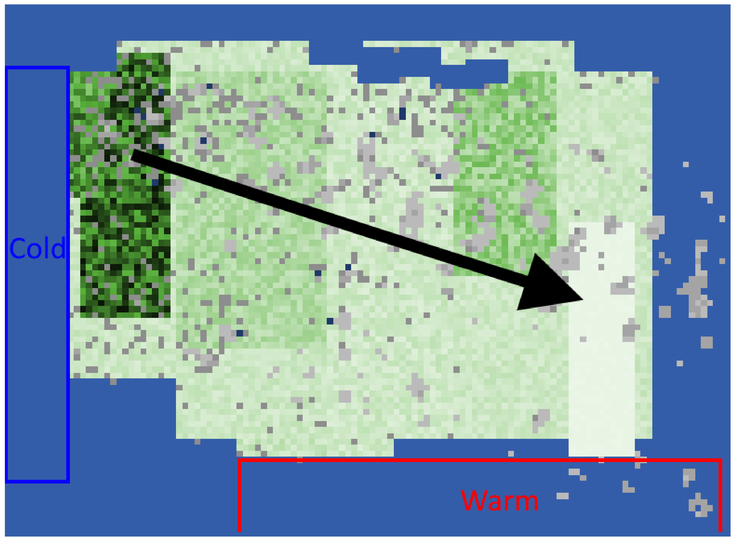

Figure 2: A picture showing the model populated by clouds. Shown are the two hot and cold regions of ocean surrounding the island, and the direction of cloud travel.

Model Constraints

To constrain our model, we assume these things:

- Extreme weather events will not be taken into account
- No other landmass outside of the island will affect the weather patterns
- Natural jet streams follow seasonal patterns
- Only cloud cover over 20 percent is tracked
- Each timestep equates to half of an hour.
- Each tile measures 38x38km.

All of these assumptions create a natural and "unaltered" environment for the study of weather patterns on a general island structure. Additionally, this allows for the natural course of weather to change with the season via the jetstream changes that occur. However, the main constraint is the lack of landmass around the island. It is vital to creating a base model that is avoidant of other land to reduce variability in the overall model.

Results

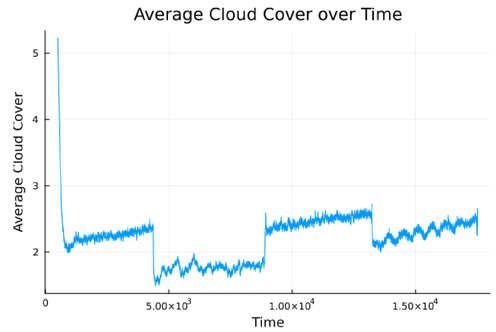

Figure 3: Average cloud cover over time for the model duration. Seasonal changes are very apparent.

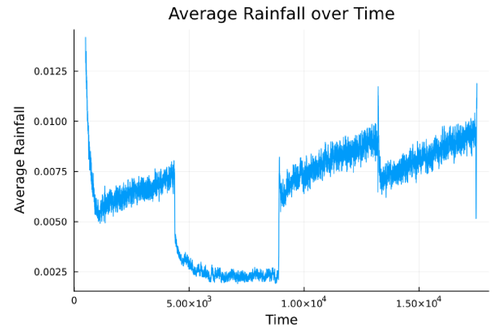

Figure 4: Average rainfall over time for the model duration. Seasonal changes are very apparent.

Conclusion

Bulleted list of conclusions:

- Seasonal changes drastically affect cloud cover and rainfall
- Cloud cover and rainfall averages can diverge from each other
- Averages can settle into cyclical patterns, perceived randomness, or steady states

Future Work

Independent modeling of variables to determine effect on the simulation would greatly increase understanding in how certain values change a weather system. Refactoring of code to generate smoother graphs would also allow greater accuracy into our data analysis.