Exploring Cloud Coverage & Wind Energy Efficiency

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Clouds can have a massive impact on the environment; however, wind is one of the most significant outcomes.

Globe Badges

When it comes to badges, our team believes we qualify for a lot of them. The "I am a problem solver" badge was one of them because the project we were working with wasn't necessarily a project that had been looked at before; therefore, we were looking at data that no one looked at before.

The "I am a collaborator" badge could also be one due to us talking to people from NASA as well as our school teachers–Mrs. Ward, Mrs. Kubiak, Mr. Best, and Mr. Richardson–who helped us with the conversions for our data as well as writing the research paper and helping with our project step by step. When it came to how we should go about the project, we consulted with Marile Colon Robles–NASA Langley–as well Sara Mierzwiak–UT, Globe Mission Earth–who was a big help with furthering our research.

For the "I make an impact" our team believes we qualify for this as well due to the problem with not enough alternative energy in the city. With our project, we were able to make groundbreaking data that wasn't looked at when it came to alternative energy in the city. This

will help us make further improvements on how much gas we use in the city and switch to alternative energy which could better our stances on climate change.

The “I am a data scientist” badge is also something we believe we qualified for due to one of our team members being able to record the data we collected and turn it into a data chart to see what kind of correlation was between our hypothesis and the data we had collected. We had help from one of our teachers–Mrs. Ward–with collecting data and creating a formula that would show the correlation between our data and hypothesis.

Abstract

This study aims to investigate the relationship between cloud coverage, high, middle, and low-level clouds, and wind speed to better understand the factors that affect wind speed and the efficiency of turbines. The researchers collected data using an anemometer, wind turbine, and Globe Observer app to measure wind speed, energy production, and cloud coverage. However, they found a weak correlation between cloud coverage and wind speed, as well as wind turbine efficiency. Despite the low correlation, the researchers believe that further experiments and research should be done to find any possible correlations between other factors that cloud coverage affects.

Introduction

The study aims to investigate the relationship between cloud coverage, high, middle, and low-level clouds, and wind speed. It is important because it can help in better understanding the factors that affect wind speed and the efficiency of turbines. This knowledge can have significant implications for weather forecasting and climate modeling. A brief review of the literature on this subject reveals that previous studies have found a positive correlation between cloud

coverage and wind speed. Other studies have also found that high-level clouds can have a significant impact on wind speed and frequency in wind farms. However, there is still much that is not known about the relationship between cloud coverage, high, middle, and low-level clouds, and wind speed, and further research is needed to better understand these complex interactions. According to M.-C. Robles, a NASA scientist, there are no articles directly related to the current research. However, Robles has found articles related to wind farms and stated that the research is groundbreaking.

Hypothesis

When there is a higher percentage of cloud coverage and high-level clouds, there will be higher wind speeds and more frequent because the clouds will cause uneven heating.

Objective

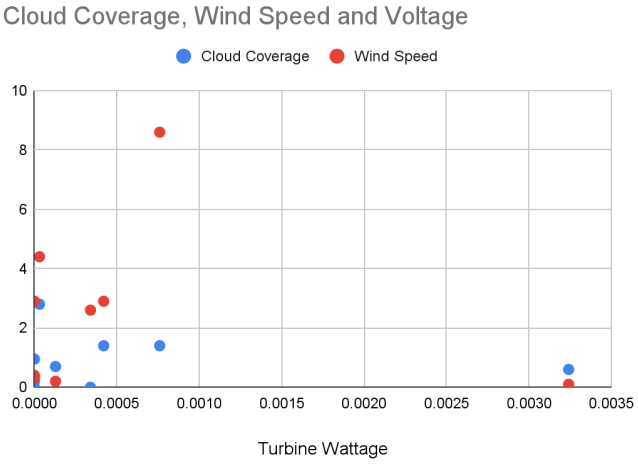
The purpose of their research is to investigate whether the level of cloud coverage can provide insights into wind speed and efficiency when utilizing a wind turbine. The purpose of our research is to see if the amount of cloud coverage can help understand wind speed and efficiency while using a wind turbine.

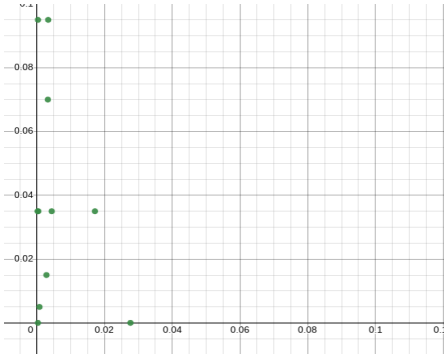
Methods

To collect their data, they would go out to the same spot and use an anemometer to measure the wind speed, as well as a wind turbine to measure energy production in volts and amps. Furthermore, they also used the Globe Observer app to collect data on the types of clouds and how much cloud coverage there was. They had to take into consideration factors such as whether there was precipitation or if it had already rained or not. Then, the data that was collected was put into Googleheets to help make the charts. They then used Stats Blue for the "Multiple Linear Regression Calculator" to show the impact on watts.

Results

According to their research, there is a weak correlation between cloud coverage and wind speed, as well as wind turbine efficiency. The correlation is only around 20%, which is statistically considered to be weak. They used a linear regression calculator to analyze the data but were unable to consider the impact of cloud types on wind speed or turbine efficiency. As per M.C. Robles, (personal communication on December 5, 2023), "This may not be a well-researched topic, but it's still worth exploring to determine whether or not such variables are correlated."





Model: $\text{watts} = 0.0055 + 0 \cdot \text{Surface temp} - 0.0083 \cdot \text{Coverage} + 0.0015 \cdot \text{wind speed}$

Conclusion

The researchers set out to investigate a possible correlation between cloud coverage and type, wind speed, and turbine efficiency to anticipate future weather patterns. However, they found little correlation between wind speed and cloud coverage. Despite the low correlation, the researchers believe that further experiments and research should be done, looking at many more variables to find any possible correlations between other factors that cloud coverage affects. As Robles said, "It is always good when you have a high correlation; however, just because it's a low correlation doesn't mean it's a fail."

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