The Relationship Between Solar Radiation and Solar Power Generation in Taiwan

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Abstract / Summary

Solar energy is a key renewable energy source that helps reduce carbon emissions and mitigate climate change. The efficiency of solar power generation is strongly influenced by environmental factors, particularly solar radiation and cloud cover. This research proposal aims to investigate the relationship between solar radiation levels and solar power generation in Taiwan by using atmospheric data from the GLOBE Program and publicly available energy statistics. By analyzing trends and correlations between solar radiation and solar energy output from 2021 to 2023, this study seeks to better understand how environmental conditions affect renewable energy production and to demonstrate the application of GLOBE data in real-world energy-related issues.

Background and Supporting Information

Solar radiation represents the amount of solar energy reaching the Earth's surface and is a crucial factor affecting the performance of solar panels. Taiwan has actively expanded its solar energy capacity in recent years due to renewable energy policies and favorable geographic conditions. However, the relationship between solar radiation and actual solar power generation is influenced by various environmental and technical factors and therefore requires data-based investigation.

The GLOBE Program provides long-term, standardized atmospheric observations, including solar radiation data and cloud cover, which allow students to analyze environmental conditions at regional and global scales. By combining GLOBE data with Taiwan's public solar energy generation statistics, this study connects environmental science with renewable energy applications and supports Earth system science education.

Research Question

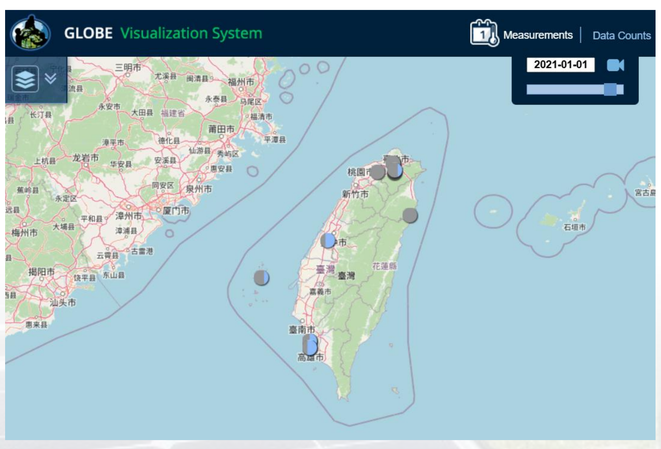
Is there a correlation between solar radiation levels and solar power generation in Taiwan?

Hypothesis

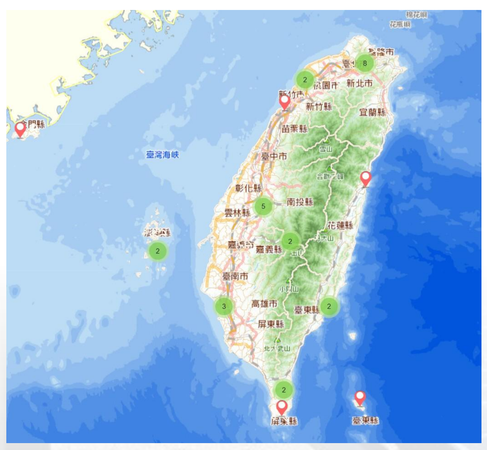
Higher levels of solar radiation are associated with higher solar power generation in Taiwan.

Description of Study Site

The study focuses on Taiwan as the research region. Taiwan was selected due to its increasing adoption of solar energy, clear seasonal variations in solar radiation, and the availability of reliable public energy statistics. The study period spans from 2021 to 2023, providing sufficient data to analyze trends and relationships over time.



https://vis.globe.gov/GLOBE/



https://codis.cwa.gov.tw/StationData

Data Collection Plan

Solar radiation data and cloud cover will be obtained from the GLOBE Program Atmosphere Protocol, using observations available in the GLOBE database for Taiwan. Solar power generation data for the same period will be collected from publicly available government energy statistics in Taiwan.

The data will be organized by month and year to allow comparison of temporal trends. Graphs will be created to visualize changes in solar radiation and solar power generation over time. Basic statistical methods, such as correlation analysis and average comparisons, will be used to examine the relationship between the two variables.

Expected Outcomes or Goals

This study is expected to show a positive correlation between solar radiation levels and solar power generation in Taiwan. The results will help illustrate how environmental factors influence renewable energy production and highlight the importance of solar radiation in solar energy planning.

Challenges and Considerations

This research focuses on large-scale trends and does not account for factors such as solar panel efficiency, installation angle, maintenance conditions, or localized weather events. Additionally, solar power generation data represent aggregated values rather than measurements from individual solar facilities. These limitations may affect the strength of the observed correlation but do not prevent analysis of overall trends.

Significance

The findings of this study may contribute to a better understanding of the relationship between environmental conditions and renewable energy production. This research supports climate and energy education and demonstrates how students can use GLOBE data to investigate real-world Earth system science issues related to sustainability and renewable energy.

Badge Descriptions

I Am a GLOBE Researcher

This project uses official GLOBE atmospheric data to investigate an environmental research question related to solar radiation.

I Am a Data Scientist

The study involves organizing datasets, creating graphs, and performing basic statistical analysis to examine relationships between variables.

I Am an Earth System Scientist

This research connects atmospheric science with renewable energy production, demonstrating interactions between the Earth system and human activities.

Citations

- The GLOBE Program Official Website
- Publicly available energy statistics from Taiwan government agencies