

# MA615 Final Project Report

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## Introduction

This report presents the findings of the air quality analysis conducted for Aruba. Using an interactive Shiny dashboard, we explore the PM1.0 levels collected from two sensors, analyze their trends, and assess air quality levels over time. Additionally, this analysis includes a comparison of Aruba with Antigua and Barbuda, Barbados, Dominica, and Grenada based on national GDP and population statistics.

## Data Description

Data Source: Metabolic Foundation, World Bank Data

- The dataset includes PM1.0 measurements collected hourly from two sensors: pms1 and pms2. Measurements were later aggregated into 24-hour moving averages to facilitate air quality analysis.

Key Variables:

- **PM1.0 Levels:** Fine particulate matter concentration measured in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).
- **Timestamps:** Converted from UTC to local Aruba time (UTC -4 hours).
- **National GDP:** GDP data for Aruba and the four comparator nations (Antigua and Barbuda, Barbados, Dominica, Grenada) were used to evaluate economic context.
- **Population:** Population data was analyzed to understand the potential human impact and exposure to air quality issues.

## Methods

## Dashboard Features:

Interactive Time Series Visualization, Allows users to explore daily trends.

Highlights specific timeframes (e.g., August 1–7, 2023) for detailed hourly analysis.

Air Quality Classification: Users can filter by time period for focused analysis.

Comparative Analysis: Economic and Population Data, Collected and compared national GDP and population statistics from publicly available databases.

Data Cleaning: Removed anomalies and missing values.

## Conclusion

Aruba demonstrates several key strengths compared to Antigua and Barbuda, Barbados, Dominica, and Grenada. The island's well-developed tourism industry and strong connections to North American and European markets give it an economic edge. Additionally, its dry tropical climate and year-round warm weather make it an attractive tourist destination.

However, Aruba faces significant challenges, including limited natural resources and high dependency on imports for food and water. Environmental pressures from tourism also strain its ecological systems, and the island's economy remains highly reliant on tourism, making it vulnerable to global economic changes.

When compared to the other nations, Aruba benefits from a relatively stable economy and higher GDP per capita, but its smaller population limits the scale of potential interventions. In contrast, countries like Barbados may have more diversified economies but face similar environmental pressures.

Addressing these weaknesses through sustainable tourism practices, improved resource management, and regional collaboration will be essential for Aruba to maintain its competitive advantages and ensure long-term sustainability.

## Appendix

<https://jinrli.shinyapps.io/615final-projct/>

<https://github.com/KinokoZ/615final-projct>

