Forecasting Atmospheric Carbon Dioxide Concentration with ARIMA Models

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Contents

1. Abstract

As a greenhouse gas, carbon dioxide (CO_2) is one of the driving forces behind global warming. Since the beginning of the industrial revolution, atmospheric CO_2 levels have risen more than 40% and give no idication of slowing.(citation - wikipedia) This project utilizes seasonal autoregressive integrated moving average (SARIMA) models to accurately forecast atmospheric carbon dioxide concentrations 10 months into the future. These forecast can be used to predict other meteorological phenomena, such as catastrophic weather events and global temperature rises.

2. Introduction

This paper explored the

2.1 About the Data

The models in this project were trained from monthly mean atmospheric carbon dioxide concentrations measured in parts per million. The data were collected at the Mauna Loa Observatory in Hawaii, beginning in March 1958. These data are publically available and freely distributed by the National Oceanic & Atmospheric Administration in accordance to their Global Greenhouse Gas Reference Network. The data table used in the project is available at the NOAA website.

2.2 Software Used in Analysis

All statistical analysis performed in this project was done with the `RStudio` integrated development environment. In addition to base R, the following software libraries were used: `MASS`, `stats`, and `forecast`. Please note that `forecast::Arima()` was used instead of `stats::arima()`. According to the creator of the `forecast` package, Rob J Hyndman, `Arima()` allows for the inclusion of a contant term in the model when using differenced data. This functionality is not included in `arima()`. ### 2.3 Results

2.4 Preview of Analysis

We begin our analysis by loading our data in `R`.

3. Analysis

3.1 Exploratory Data Analysis

3.2 Data Transformations

3.3 ACF and PACF Analysis

3.4 Model Fitting

3.4.1 Model 1

3.4.2 Model 2